

**Colorado Chapter of the Wildlife Society
2018 Annual Meeting
7-9 February
Grand Junction, Colorado**

ABSTRACTS

Wednesday 7 February 2018

Symposium: Overview of Integrated Monitoring of Bird Conservation Regions (IMBCR) Program

Opening Remarks

T. LUKE GEORGE, Bird Conservancy of the Rockies

Development of the IMBCR Program

JENNIFER A. BLAKESLEY, Bird Conservancy of the Rockies

Abstract. Integrated Monitoring in Bird Conservation Regions (IMBCR) was designed by a team of biologists and biometricians from the Bird Conservancy of the Rockies, US Forest Service Rocky Mountain Region and Colorado Parks and Wildlife. The program was first implemented in Colorado in 2008. A catalyst for development of the IMBCR program was the North American Bird Conservation Initiative's 2007 Report, "Opportunities for Improving Avian Monitoring". IMBCR uses distance sampling and removal-in-time methods for estimating detection probability, and allows for estimation of both density and rates of site occupancy. The design incorporates random sampling of survey sites among nested strata, allowing for valid inferences to be made at multiple spatial scales. Development, geographical expansion and annual implementation of the IMBCR program is made possible through collaboration among numerous partners from Federal and State agencies, private land owners and Non-governmental organizations.

IMBCR: The first 10 years, challenges, and opportunities

CHRIS WHITE, Bird Conservancy of the Rockies

Abstract. For the last 10 years, the Integrated Monitoring in Bird Conservation Regions (IMBCR) program has used a spatially balanced sampling design to monitor bird populations. This design allows inference to avian species' occurrence and population sizes at various scales, from local management units to entire BCRs or states, facilitating conservation at local and regional levels. The sampling design allows analysts to estimate species' densities, population sizes and occupancy rates for individual or multiple strata, and to compare population response in areas of management activities or disturbances with the surrounding landscape. The IMBCR design also provides a spatially consistent and flexible framework for understanding the status and annual changes of bird populations. Collaboration across organizations and spatial scales increases sample sizes and improves the accuracy and precision of population estimates. Analyzing the data collectively allows us to estimate detection probabilities for rarer species that would otherwise have insufficient numbers of detections at local scales.

The IMBCR program has grown in scope from an area of inference of approximately 265,000 km² (65.5 million acres) in 2008 to 1.9 million km² (470 million acres) in 2017. Along the way, the program has faced many challenges and the IMBCR partnership has learned valuable lessons, but several challenges remain. I will discuss the growth and evolution of the IMBCR program from 2008 to present, including the partnerships developed, the challenges faced, and the insight gained through this process.

Monitoring and Measuring Conservation Effectiveness at Multiple Scales

DAVID C. PAVLACKY, JR., Bird Conservancy of the Rockies

*Abstract. Monitoring plays important roles in conservation science, effectiveness monitoring and adaptive management. The standard design of the Integrated Monitoring in Bird Conservation Regions (IMBCR) program is applicable to conservation science and adaptive management, but may not efficiently address effectiveness monitoring. My objective is to outline auxiliary or 'overlay' stratification schemes to address management questions of the IMBCR partnership. The management units are superimposed on existing IMBCR strata, allowing before-after-control-impact designs nested within the spatial and temporal dynamics of the IMBCR program. The first study involves point-transect distance sampling to estimate population density of grassland birds on lands managed by the Lesser Prairie-Chicken Initiative (LPCI) relative to reference landscapes. I predicted LPCI prescribed grazing would increase the abundance of grassland obligates, but not species specializing on keystone habitat features. The second case study involves multi-species occupancy to estimate trends for sagebrush-dependent species in a Bureau of Land Management (BLM) region with high oil-gas development relative to reference landscapes. I expected species sensitive to habitat fragmentation would decline in the high development stratum relative to the reference strata. LPCI grazing increased population sizes of the Cassin's sparrow (*Peucaea cassinii*) and lark bunting (*Calamospiza melanocorys*), but not the long-billed curlew (*Numenius americanus*) and burrowing owl (*Athene cunicularia*). The sage thrasher (*Oreoscoptes montanus*) declined in regions with high oil-gas development relative to the BLM reference region. The overlay projects provide conservationists a way to scale-up local management efforts to regional bird populations and the treatment effects may ultimately be useful for adaptive management.*

Response of nomadic grassland birds to temporal variation in habitat conditions

ADAM W. GREEN, Bird Conservancy of the Rockies

DAVID C. PAVLACKY JR., Bird Conservancy of the Rockies

T. LUKE GEORGE, Bird Conservancy of the Rockies

Abstract. Grasslands are dynamic ecosystems and the species that use these habitats must respond to changing habitat conditions. Many species have evolved nomadic behaviors to take advantage of sites with ideal habitat conditions. Distribution models are increasingly being used to understand how landscape changes are affecting the spatial and temporal distributions of plants and animals, yet they only describe patterns, rather than the processes resulting in those patterns. To address this issue, we extended the Bayesian multi-scale occupancy model to estimate extinction and colonization for large-scale occupancy and applied it to data of two grassland bird species, the Chestnut-collared Longspur (CCLO) and Lark Bunting (LARB), collected as part of Bird Conservancy of the Rockies' Integrated Monitoring in Bird Conservation Regions program. We included covariates for landscape composition and annual vegetation greenness to explain large-scale occupancy, extinction and colonization, and covariates for point-level habitat structure to predict small-scale occupancy. Large- and small-scale occupancy of CCLO increased over the period, despite declining regional abundance, and LARB occupancy and abundance remained stable. Both species colonized new sites containing less than ideal habitat and went locally extinct at sites with poor habitat, and the species used local features similar to those chosen

at the landscape level. In addition to applications at multiple spatial scales, our model can be used to estimate dynamic parameters influencing temporal habitat use and can be easily extended to accommodate additional scales. Our extension of the multi-scale model allows us to better understand the dynamic processes influencing the distribution of nomadic and is well-suited for addressing ecological questions within the theory of hierarchical habitat selection.

IMBCR and bird conservation in Colorado: Perspective from Colorado Parks and Wildlife

DAVID KLUTE, Species Conservation Unit Supervisor, Colorado Parks and Wildlife

***Abstract.** Colorado Parks and Wildlife (CPW) has long been interested in monitoring bird populations. Beginning in 1999, CPW began supporting the Monitoring Colorado's Birds (MCB) program. MCB provided a strong foundation but had some shortcomings, including dependence on a habitat-based sampling frame that could shift temporally. Development of IMBCR created a program that addresses this shortcoming and has many additional strengths including explicit incorporation of detection probabilities and use of multiple estimation methods; a hierarchical design that provides estimates at multiple spatial scales; collaboration with multiple partners and implementation at regional scales, and the ability to change sampling intensity through time in response to volatile funding levels and other factors. These characteristics created a strong foundation on which to examine the status of bird populations in Colorado and regionally, and to investigate responses of bird populations to anthropogenic and natural environmental changes. Challenges to ongoing implementation of IMBCR exist and include the cost of annual field implementation and data analysis, maintaining program support at regional scales over long time periods, finding ways to investigate the breadth of questions which can be addressed with a very large data set, implementation of new analytical techniques, and effective use of program outputs to make management decisions. CPW remains committed to addressing these challenges and improving our use of IMBCR to evaluate species status and to inform conservation decisions.*

Using IMBCR to address management decisions on USFS lands

RICK TRUEX, USDA Forest Service

***Abstract.** The US Forest Service (USFS) has been a contributor to the partner-based Integrated Monitoring in Bird Conservation Regions (IMBCR) program since its inception, and all national forests and grasslands in the Forest Service's Rocky Mountain Region are included in annual sampling efforts. The hierarchical design of IMBCR provides opportunities to examine status of various avian species on USFS lands and nearby adjacent lands. Importantly, IMBCR data provides a rich data source to better understand habitat relationships and the potential effects of management activities and natural disturbances on avian communities. In 2012, the USFS adopted new planning regulations to guide implementation of the National Forest Management Act. These planning regulations rely largely on managing for ecosystem integrity to provide for species diversity. The 2012 planning regulations include new monitoring requirements that emphasize the importance of multi-party monitoring to help leverage monitoring resources and provide information at scales larger than a single national forest or grassland. This presentation will highlight 2 case studies using the IMBCR program: developing habitat relationship models for select species on the Rio Grande National Forest and monitoring overall effects of landscape-scale forest management in Colorado's Front Range. Lastly, the role of IMBCR data as one tool to monitor ecological integrity on national forests and grasslands will be discussed.*

Sampling mammalian species using the IMBCR protocol

JAKE IVAN, Colorado Parks and Wildlife

***Abstract.** The Bird Conservancy of the Rockies' (BCR) protocol for Integrated Monitoring in Bird Conservation Regions (IMBCR) is a highly successful program for monitoring avian communities across the west. From this unprecedented effort, partners and scientists can estimate density and occupancy information to assess population trends, describe habitat associations, and inform or evaluate conservation actions for avian communities. Here we describe an approach for sampling mammalian communities concurrently with avian sampling efforts by embedding remote camera systems within the context of the IMBCR sampling protocol. We used this technique to assess avian and mammalian responses to bark beetle outbreaks in subalpine forests of Colorado, 2013–2014. We obtained photos of 26 mammalian species from 300 cameras deployed at the center of IMBCR sampling units. Of the 26 species, 13 had sufficient data to complete analyses using standard occupancy models. Approximately 40% more person-hours were required to sample the mammalian community in addition to the avian community. Deployment of cameras at IMBCR sampling units was trivial; the bulk of the additional effort was divided evenly among retrieving cameras at the end of summer and parsing through photos to assign species identifications. If cameras are not already available for use on such a project, approximately \$500/unit would be required to for their purchase.*

Monitoring the effects of restoration on riparian birds along the Dolores River

ALEX VAN BOER, Bird Conservancy of the Rockies

***Abstract.** Auxiliary or “overlay” projects extend the Integrated Monitoring in Bird Conservation Regions (IMBCR) design to answer specific management questions. While not integrated into the hierarchical stratification of the program, these projects incorporate IMBCR detections to provide robust estimates of avian density and occupancy in a regional context. In 2016, Bird Conservancy of the Rockies collaborated with the Dolores River Restoration Partnership to design a project monitoring the effectiveness of Tamarisk removal and habitat enhancement on birds along the Dolores River corridor in Colorado. We modified the IMBCR design to target riparian habitat by using a smaller 0.25-km² quarter-grid. We compared bird abundance in strata defined by active native revegetation, passive revegetation, and no restoration activity. We expect to see increased bird abundance as native vegetation recovers in treatment areas. We conducted field work during the 2016-2017 breeding seasons, conducting 353 point counts on 110 grids, and identifying 96 unique bird species. Incorporating detections from across the IMBCR program, we were able to generate robust density estimates for 38 species in 2016 (CV < 50%). Preliminary results suggest that Tamarisk removal may temporarily reduce Spotted Towhee and Common Yellowthroat density, species that prefer dense shrubs. However, riparian treatment had a weak, positive effect on Black-headed Grosbeak and Lazuli Bunting. With continued monitoring, we hope to be able to use this dataset to guide future management action along the Dolores River. This project is an excellent candidate for supplemental analyses including local habitat relationship models and trends following restoration.*

A decade of private lands stewardship in Colorado: Implications for avian conservation in the West

BECKY JONES, Bird Conservancy of the Rockies

***Abstract.** Bird Conservancy of the Rockies (Bird Conservancy) has been working to conserve birds and their habitats for 30 years in the Intermountain West and Great Plains through an integrative model of science, education and private lands stewardship. For the past decade we have been monitoring bird populations in Colorado and since then have expanded to 14 additional western states through the Integrated Monitoring for Bird Conservation Regions (IMBCR) program. We have also created a Private Lands Wildlife Biologist (PLWB) program, where field biologists apply this data towards conservation on private lands. Private land covers over 70% of all land in the contiguous U.S., and since many bird species of concern utilize these private lands for habitat, working with private landowners is vital to bird conservation. Bird Conservancy strives to develop a model of land stewardship guided and driven by scientific understanding, to help with both our prioritization of conservation investments, as well as an evaluation of those investments. We present examples of successful PLWB program's habitat conservation work for both birds and people, referencing our work in sagebrush steppe, mountain shrub, riparian areas, and forested ecosystems, as well as highlight our partnerships with other conservation collaboratives. For example, the Dolores River Restoration Partnership has used IMBCR to collect new data to inform future management of riparian areas along the Dolores River. We will also present opportunities for further adaption and application of IMBCR to evaluate Bird Conservancy's land stewardship impacts.*

The IMBCR Program: Past, present, and future

T. LUKE GEORGE, Bird Conservancy of the Rockies

***Abstract.** The IMBCR program: Past, present, and future The Integrated Monitoring in Bird Conservation Regions (IMBCR) program started in Colorado in 2008 and has expanded to 15 states and 10 Bird Conservation Regions. The success of the program is a result of the strong foundation in sampling design, rigorous training of field technicians, stringent data quality control, strong partnerships and state-of-the art analyses. The program provided estimates of density for 177 and occupancy for 172 species in Colorado in 2016. In addition, robust estimates ($CV < 50$) of density were obtained for 11 of 22 landbird Species of Greatest Conservation Need (SGCN) and robust estimates of occupancy were obtained for 14 of 20 SGCN. These estimates provide an important baseline for examining trends and the impacts of natural perturbations and management action on landbird density and abundance. Moving forward, the IMBCR program must provide information to assist managers make informed decisions to advance conservation objectives. Bird Conservancy of the Rockies is working on distribution maps, Bayesian trend analyses, and Decision Support Tools to meet these needs.*

Summarizing IMBCR data using the Rocky Mountain Avian Data Center

NICK VAN LANEN, Bird Conservancy of the Rockies

***Abstract.** Robust avian count data across large spatial scales and temporal extents can be difficult to find, obtain, and apply. The Integrated Monitoring in Bird Conservation Regions (IMBCR) partnership strives to make data and results discoverable and easily accessible via the Rocky Mountain Avian Data Center, a node of the Avian Knowledge Network. Join Nick Van Lanen, Biologist with the Bird Conservancy of the Rockies, for an overview of available data and results on the Rocky Mountain Avian Data Center, how information can be queried, recommendations for interpreting results, and some*

suggested applications of results to inform real world scenarios. Participants will be introduced to avian population metrics produced with IMBCR data and provided an overview of precision measures associated with those metrics. They will also learn how to navigate to mapped survey locations and view raw count and survey effort information. Additionally, participants will learn to query information at various geographic extents, for particular species, and over specific timeframes. An emphasis of the workshop will be how users can apply available data and results to address conservation questions and potentially make better-informed management decisions. Finally, the Bird Conservancy of the Rockies will seek participant input regarding the functionality and utility of the Rocky Mountain Avian Data Center so it can be modified as needed to better meet user needs. Participants are encouraged to bring a laptop for the second half of the workshop so they may practice querying information while in-person support is available.

Thursday 8 February 2018

Plenary Session: Road Ecology

Introduction to the Road Ecology Plenary Session

ARAN JOHNSON, Moderator, Southern Ute Indian Tribe

Road ecology: Are we taking the right turns?

MARCEL P. HUIJSER, PhD, Western Transportation Institute - Montana State University, 2327 University Way, Bozeman, MT 59715, phone: 406-543-2377, e-mail: mhuijser@montana.edu

Abstract. Road ecology has made substantial advances over the last few decades. Our knowledge has increased and mitigation measures to reduce the impacts of roads and traffic on wildlife are now widespread and implemented regularly. In many cases, the mitigation measures address human safety through reducing collisions with large mammals, provide safe crossing opportunities for wildlife, and it can even make economic sense to implement these mitigation measures. These successes may be reason to celebrate. However, it may also be time for us to think about whether we are taking the right turns. What are the effects of roads and traffic that we are mitigating? Are we forgetting things? What do we need to do to get mitigation implemented along road sections that are a concern to biological conservation but that are not a major safety concern? Are the locations we mitigate the correct locations and are they consistent with our objectives? What are the biases in our processes? Can we improve on the design of the mitigation measures to make them more effective? Can we be smarter and optimize the effectiveness of mitigation measures? Can we quantify what is needed to achieve our objectives?

Embracing road ecology

DAVID ELLER, Colorado Department of Transportation

Abstract. At the Colorado Department of Transportation we believe our role is to "Save Lives and Make People's Lives Better". As we analyze accident data along State Highways in Western Colorado we recognize that often the majority of vehicle accidents are wildlife related. As engineering professionals we believe we have solutions to mitigate the accidents. However, as joint partners with other agencies such as CPW we realize that our goals are not unique, but rather very similar, and goals for safety and roadway ecology have common ground. This presentation will talk about our common goals and how we can continue to build on recent success. Brief discussion on challenges with limited funding and the importance of responsible prioritization of any project, and importance in considering input from multiple agencies to make data driven decisions.

The big picture - CPW's interest and involvement in wildlife and transportation solutions

DEAN RIGGS, Northwest Deputy Regional Manager, Colorado Parks and Wildlife

Abstract. Roads across Colorado can have impacts on big game population through mortality caused by wildlife vehicle collisions (WVC), fragmentation and loss of habitat, and the potential of roads to become a barrier to wildlife movements. It is important to work with a diverse group of partners to address these concerns, especially as more people move to and visit Colorado, putting greater stress on existing resources. WVCs are one type of big game mortality that we can actively and effectively manage to decrease the impact, unlike predation or disease which is more difficult. CDOT and CPW identify WVCs as a common concern, both in relation to human safety and wildlife impacts. CDOT and CPW are collaborating on the development of the West Slope Prioritization Study which will identify wildlife-highway conflict areas and provide a framework to prioritize highway segments for future wildlife-highway mitigation projects.

At the crossroads: The role of wildlife professionals in protecting wildlife across transportation corridors

PATRICIA CRAMER, Independent Wildlife Researcher

Abstract. Wildlife mitigation in transportation systems relies on the active involvement of wildlife professionals. This talk blends the knowledge of how wildlife need to move across transportation corridors, examples of stellar projects in the Western U.S., and how wildlife professionals can become more involved in transportation planning and the creation of wildlife crossing structures. Stories of individual animals' movements, how neighboring western states were able to bring projects together, the results of some of the author's research, and resources the participants can use to help bring about wildlife mitigation will bring home the subject to participants. The objective of this talk is to inspire conference participants to become more involved in transportation planning.

A perspective on lessons learned in Montana - wildlife crossings for creatures large and small.....moving forward in Colorado

PAT BASTING, Jacobs Engineering

Abstract. Pat will discuss various types, sizes, and costs of wildlife crossings built in Montana and provide an overview of the currently ongoing West Slope Wildlife Prioritization Study here in Colorado.

Colorado wildlife crossings: Then, now and the road ahead

JULIA KINTSCH, EcoResolutions

Abstract. This presentation will provide an overview of wildlife crossings mitigation in Colorado from the 1970s to present. Colorado was one of the earliest states to experiment with transportation infrastructure designed explicitly for the purpose of reducing wildlife-vehicle collisions and supporting wildlife movements across roads. These efforts produced Colorado's first wildlife crossings and lessons in designing effective mitigation. Across Colorado a variety of projects are now underway, including local and regional studies to prioritize highway segments for mitigation for the best use of limited funds, and wildlife mitigation projects, including wildlife overpasses and underpasses. This increase in wildlife mitigation projects is the result of expanding interagency collaborations, partnerships, and community engagement.

Colorado State Highway 9: Collaboration and research advancing safe passage for wildlife in Colorado

MICHELLE COWARDIN, Colorado Parks and Wildlife

***Abstract.** The Colorado State Highway 9 (SH9) Wildlife and Safety Improvement Project is the culmination of a comprehensive and collaborative effort by the Colorado Department of Transportation (CDOT), Colorado Parks and Wildlife (CPW) and numerous other public and private partners. It was designed to improve safety while maintaining permeability for wildlife along a 10.5-mile stretch of SH9 between Kremmling and Silverthorne in Grand County. The highway had a large number of wildlife-vehicle collisions because it follows a valley with a high concentration of wintering mule deer, as well as other wildlife, such as elk, moose, pronghorn, black bear, coyote, and mountain lion. Construction was phased over two years, allowing for researchers to monitor and evaluate the project effectiveness in Phase 1 and make design modification recommendations for Phase 2. Phase 1, completed in 2015, included one overpass, three underpasses and 6 miles of 8' wildlife exclusion fencing. Phase 2 was completed in 2016, and included a second overpass, two additional underpasses, and continuation of the wildlife fencing. Both phases had numerous wildlife escape ramps, deer guards and pedestrian access gates. Phase 1 camera trap monitoring commenced in December 2015 at 27 mitigation feature locations. Post-construction monitoring, for both Phase I and II, will continue at 32 locations with 62 camera traps through 2020. Phase 1 camera monitoring documented initial wildlife responses and provided a basis for the partners to integrate design modifications into Phase 2. The primary alterations incorporated into Phase 2 included: a flat-rail to a round-bar deer guard at select locations; adjusted escape ramp locations; escape ramps with decreased slope; and escape ramps without guide-rail fencing. These modifications were possible because of the established interagency and collaborative relationships at the project level. The concurrence in this project of phased construction, cross-disciplinary collaboration, and Phase I monitoring proved fruitful for an adaptive management approach.*

Creating safe passage for smaller species using existing highway structures

DR. KERRY FORESMAN, Professor Emeritus, University of Montana

***Abstract.** For over 80 years people have documented the threat highways pose to animals. Over this period highways have significantly increased in size resulting in greater vehicle speeds and volumes producing an even greater threat to wildlife. A majority of research on wildlife/highway mitigation has focused on larger species such as deer, elk, and bears where the threat of collisions is more apparent, however a large number of accidents also occur when drivers swerve to avoid smaller species, and many smaller species are killed if an impact occurs. Smaller mammals are actually affected in 2 primary ways. First, wide expanses of a 4-lane highway (and shoulders) provide a formidable barrier for species that are primarily prey for mammalian carnivores and raptors. These species are vulnerable if they attempt to cross a highway, given the lack of protective cover. A majority of these species have evolved behavioral patterns that cause them to avoid areas devoid of vegetative cover thereby reducing their susceptibility to predation and, as a result, their populations are readily fragmented by highway construction. Secondly, species that do attempt to cross these openings [e.g. the predators which behaviorally do not perceive openings as threatening such as skunks, raccoons, bobcats, lynx], are often killed because the distance is great and vehicles are moving so quickly. My research has addressed these concerns and has allowed me to develop a shelf system which can be placed in highway culverts (from small drainage culverts to large culverts handling stream flows) to mitigate both problems.*

Eagle mortality associated with wildlife-vehicle collisions

HILLARY M. WHITE, U.S. Fish and Wildlife Service

***Abstract.** Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are at risk of mortality due to collisions with vehicles, especially when foraging on road-killed wildlife. As live prey becomes less available during winter months, eagles will opportunistically feed on roadside carrion; typically on carcasses of big game and lagomorphs. The U.S. Fish and Wildlife Service (USFWS) and our partners are interested in understanding the factors that increase vehicle strike risk to eagles. By combining recently developed golden eagle distribution models (e.g., breeding, wintering, and movement/migration models) with information about big game migration corridors, road density, and known wildlife-vehicle collision hotspots, we can begin to focus studies in areas where eagles may be more susceptible to vehicle strikes. In fact, we recently contributed to, and collaborated on, a new study that quantifies eagle vehicle strike. We will discuss our approach to developing a spatially explicit evaluation of risk factors to eagle-vehicle collisions, in support of identifying high-risk areas to implement mitigation measures that would reduce risk to eagles.*

I-25 wildlife mitigation

KORBY MINTKEN, Pinyon Environmental, Inc.

FRANCESCA TORDONATO, Colorado Department of Transportation

***Abstract.** This presentation will cover a road widening project along the I-25 corridor, between Castle Rock and Monument, Colorado. Project biologists and engineers have teamed up to determine the most suitable locations for wildlife crossings throughout the project corridor. Wildlife mitigation will be necessary to provide safety for both motorists and wildlife within the corridor. Wildlife crossings proposed to be installed will range between 150' and 230' long. Discussion topics would include, project background, wildlife data collection methods, hardships of design due to current landscape, and species using the corridor. This project is intended to break ground in the late months of 2018.*

Connecting people to the science of long distance migrations: Lessons for road ecology

BILL RUDD, Wyoming Migration Initiative

***Abstract.** The Wyoming Migration Initiative's mission involves sharing scientific information through public outreach. This means telling our science-based stories in ways that people can understand and, more importantly, relate to. This presentation will cover several WMI examples of using effective communication to relay important wildlife stories to a broad range of audiences. Lessons learned from work of the WMI can be applied to the wildlife roads arena. Although crossing structures are expensive, they are often cost-effective and they typically garner great public support. One of the challenges is to build a base of public support in order to obtain the necessary resources to build many more wildlife mitigation components into our highways. We need good science to help understand the problems and the solutions associated with wildlife-roadway interactions, but we must make the extra effort to get this information into peoples' hearts and minds so that positive action can be taken.*

THURSDAY 8 FEBRUARY 2018

IGNITE Session

Introduction to the IGNITE Session

KRYSTEN ZUMMO-STRONG, moderator, Pheasant Forever

CPW-CDOT collaboration on potential wildlife crossings between Castle Rock and Monument on Interstate 25

BRANDON MARETTE, Colorado parks and Wildlife

KAREN VOLTURA, Colorado Parks and Wildlife

Abstract. Colorado Parks and Wildlife (CPW) collaborated with Colorado Department of Transportation (CDOT) to study the best places for wildlife crossing (under/over passes) on an 18-mile section of I-25 that is proposed to begin construction November of 2018. CPW and CDOT both installed wildlife cameras to see which existing underpasses are being used by big game species. CPW also combined 3 sources of crash data to determine where “hot spots” are located in this corridor between Castle Rock and Monument.

Toss that elevator speech out the window: giving SciComm deeper roots

KRYSTEN ZUMMO-STRONG, Pheasants Forever

Abstract. In recent years, the conversation on how to improve scientists' ability to communicate with the public has become an ever increasing topic within all fields of science. Although recognizing we have an issue is the first step in resolving this struggle, we seem to be stuck in a cycle of talking about our inadequacy without making real steps towards a solution. Here I will bring to light the depth of this struggle, and how scientists can take it upon themselves to make a difference in how they communicate to bring science back into a positive light in the public arena.

Applying the COM-B model of behavior change to a case study of wildscape gardeners: Implication for conservation research

MEGAN S. JONES, Colorado State University

Abstract. Many of today's conservation challenges – from urbanization to climate change – have their roots in human behavior. Behavior change campaigns are therefore an essential tool for contemporary conservation, and social science can help practitioners identify what makes these campaigns most effective. With that objective in mind, this study applies and extends a pioneering public health framework for designing behavior change interventions – the COM-B model – to a case study of bird habitat enhancement in an urban corridor. Through ethnographic research with Colorado Front Range residents participating in Audubon Rockies' Wildscape Ambassadors program, we categorize the ways in which the capabilities, opportunities, and motivations of these urban gardeners influence their behavior. In particular, we investigate two clusters of behavior: wildscape gardening practice, in which participants try to improve bird habitat on their own property, and wildscape gardening advocacy, in which they encourage others to also adopt behaviors that improve bird habitat. Data are triangulated through a combination of case study interviews, document analysis, and participant observation. We found that wildscape gardening is a long-term commitment driven by many interconnected motivations, achieved by individuals along different spectrums of capability, and enhanced by access to a range of

opportunities. These findings suggest that behavior change campaigns can inspire and include many different types of conservation leaders in Colorado and beyond.

Gray wolf and human road behavior

LIZZIE CATO, Yellowstone Wolf Project

Abstract. Gray wolves living in Yellowstone National Park are some of the most publicly viewed wild wolves in the world. Yellowstone, like many of the popular national parks, is faced with increasing human visitation. Biologists on the Road Observation and Management Crew with the Yellowstone Wolf Project must balance collecting wolf behavior data and managing wolf viewing opportunities for the public. These two goals sometimes contradict each other and create unique challenges for park biologists, especially along the roadways. Since both the wolves and the visitors aren't leaving the park in the foreseeable future, solutions have been developed to accomplish both goals.

Modeling raptor distribution and creating consistent statewide survey protocols

REESA YALE CONREY, Colorado Parks and Wildlife

KEVIN AAGARD, Colorado Parks and Wildlife

JONATHAN DECOSTE, Boulder Open Space

LIZA ROSSI, Colorado Parks and Wildlife, Species Conservation Unit

WILLIAM KENDALL, USGS Colorado Cooperative Fish and Wildlife Research Unit

JAMES GAMMONLEY, Colorado Parks and Wildlife

Abstract. Colorado Parks and Wildlife (CPW) is working with our partners to model distribution and improve statewide survey efforts for raptors. Our current research focuses on four species on conservation concern: golden eagles, bald eagles, ferruginous hawks, and prairie falcons. Our preliminary distribution maps, based on nest records, will guide a sampling-based protocol in which we track survey effort and record non-detections in addition to nest location and status. While this research and planning is ongoing, we as our awesome employees, partners, and volunteers who collect raptor data to please completely fill out datasheets, send if your survey protocols, and know that your work is valuable and appreciated.

Assessing accuracy of land cover datasets in Greater Sage-Grouse habitats

MARCELLA FREMGEN, Boise State University, Bird Conservancy of the Rockies

*Abstract. Remotely-sensed land cover datasets and maps have been increasingly employed in studies of wildlife habitat use, especially for landscape scale evaluations and management planning. These maps can be cost-effective, but must be ground-truthed to draw meaningful conclusions from the analysis. Research regarding habitat use by sage-grouse (*Centrocercus urophasianus* and *C. minimus*) has employed Gap Analysis Program (GAP) and LANDFIRE layers of habitat classifications. Use of inaccurate data, or data with undocumented accuracy, may result in incorrect interpretations of habitat use and potentially incorrect habitat prioritization for conservation. We used field-collected data on dominant vegetation types of sagebrush species, percent cover, and height to evaluate the accuracy of GAP and LANDFIRE datasets for sagebrush habitats used by Greater Sage-Grouse in southern Idaho. Accuracy of LANDFIRE was compared to field data at a broad community scale (e.g., big sagebrush [*A. tridentata*], dwarf sagebrush, other vegetation types), and at a species level (e.g., little sagebrush [*A. arbuscula*], black sagebrush [*A. nova*], Wyoming big sagebrush [*A. t. wyomingensis*]). Land cover classes from GAP reflect large landscapes, and GAP had the highest overall classification accuracy (49.8%) compared to*

the accuracy of relatively narrower LANDFIRE community-level classification (39.1%) and species-level classification (31.9%). Comparisons were made both at the pixel level and with three sizes of moving windows. Estimates of percent cover and height were not accurately reflected in the LANDFIRE dataset, especially in heterogeneous habitats with mosaics of different species. Therefore, researchers must be cautious when applying GAP or LANDFIRE datasets to smaller scale (community or species level) habitat studies in sagebrush habitats.

The narrow leaf of Deadman Creek

JESSE MCCARTY, U. S. Forest Service

*Abstract. The woodland riparian ecosystem along the Deadman Creek on the Saguache Ranger District hosts a large intact gallery of large and old Narrowleaf Cottonwoods (*Populus angustifolia*) with Rocky Mountain juniper (*Juniperus scopulorum*). This is an uncommon association limited to desert riparian areas. It is known only from foothill streams of Wyoming, Colorado and New Mexico.*

By ranking the relative rarity or imperilment of a species, the quality of its populations, and importance of the associated conservation sites, the methodology can facilitate the prioritization of the conservation efforts so the most rare and imperiled species may be preserved first. The globally vulnerable (G3) and state imperiled (S2) narrowleaf cottonwood is an excellent bank stabilizing species, contributing to the development of stable riparian communities for use by a variety of wildlife. The clonal reproduction of established narrowleaf cottonwood stands leads to heterogeneous trunk size and spatial clumping, increasing habitat richness for wildlife.

Wilderness icon or hen house villain: The Rocky Mountain Red Fox

PATRICK A. MAGEE!, Western State Colorado University

*Abstract. The red fox (*Vulpes vulpes*) was historically considered an icon of wilderness where it lived in mountainous regions. More recently several forces have altered the distribution of red fox. Depending on their origin and genetic background, the behavior of red fox varies. Contemporary red fox in Colorado may represent various origins and may shine light on their evolving synanthropic nature. In this presentation I review the historical and current distribution of red fox in Colorado and their origins based on phylogeography studies and oral histories.*

THURSDAY 8 FEBRUARY 2018

Invited Talk

The first five (or more) decades of chronic wasting disease: Lessons for the five decades to come

MICHAEL W. MILLER, Colorado Parks and Wildlife

Abstract. Chronic wasting disease -- an infectious prion disease of Colorado's four native cervid species -- has run the gamut from minor scientific curiosity to national crisis since the syndrome's first recognition in the late 1960s. Many facets of chronic wasting disease biology and ecology are now well understood, but science informing effective management and control strategies remains incomplete. With two exceptions (Ontario and New York), the disease has persisted in reporting jurisdictions in the face of widely varied control attempts. Eradicating chronic wasting disease appears infeasible given its extensive distribution and other epidemiological attributes. Regardless, adaptive approaches for containing foci and reducing infection and transmission rates still deserve fuller professional attention. Such pursuits

undoubtedly will be more difficult to champion and garner support for in sociopolitical climates ranging from apathetic to combative, particularly when control prescriptions impinge upon or conflict with commercial and sport hunting interests. There are two important motivations for making progress toward sustainable containment and control strategies for chronic wasting disease in the coming decades: First, data from a growing number of sources suggest that heavily-infected cervid populations will not thrive in the long-term. Second, data on chronic wasting disease prions and experience with other animal prion diseases suggest minimizing human exposure to these agents would be prudent.

Thursday 8 February 2018

Posters

Bird, mammal, and herpetofauna inventory of the Bitter Brush State Wildlife Area, Moffat County, CO

BRIAN HOLMES, Colorado Parks and Wildlife

ALYSSA KIRCHER, University of Wisconsin – Madison

Abstract. In Colorado, State Wildlife Areas (SWAs) are state- or privately-owned lands that offer state-managed, wildlife-related recreation to the public. The Bitter Brush SWA (BBSWA) is one of about 350 SWA lands in Colorado and one of about 190 in which Colorado Parks and Wildlife is the fee title owner with primary management authority. Most SWAs have been acquired to 1) provide hunting and/or fishing opportunities for the public, or 2) secure important seasonal ranges for key wildlife species (primarily big game). While serving these dual primary purposes, SWAs also protect and provide habitat for numerous wildlife species representing the diverse native fauna of Colorado including big game, small game, nongame, and species of concern. Originally acquired to protect winter range for mule deer from the two largest herds in Colorado, the BBSWA encompasses ~8,400 acres in central Moffat County near the southern boundary of the Wyoming Basin ecoregion. From January 2015 to December 2017 we conducted a multi-method inventory for birds, mammals, reptiles, and amphibians on the BBSWA in order to better understand the wildlife community and to help inform future management decisions. We confirmed a total of 102 species present on the SWA while documenting five additional species in similar habitat within two miles of the SWA, for a total of 107 species (4 amphibians, 7 reptiles, 31 mammals, and 65 birds) known or likely to occur on the BBSWA. Our poster will report on the methods used, effort expended, species documented, inventory completeness, and relative abundance of wildlife species found on the BBSWA.

Influence of road and OHV use on Great Basin spadefoot habitat use

BILLIE WILLIAMS, undergraduate student; Colorado Mesa University

HEIDI PLANK, Bureau of Land Management

DANIEL NEUBAUM, Colorado Parks and Wildlife

Abstract. We used radiotelemetry to monitor potential impacts from OHV use in Hunter Canyon on Great Basin Spadefoot toads, a Bureau of Land Management (BLM) sensitive species and Colorado Parks and Wildlife Tier 2 State Wildlife Action Plan (SWAP) species. The Grand Mesa Jeep club installed and maintains an OHV enclosure to prevent off-highway vehicle use for a portion of the breeding grounds used by spadefoots in Hunter Canyon. Monitoring to determine the impacts to habitat use, survival, and breeding activity within and outside of the closure in Hunter Canyon will help inform future management actions. Our study also provides some of the first data for this species in Colorado related to burrow requirements and water temperatures of breeding pools which may be influenced by climate change. A

total of 28 spadefoots were captured and 18 marked with transmitters between May-July of 2017. Burrows were found for 18 marked toads with numbers identified for each individual ranging from 1 to 22. Burrows were typically located in soft soil and leaf litter, usually found adjacent to the stream bed, and varied in depth. Soil temperature of burrows averaged 21.8°C but varied from summer to autumn as the temperature got cooler. Water temperature where tadpoles were found averaged 20°C. No mortalities of spadefoots resulted from OHV use but one was driven over and survived. This spadefoot study investigates fragmentation of habitat tied to roads and OHV use for the first time and can inform future travel management recommendations.

TRACT: a tool for prioritizing and ranking the National Wildlife Refuge System's land acquisition

MINDY B. RICE, U.S. Fish and Wildlife Service

Abstract. Identifying priority landscapes for conservation and management of wildlife is an important application for agencies tasked with acquiring land. Roughly 350 of the 563 national wildlife refuges in the National Wildlife Refuge System (NWRS) of the US Fish and Wildlife Service (USFWS) have unprotected lands and/or waters located within their approved land acquisition boundaries. Many of these lands and waters provide important wildlife habitat, and protecting this habitat would help USFWS fulfill its mission to conserve fish, wildlife, and plant species. USFWS recently developed a Strategic Growth Policy for the NWRS which identifies specific biological criteria that will be used to evaluate and prioritize proposed land acquisitions at existing refuges, as well as evaluating proposed new refuges and refuge expansion proposals. The three priority conservation targets outlined in the policy include recovery of threatened and endangered species, implementing the North American Waterfowl Management Plan (NAWMP) and conserving migratory birds of conservation concern. Our team identified various potential factors and data sources to rank proposed land acquisitions based on these priorities. Team members incorporated the appropriate factors and data sources into separate decision trees for each priority, to provide a biological, science-based, and transparent process for ranking refuges within proposed NWRS land acquisitions. Collectively, these decision trees and the associated criteria are known as the Targeted Resource Acquisition Comparison Tool, or the TRACT. The TRACT is a decision support tool, not a decision making tool, and thus, the goal of TRACT's rankings is to provide decision makers with an objective analysis that is grounded in the best available science.

Monitoring the use of abandoned mines by wildlife in the Sangre de Cristo mountain range

TYLER CERNY, undergraduate student, Adams State University

JOSE MIX, Adams State University

WYATT MORAN, Adams State University

ERIKA IBARRA-GARIBAY, Adams State University

TIM ARMSTRONG, Adams State University

Abstract. Recent events including the Gold King mine blowout, ongoing concerns about the transmission of a fungal disease called white-nosed syndrome among bats, and concerns about human safety have prompted many to propose sealing or gating abandoned mines across the western US to prevent drainage and human entry. Observations indicate that large carnivores including pumas and black bears are using abandoned mines. We have initiated a study of mine usage by wildlife in the Sangre de Cristo Mountains to determine the extent of this usage. During the summer of 2017, we placed 30 remote trail cameras to monitor abandoned mines to learn more about how wildlife are using these mines. If wildlife are using mines as refuges from low temperatures, or for denning sites, sealing or gating mines may

have adverse effects on local wildlife. Preliminary data from the summer indicate that carnivores are visiting mines, but we expect usage to increase during the winter season.

Calcium supplementation negatively affects lifespan of breeding Tree Swallows

MARINA D. RODRIGUEZ, graduate student, Colorado State University

SUSAN M. BAILEY, Colorado State University

KATHRYN P. HUYVAERT, Colorado State University

PAUL F. DOHERTY, JR., Colorado State University

***Abstract.** Stress can have various effects on the health and longevity of organisms. One mechanism whereby stress exposure affects health and lifespan is telomere length. Telomeres are non-coding, repetitive DNA sequences that cap the end of eukaryotic chromosomes whose length is highly correlated with lifespan. Telomeres shorten with age, and telomere length can be inherited from parents. More rapid shortening can also occur with increased stress. While many studies focus on factors that cause telomere shortening, very few studies in the wild have looked at factors contributing to a slowing down or reversal of telomere shortening. Because calcium has been shown to increase reproductive success in passerines, we utilized calcium supplementation to determine if the nutrient can act as a buffer to shortening telomeres in female Tree Swallows (*Tachycineta bicolor*) and their offspring during the breeding season. We took blood samples from females and supplemented nests with calcium (crushed oyster shell) or a control (local soil) at the beginning of nest construction. Once chicks were 12 days old, a second blood sample was taken from mothers as well as nestlings. Our preliminary data suggest that the increase in reproductive success that comes with calcium supplementation may have a negative effect on telomere length, therefore lifespan, of female Tree Swallows. Higher rates of telomere shortening in females supplemented with calcium may be due to increased stress as a result of higher hatching success and larger broods. In offspring, however, telomere length at 12 days old was longer in chicks supplemented with calcium.*

A novel qPCR assay for avian sexing

JAMES KELLEHER, undergraduate student, Colorado State University

EMILY WOLCOTT, Delaware Valley University

DARL SWARTZ, Delaware Valley University

***Abstract.** Many groups of birds are difficult to consistently sex, due to a lack of sex-specific characteristics in plumage or external anatomy. Current methods such as physical examinations or blood testing are either extremely difficult, detrimental to the animal, or both. Reliable and noninvasive methods of sexing would be valuable for both industrial and wildlife professionals. Our goal was to determine if DNA isolated from fecal samples can be used in a novel qPCR assay to reliably determine avian sex across a range of species. Samples were gathered from native Pennsylvanian passerines at a local wildlife rehabilitator. As none of these species have published genomes, sequences from closely related species were aligned to locate highly conserved sequences for a general avian gene and a female-specific gene on the W chromosome. Primers for these sequences were designed and assays were run on tissue and fecal samples, with mixed results. During tissue runs, the general gene amplified in House Finch samples but not in American Robin samples. The female-unique gene was amplified in every sample, including males and blanks and was independent of [DNA], suggesting issues in the sequence itself. Results from the fecal samples suggest that the DNA was too degraded to acquire meaningful data, as only one sample amplified at all. These results suggest that fecal DNA is inadequate for use in avian sexing, and that feathers are a more effective and minimally invasive source of DNA. Additional W-chromosome genomic sequencing is needed to better characterize specific species and design primers.*

Friday 9 February 2018

Contributed Papers

MARCELLA FREMGEN, moderator, Bird Conservancy of the Rockies

Behavioral plasticity buffers mule deer from demographic impacts of energy development

JOSEPH M. NORTHRUP, Colorado State University

CHARLES (CHUCK) R. ANDERSON JR., Colorado Parks and Wildlife

BRIAN D. GERBER, Colorado State University

GEORGE WITTEMYER, Colorado State University

Abstract. Developing effective measures to mitigate development impacts has become important for wildlife managers but has been hindered by inability to identify factors driving populations. Current research predominantly addresses behavioral responses to development, but often lacks assessment of demographic and population-level influences. We assessed the demographic and behavioral responses of a mule deer population to natural gas development on winter range in the Piceance Basin of Colorado, USA between 2008 and 2015. We focused data collection on two winter range study areas that experienced different levels of energy development (0.1 pads/km² and 0.9 pads/km²). We assessed mule deer behavioral responses by examining habitat selection patterns of adult female mule deer. To address demographic responses, we compared annual adult and over-winter fawn survival, fawn and adult female body condition, pregnancy rates, fetal counts, and annual changes in density. We noted strong differences in habitat selection between study areas, but found no differences in any demographic parameters measured. Our results indicate that deer were able to alter their behavior in response to development on winter range to avoid any demographic consequences. Given our results, mitigation efforts should focus on the drilling phase of development, as it appears that deer can adjust to relatively high densities of producing well pads, provided there is sufficient vegetative and topographic cover available. Our study highlights the importance of concomitant assessments of behavior and demography to provide a holistic understanding of the impacts of habitat modification on wildlife.

Estimating snowshoe hare density from pellet counts on BLM lands in Fremont County, Colorado

EMILY LATTA, Bureau of Land Management

MATTHEW RUSTAND, Bureau of Land Management

Abstract. The 2013 Lynx Conservation Assessment and Strategy (LCAS) provides management guidance of lynx habitat for agencies and includes direction on sustaining snowshoe hare habitat at the Lynx Analysis Unit (LAU) level. The BLM-Royal Gorge Field office designed a snowshoe hare fecal pellet protocol to estimate hare density and to address whether the BLM administered lands in the Three Peaks area of Fremont County Colorado contain a density of snowshoe hares capable of supporting a lynx population. The main objective is to determine whether an LAU is warranted for the Three Peaks area and the auxiliary objective is to quantify hare response to timber management over the long-term to further facilitate project level management decisions. This monitoring project will begin implementation during the Fall of 2018.

Conservation easements and sportsmen: What's in it for me?

ILANA MOIR, Colorado West Land Trust

STEPHANIE DURNO, Colorado Parks and Wildlife

Abstract. Conservation agreements used by land trusts are effective tools for protecting land from development in perpetuity. These agreements can be, and often are, crafted to specifically benefit wildlife and improve the quality of habitat on these lands. Sportsmen and women may be suspicious of the intent and efficacy of land trusts and conservation easements, often because of the perceived lack of value. While conservation easements may not provide additional public hunting or fishing access, they provide myriad wildlife benefits that enhance herd health and augment big game populations, which in turn improves hunting on public lands. Colorado West Land Trust operates on the western slope of Colorado and has conserved 88,000 acres of elk winter range and 66,000 acres of mule deer winter range since 1980. While the majority of conservation easements do not guarantee public access, the lands are also not subject to the recreational and extraction pressures of public lands. The privately conserved lands provide year round habitat to wildlife and improve stewardship of private lands. Land trusts encourage hunters and anglers to be educated about conservation values on private land, as they function throughout the year to enhance wildlife populations that are then available to hunting and fishing in their favorite access areas.

Overview of Colorado's State Wildlife Action Plan and the Recovering America's Wildlife Act

ERIC ODELL, Colorado Parks and Wildlife

Abstract. State Wildlife Action Plans serve as a conservation blueprint for state wildlife agencies and their partners to strategically address threats and implement actions on a variety of species and habitats. Since revising Colorado's State Wildlife Action Plan in 2015 there have been novel efforts to implement the actions outlined in the document. By having an approved State Wildlife Action Plan, the state is eligible for State Wildlife Grants from the US Fish and Wildlife Service. Colorado typically receives ~\$1 million/year in State Wildlife Grant funds. The Association of Fish and Wildlife Agency's sponsored group known as the Blue Ribbon Panel has made recommendations on how long term, sustainable funding may be secured to ensure continued and enhanced efforts to keep common species common. Reflecting those recommendations, recently introduced federal legislation, if passed and funded, would amplify the available federal funding by nearly 30 times. An overview of Colorado's State Wildlife Action Plan and the status and next steps relative to the recently introduced Recovering Americas Wildlife Act will be described in this presentation.

USFWS update on status of federally listed species recovery in western Colorado: focus on Gunnison Sage-grouse

MARK BRENNAN, U.S. Fish and Wildlife Service

Abstract. The Western Colorado Field Office (USFWS) is responsible for the recovery of numerous terrestrial and aquatic species listed under the Endangered Species Act. I will present some updated information on the current status of the Gunnison sage-grouse, Canada lynx, western yellow-billed cuckoo, southwestern willow flycatcher, the four Colorado River fish, and various cutthroat trout species. I will focus on the status of recovery planning for the Gunnison sage-grouse, which was listed as threatened in 2014. Under new USFWS policy for developing species recovery plans, we are developing a species status assessment (SSA) as the foundation for all future decisional actions on this species. This

will include the development of a formal recovery plan, a five-year status review, and any future status decisions, including de-listing or up-listing to endangered if necessary.

Modeled snow persistence in occupied and potential wolverine habitat in the Rocky Mountains

STEPHEN C. TORBIT, U.S. Fish and Wildlife Service

JOHN GUINOTTE, U.S. Fish and Wildlife Service

ANDREA RAY, NOAA/ESRL Physical Sciences Division

JOSEPH J. BARSUGLI, NOAA/ESRL Physical Sciences Division and University of Colorado

BEN LIVNEH, University of Colorado

CANDIDA F. DEWES, NOAA/ESRL Physical Sciences Division and University of Colorado

IMTIAZ RANGWALA, University of Colorado

AARON HELDMYER, University of Colorado

JENNA STEWART, University of Colorado

***Abstract.** Wolverines may utilize snow for predator avoidance, food storage, temperature regulation and denning cover. The impacts of climate change on snow persistence and thereby wolverine population performance has been suggested as an important negative factor for wolverines. The Fish and Wildlife Service engaged with the National Oceanic and Atmospheric Administration and University of Colorado to model fine scale persistence of snow in occupied and potential wolverine habitat in Rocky Mountain and Glacier National Parks. The primary objective was to refine the spatial and temporal scale of snow modeling efforts and improve the scientific understanding of the extent of spring snow retention in the future under a changing climate. Future snow pack projections were generated using the Distributed Hydrology Soil Vegetation Model for the historic period 1998-2013, and validated against SNOTEL stations and MODIS satellite data. Five future scenarios were selected from CMIP5 global climate model projections based on the RCP 4.5 (moderate) and RCP 8.5 (high) emissions scenarios. All projections show declines in the number of years with significant snow. In each study domain, areas with frequent availability (14 out of 16 years) of significant snow (≥ 0.5 m) become concave elevation areas. In contrast, lower elevation areas had the largest decreases in the number of years with significant snow cover. Large tracts of significant snow covered area were projected near documented dens and inferred elevations for expected denning for all three scenarios. This suggests wolverines would not have to move far to reach areas with significant snow in the future.*

Field observations and Bayesian models forecast evolutionary response to chronic wasting disease in mule Deer

NATHAN L. GALLOWAY, Colorado State University

CHRIS GEREMIA, Colorado State University

N. THOMPSON HOBBS, Colorado State University

MICHAEL F. ANTOLIN, Colorado State University

***Abstract.** Chronic wasting disease is a fatal neurodegenerative prion disease that infects white-tail deer, mule deer, elk and occasionally moose in North America. We conducted a five-year mark recapture study of a population of Northern Colorado mule deer (*Odocoileus hemionus*) with endemic disease, including 217 females. All study animals were also genotyped at the prion precursor gene, *Prnp*, which has been shown repeatedly and in many species to express amino acid changes that alter prion disease dynamics. Mark-recapture data revealed decreased disease incidence for the genotypic group made up of heterozygotes, *Prnp* 225SF, and rare homozygotes, 225FF. We found no evidence for an evolutionary*

trade-off of decreased survival of CWD-negative deer with the minor allele but emphasize the difficulty in estimating dynamic rates for the rare homozygotes. We employed these estimates of annual disease risk in conjunction with survival estimates as well as recruitment estimates from the literature to forecast evolutionary change using a matrix model of the population. The forecast revealed a clear expected evolutionary change in the Prnp minor allele frequency given our model and data. However, this prediction only highlights the question as to why the rare allele is persistently rare even in a population that has experienced disease pressure for many decades.

Unsuspected retreats: Use of rock crevices and talus as autumn transition roosts and potential hibernacula

DAN NEUBAUM, Colorado Parks and Wildlife

Abstract. Identification of autumn and winter bat roosts in Western North America (West) has become a priority as White-nose Syndrome (WNS) spreads. Management efforts in Eastern North America have focused on caves and mines that house large winter colonies. Surveys across the West indicate most bat species are not using caves and mines in large numbers leaving biologists and land managers struggling to make management decisions. Identifying appropriate sites in which to collect baseline population data prior to arrival of WNS, where to limit access to reduce accidental spread of WNS, and determining how well WNS will persist if introduced are difficult questions to address without known locations. Mounting evidence for use of rock crevices as summer, autumn and winter roosts, may explain why numbers of bats found in caves and mines across the West generally tend to be lower than expected. We tracked 38 little brown bats in autumn as maternity colonies dispersed and located 49 roosts in buildings, trees, and rock crevices, some of which were in talus fields. Marked bats moved small distances between capture sites in summer range to autumn roosts (Mean = 3km) with changes reflected in elevation rather than latitude. Roost switching was common, averaging 2 roosts per bat (range 1-7). Temperatures in rock crevice roosts maximized benefits of torpor with those in talus fields covered by snow for 2-6 months. Landscape analysis evaluate a priori models with distance from capture site, roost density, aspect, elevation, and shade variables compared to randomly available sites.

Movements and demography of the Brown-capped Rosy-Finch

T. LUKE GEORGE, Bird Conservancy of the Rockies

RAYMOND VANBUSKIRK, Rio Grande Bird Research

ERIKA ZAVALTA, University of California – Santa Cruz

GARTH SPELLMAN, Denver Museum of Nature and Science

*Abstract. Brown-capped Rosy-Finches (*Leucosticte australis*) (hereafter rosy-finches) nest at higher elevations than any other bird species in the United States, and their breeding distribution is limited to Colorado and the Snowy Range of Wyoming. Despite residing in an almost pristine environment for most of the year, Christmas Bird Count (CBC) data suggest that rosy-finches may have declined by as much as 95% over the past 50 years and are on the Partner's in Flight Red List. To obtain a better understanding of their life history, we summarize information on the movements and demography of this poorly studied species. Limited information from recoveries of banded birds suggests that rosy-finches do not move far between years when captured in winter (mean=43±12 km, n=51) or between winter and breeding locations (30±14 km, n=5). Estimates of rosy-finch abundance from the Integrated Monitoring in Bird Conservation Regions program in Colorado over the period 2008-2017 varied between 6 and 55,000 individuals. Annual survival of birds banded at the Sandia Crest in New Mexico over the period 2004-2017 was 0.31±0.033. Juvenile-to-adult ratios of rosy-finches were slightly below those of taxonomically*

related species or species that reside in similar environments. Small population size combined with low annual survival and productivity suggest that rosy-finches could be in peril. Furthermore, limited movement of individuals suggests that “rescue” of populations by immigration from other locations may be unlikely.