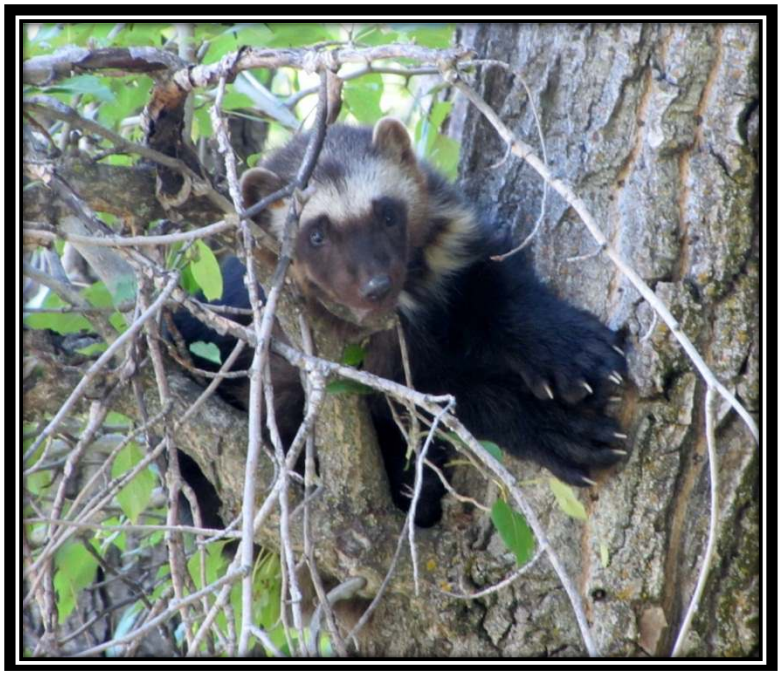
51st Annual Conference of the Montana Chapter of The Wildlife Society



Wildlife and Change: The Influence of Climate, Politics, and Social Dynamics on Wildlife Conservation and Management

Grouse Mountain Lodge

Whitefish, Montana

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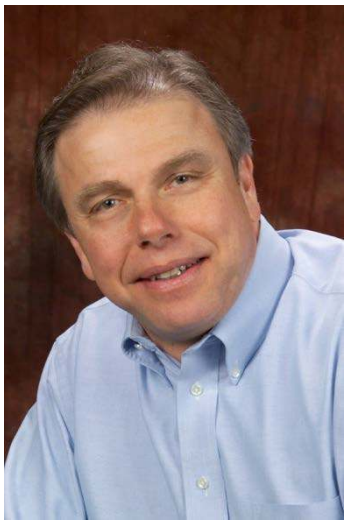
MT CHAPTER TWS ELECTION 2013

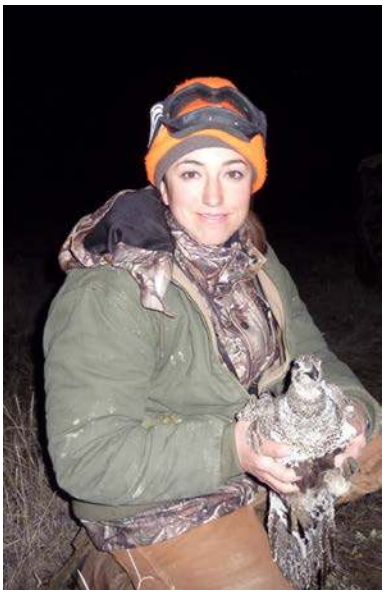
NOMINEES FOR PRESIDENT-ELECT

Kristina Boyd has been active in TWS since 2006, is a Certified Wildlife Biologist, an alumnus of the Leadership Institute, and founder and chair of the Early Career Professional working group. She earned a B.A. in Biology from Boston University in 2000 and an M.S. in Wildlife Management from Humboldt State University in 2009. Kris has conducted work throughout the west on ecology and management of vegetation and habitat, insects, herpetofauna, passerines and raptors, small mammals, ungulates, mesocarnivores and apex predators. Many of her project involvements have been cooperative in nature through various federal, state, tribal, and private organizations.

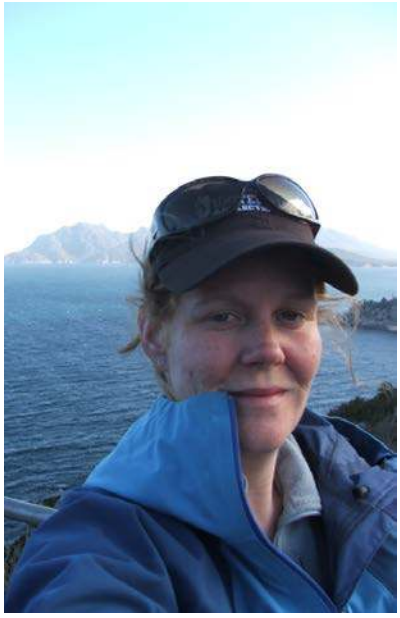


Lorin Hicks has been a member of TWS since 1975. Based in Columbia Falls, he is the Director of Fish and Wildlife Resources for Plum Creek Timber Company, with management and research responsibilities for Company lands from West Virginia to Oregon. Dr. Hicks received his BS in Wildlife Biology at Arizona State University, his MS in Wildlife Ecology at the University of Michigan and his Ph.D. in Forestry at the University of Montana. He is a member of the Montana Common Loon and Bat Working Groups and a founding member of the Montana Bald Eagle Working Group. Dr. Hicks initiated the Swan Valley Grizzly Bear Conservation Agreement and supervises the implementation of Plum Creek's Native Fish Habitat Conservation Plan on over 800,000 acres of company property in Montana.

NOMINEES FOR SECRETARY



Melissa Foster works for Montana Fish, Wildlife & Parks as the Glendive area wildlife biologist. She has been in that position almost a year now, and loves it. She enjoys the dedication and talent of the wildlife folks in Region 7. Before that, she worked for FWP doing research on sage grouse. That was an amazing job where she got to spend tons of time outdoors and realize what a great place eastern MT is to live. She grew up in Michigan, and earned a B.S. at Michigan State. Her two favorite seasonal jobs were a summer spent radio tracking rattlesnakes on the MI west coast and 5 months doing forest research in Puerto Rico. She did her M.S. at the University of Tennessee on waterfowl food resources. She likes the outdoors, hunting, and riding horses. She thinks being secretary of MT TWS would be a great opportunity to get to know the people and wildlife issues across the state and nation better.



Megan O'Reilly is currently working for the USFWS, Habitat and Population Evaluation Team (HAPET) in Great Falls and a M.S. candidate at Montana State University. Megan has been very involved with both The Wildlife Society Montana Chapter and the Montana State University Student Chapter since beginning her undergraduate degree at Montana State University in 2005, serving as both secretary and president of the Student Chapter. After many years of attending the annual conference, presenting her undergraduate and graduate research and attending presentations, she is interested in becoming more knowledgeable about and involved in the year round operational aspects of the Montana Chapter and would enjoy the opportunity to serve the Chapter in this position.

CONFERENCE SCHEDULE- Rooms in Parentheses

	25-Feb	26-Feb		27-Feb		28-Feb		1-Mar
7:00 AM						**Chapter Business Meeting** (*WINE ROOM*)		
8:00 AM								
9:00 AM		**Bald Eagle WG** (*EAST DIVIDE*)		**Development Special Session 8:30 to 12:00** (*GLACIER*)		**Presentations** (*GLACIER/UPPER GLACIER*)		**Presentations** (*GLACIER/UPPER GLACIER*)
10:00 AM					**Resume Writing Workshop 10-12** (*UPPER GLACIER*)			
11:00 AM								
12:00 PM	**Common Loon WG** (*EAST DIVIDE*)	LUNCH BREAK		LUNCH BREAK		LUNCH BREAK		**End of 2013 MT TWS Meeting**
1:00 PM		**Bat WG** (*EAST DIVIDE*)	**Residential Development WG** (*UPPER GLACIER*)	**PLENARY** (*CONTINENTAL DIVIDE*)		**Presentations** (*GLACIER/UPPER GLACIER*)		
2:00 PM								
3:00 PM	**Harlequin WG** (*EAST DIVIDE*)							
4:00 PM		**Herp WG** (*EAST DIVIDE*)	**Partners for the Americas** (*UPPER GLACIER*)	**MAFWB** (*ALPINE*)	**Early Career Pro WG** (*NORDIC*)	**Poster Session** (*LOBBY/FOYER*)	**MSU/FWP Sheep Research** (*CARD*)	
5:00 PM				**Student/Professional Mixer** (*GLACIER/FOYER*)				
6:00 PM		**Evening Social/Welcome Reception** (*GLACIER/FOYER*)				**Awards Banquet/Silent Auction** (*CONTINENTAL DIVIDE*)		
7:00 PM				**Quiz Bowl** (*CONTINENTAL DIVIDE*)				
8:00 PM								
9:00 PM								

Plenary Session

As Montana wildlife and natural resource professionals, I am sure it goes without saying that we all firmly believe in the responsible stewardship and conservation of arguably the most diverse landscape in the Lower 48. That diversity not only includes the sheer number of species and habitats we are fortunate enough to have within our state, but it also includes the diversity of environmental and anthropogenic factors, as well as political and social challenges we confront on a daily basis. I like to believe that we still maintain the strong conservation ethic that we learned over the years and whether or not we agree that hunting and trapping are appropriate tools for wildlife management, we all would agree that farmers and ranchers are vital to wildlife conservation as they provide large blocks of habitat for a variety of wildlife species. We may not agree on how to allocate funds to programs, or which programs are most vital, but we would all agree on the importance of establishing and maintaining working relationships with colleagues and community members. We know that by building a rapport we are giving individuals a sense of ownership in the wildlife we manage as a public resource and the habitat we aim to protect. We design and implement conservation and management strategies based on research of species ecology and community interactions which are ultimately by social and political values. Regardless of where we sit on the political spectrum, we all are connected through our passion for wildlife and wildlife resources.

For this Plenary Session, we will examine potentially the most daunting ecological threat facing wildlife management and conservation, climate change. We have all heard the phrase regarding wildlife and climate change…move, adapt, or die. What is our role as a professional society in regards to the conservation of species likely to be impacted by climate change? What is your role as a professional wildlife biologist? Going a step further, we will dive into the human dimensions and social dynamics that influence our ability to conserve wildlife and wildlife resources. Whether we like to admit it or not, our operating environment is such that implementation of our management recommendations is ultimately shaped by the beliefs and values of the public. This process is guided by policy in the form of legislation which will be the final topic of the Plenary Session. We will discuss the legislative process and how it has the ability to compromise what we do or assist in what we do as wildlife professionals.

So I ask that everyone please come prepared to engage in some healthy discussion and take advantage of the opportunity to feed off of your colleagues' collective knowledge.

PLENARY SPEAKERS

Climate Change-Dr. L. Scott Mills, Professor, Wildlife Biology, University of Montana

Social Dynamics-Mike Lewis, Human Dimensions Unit, Montana Fish, Wildlife & Parks

Politics-Ken McDonald, Wildlife Division Chief, Montana Fish, Wildlife & Parks

WILDLIFE V. THE HUMAN FOOTPRINT IN MONTANA:
IS A WIN-WIN POSSIBLE?
Wednesday, February 27, 2013
8:30 a.m. – 12:00 noon

Human demands for exurban housing options, high-speed transportation routes, and a bottomless supply of energy inevitably affect the quality and quantity of wildlife habitat here in Montana. Climate change adds another layer of stress factors onto our wildlife populations. Just like for *homo sapiens*, maintaining the status quo is not an option for Montana's mule deer, sage grouse, warblers, and wolverine.

Workshop Questions

- With change a given dynamic on the landscape, how can biologists effectively integrate science into the residential, transportation, and energy development decisions made by others?
- What are some of the opportunities, tools, and strategies available to biologists?
- Under what conditions can biologists effectively help developers and other decision-makers accommodate the needs of both humans and wildlife?

Workshop Objectives

- Discuss opportunities for biologists to offer information and recommendations for the development planning process.
- Share new or emerging tools and strategies for locating and designing wildlife-friendly residential subdivisions, highway projects, and energy developments.
- Stimulate thought and group discussion on the conditions under which biologists can make the best use of these opportunities, tools, and strategies.

Workshop Presenters

- John Vore, Area Wildlife Biologist, *Montana Fish, Wildlife & Parks (MFWP)*
- Brent Brock, Ecologist, *Craighead Institute*
- Tim Worley, Senior Planner, *Missoula County, MT Community & Planning Services*
- Pat Basting, District Biologist, *Montana Department of Transportation*
- Joe Weigand, Private Lands Wildlife Specialist, *MFWP*
- Jackie Corday, Charter Member of *Montanans for Safe Wildlife Passage*; also, Open Space Planner, *City of Missoula, MT*
- John Ensign, Energy Specialist, *MFWP*
- Allison Begley, Aquatic Invasive Species Coordinator (former biologist with an interest in wind energy), *MFWP*
- Sam Milodragovich, Biologist, *Northwestern Energy*

Workshop Moderator

Doris Fischer, Land Use Planning Specialist, *MFWP*

Workshop Format

- Introduction
- Planning for Residential Development and Wildlife
    - John Vore, *MFWP* Recommendations for Subdivision Development
    - Brent Brock, *Wild Planner* Tool
    - Tim Worley/Jackie Corday, Local Government View of The Effective Biologist
- Break
- Highway Projects and Wildlife
    - Pat Basting, Biologist Opportunities in Transportation Planning and Impact Mitigation
    - Joe Weigand, Wildlife-Friendly Fencing
    - Jackie Corday, Citizen's View of Biologist Role in Transportation Planning
- Energy Development and Wildlife
    - John Ensign, Biologist Opportunities to Influence Oil & Gas Developments
    - Allison Begley, Biologist Opportunities to Influence Wind Energy Developments
    - Sam Milodragovich, Industry Perspective of Biologist Role in Energy Planning and Development
- Group Discussion and Wrap-Up

ORAL PRESENTATIONS-Moderators are listed preceding sessions. (* Student presenters)

FEB 28th	ROOM—GLACIER (*Jim Williams*)	ROOM—UPPER GLACIER (*TBD*)
9:00 AM	T. Thier—The History of Woodland Caribou in Montana	N. Korb—Determining Resilient Watersheds for Long-term Conservation in a Changing Climate
9:20 AM	L. DeGroot—B.C. and Alberta Woodland Caribou	L. Saul—The Accomplishment of a Network—Priceless Resources: A Strategic Framework Wetland and Riparian Area Conservation and Restoration in MT 2008-2012—And Prioritization for 2013-2017
9:40 AM	N. DeCesare—Linking Habitat Selection and Predation Risk to Spatial Variation in Fitness for Woodland Caribou	N. Korb—Habitat Shifts in Montane Riparian Areas in the Centennial Mountains of SW MT
10:00 AM	V. Boccadori—The Science-and Art-of Moose Management in the Big Hole Valley, MT	P. Cramer—How Will Wildlife Crossings Mitigate Roads for Wildlife in the Face of Climate Change
10:20 AM	**BREAK**	**BREAK (*Alan Wood*)**
10:40 AM	*A. Brennan—Population Density, Group Size or Something in Between: Effects of a Variable Social Structure on Parasite Transmission (PhD)	*A. Mitchell—Decreased Plant and Arthropod Richness in Landscapes Dominated by Old World Bluestem Grasses: Implications for Wildlife (MS)
11:00 AM	P. Cross—Elk Contact Patterns and Potential Disease Transmission	*D. Bachen—How Do Nonnative Plants Affect Small Mammals? Effects of Vegetation Structure on Escape Ability of Small Mammals (MS)
11:20 AM	N. Anderson—Preliminary Findings of an Elk Brucellosis Surveillance and Epidemiology Project in Southwestern Montana	*J. Runnels—Differences in Bird Diversity on Bison Vs. Cattle Grazed Ranches in Northeastern New Mexico (MS)
11:40 AM	J. Shamhart—Elk Movements and Brucellosis Transmission Risk in Southwest Montana	*B. Skone—Winter Wheat—Finding a Balance Between Modern Agriculture and Nesting Ducks (MS)
12:00 PM	**LUNCH ON YOUR OWN (*Ray Vinkey*)**	**LUNCH ON YOUR OWN (*Dwight Bergeron*)**
1:00 PM	*C. Butler—Correlates of Recruitment in MT Bighorn Sheep Populations: An Initiative to Synthesize MT Bighorn Sheep Recruitment Data and Gain Biological Insight	Q. Latif—Ensemble Habitat Suitability Modeling to Guide Conservation of Black-Backed Woodpeckers
1:20 PM	M. Hebblewhite—Evaluating Bottom-up and Top-down Effects on Elk Survival and Recruitment: Year Two Update of a Case Study in the Bitterroot Valley	*M. Dresser—Changes in Nest Density and Daily Nest Survival of Two Woodpecker Species in Relation to the Mountain Pine Beetle Epidemic (MS)
1:40 PM	P. Zager—Untangling Rocky Mountain Elk Ecology and Population Dynamics: A Regional Synthesis Across the NW U.S.	*R. Crandall—Identifying Factors Influencing Presence and Reproductive Success of Golden Eagle Population in South Central MT (MS)
2:00 PM	*M. Zimova—Camouflage Mismatch in Seasonal Coat Color Due to Decreased Snow Duration (MS)	*B. Tornabene—Nesting Ecology of Spiny Softshell Turtles on the Missouri River in MT: Zoogeographic and MGMT Implications (MS)
2:20 PM	**BREAK (*Amy Jacobs*)**	**BREAK (*TBD*)**
2:40 PM	L. Stutzman—Twenty Years of Human-Grizzly Bear Conflict Management in Northwest Montana	D. Naugle—Intact Pathway Successfully Buffers Sage-grouse Migration
3:00 PM	C. Servheen & R. Mace—Progress Toward Grizzly Bear Recovery: The Current Status of Grizzlies in the Yellowstone and the Northern Continental Divide Ecosystems	M. Foster—Greater Sage-Grouse Populations and Habitat Use in the Southeast MT Sage-Grouse Core Area
3:20 PM	R. Mace—Grizzly Bear Population Vital Rates and Trend in the Northern Continental Divide Ecosystem, Montana	*E. Almberg—Sarcoptic Mange in Yellowstone's Wolves: Dynamics, Impacts, and the Role of Citizen Science (PhD)
3:40 PM	W. Clark—Twenty-three Years of Harlequin Duck Surveys on the Rocky Mountain Front: Do We Know Anything Yet	D. Ausband—Home Alone: Influence of Individual, Pack, and Environmental Variation on Pup Attendance in Gray Wolves

MAR 1st	ROOM—GLACIER (*Whisper Camel-Means*)	ROOM—UPPER GLACIER (*Lynn Kelly*)
8:20 AM	K. Laudon-Biology is Easy, Understanding People is Hard. Musings of a Wolf Biologist with a lot of Windshield Time	B. Maxell—Statewide Efforts to Monitor Year-round Bat Activity Patterns and Characterize Cave and Mine Roost Habitats
8:40 AM	M. Anderson—Wildlife Research and Service Learning in Undergraduate Course: Potential and Pitfalls	B. Bastasz—Volunteer Contributions to Montana's Statewide Bat Monitoring Project
9:00 AM	T. Baumeister—Passing the Baton: Growing the Next Generation of Those Who Care	A. Anderson & B. Turnock—Out of the Limelight: Searching for Three Rarely Seen Species in Montana
9:20 AM	A. Cilimburg—Inhabiting the Nexus of Wildlife Science, Policy, Conservation	S. Miller—A Correction for Overestimation Bias in Estimates of Black-tailed Prairie Dog Abundance Based on Aerial Surveys of Colony Sites in Colorado and Montana
9:40 AM	M. McTee—Biodegradable Shooting Targets Acidify Soils, Limit Plant Growth, and Mobilize Lead	K. Stone—Using Advanced Technology to Evaluate the Effects of Restoration Treatments on Bird Use of Shrubby Draws During Fall Migration
10:00 AM	**BREAK (*Tim Manley*)**	**BREAK (*Ben Turnock*)**
10:20 AM	R.Garrott—Telemetry Studies of Mountain Ungulates in the Greater Yellowstone Area: A Progress Report	R. Domenech—Habitat Use of Over-Wintering Adult Golden Eagles in the Western U. S
10:40 AM	*J. Devoe—Preliminary Results of Occupancy Survey for Modeling Habitat Selection of Sympatric Bighorn Sheep and Mountain Goats in the GYA (MS)	J. Sumner—Montana Peregrine Falcon Survey: 2012
11:00 AM	K. McKelvey—Recovery of Wolverines in the Western US: Recent Extirpation and Recolonization or Range Retraction and Expansion?	P. Farnes—Using Climate Data to Understand the Response by Wildlife and Fisheries
11:20 AM	R. Yates—Wolverine Food Habits and Foraging Strategies in Glacier National Park, MT	W. Reudiger—High, Wide and Handsome—A Review of Wildlife and Aquatic Crossing Technology Over the Last Decade (2001-2011)
11:40 AM	R. Silverstein—Estimating Lynx Habitat Under Future Fire Management and Climate Change Scenarios	

POSTER PRESTENTATIONS (*Student Presenters, **High School Presenter)

L. Hanauska-Brown—Black-footed Ferret Recovery: Things are Looking Up!
C. Wightman—Montana Golden Eagle Management Guidelines
*E. Kennison—Where are Long-toed Salamanders Found in a Game of Hide-and-Seek with Trout? (MS)
**R. Rademacher—Assessing Genetic Diversity Between Bighorn Sheep Populations in Western MT
*M. O'Reilly—Montana Prairie Pothole Joint Venture Breeding Shorebird Monitoring Project (MS)
V. Saab—Occupancy Dynamics of Avian Species in Relation to a Mountain Pine Beetle Epidemic
*S. Sells—Proactive Management of Pneumonia Episzootics in Bighorn Sheep in MT- Project Update (MS)
E. Rasmussen—Migrating and Overwintering Populations of Diurnal Raptors in the Bitterroot Valley, MT
T. Hayes—Elk Habitat Use on Degraded Rangeland
D. Leick—Avian Monitoring with Autonomous Recording Unites in the Bitterroot Valley, MT
*B. Hand—Limited Maternal Gene Flow Amongst Elk in the Greater Yellowstone Ecosystem Revealed by Mitochondrial DNA (PhD)
A. Cilimburg—Citizen Scientists Add to Our Understanding of Bird Populations and Status Across MT
R. Sojda—Exploring Adaptive Management for Greater Sage-Grouse in Northern MT in the Face of Climate Change

ABSTRACTS-ALPHABETICAL BY PRESENTER'S LAST NAME(* indicates presenter, ** indicates student presentation/presenter)

**SARCOPTIC MANGE IN YELLOWSTONE'S WOLVES: DYNAMICS, IMPACTS, AND THE ROLE OF CITIZEN SCIENCE

Emily Almberg*, Dept. of Biology, Penn State University, University Park, PA 16802
Paul Cross, US Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT 59715
Douglas Smith, Yellowstone Wolf Project, Mammoth Hot Springs, WY 82190
Andrew Dobson, Dept. of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544
Peter Hudson, Huck Institutes of the Life Sciences, Penn State University, University Park, PA 16802

Sarcoptic mange, caused by the mite, *Sarcoptes scabiei*, invaded the wolf population within Yellowstone National Park in 2007. Since its invasion, we have followed the mite's spread throughout the park, conducting monthly observational surveys to assess individual infection status and pack prevalence. The spatio-temporal patterns of mange invasion have been largely consistent with patterns of host connectivity and density, and we demonstrate that the area of highest resource quality, supporting the greatest density of wolves, have been the region's most susceptible to parasite-induced declines. Heavily infected individuals suffer twice the mortality rate as uninfected individuals and pack growth rates are much more likely to decline in the presence of mange. Future monitoring will be augmented by a new citizen science website, aimed at collecting visitor photographs of wolves and acting as an interactive public resource for information and research updates on Yellowstone's wolves.

OUT OF THE LIMELIGHT: SEARCHING FOR THREE RARELY SEEN SPECIES IN MONTANA

Alissa Anderson*, Montana Fish, Wildlife and Parks, Kalispell, Montana 59901
Ben Turnock*, Montana Fish, Wildlife and Parks, Kalispell, Montana 59901

In the summer of 2012 Montana Fish, Wildlife and Parks conducted surveys to document three little known species of concern in northwest Montana. Each inventory supplied a snapshot of information to continue monitoring their presence on the landscape. The unique life history of the black swift (*Cypseloides niger*), Coeur D'Alene salamander (*Plethodon idahoensis*), and northern bog lemming (*Synaptomis borealis*) excludes them from detection during standard multi-species surveys. In addition, previous diversity surveys in Montana that did not employ targeted surveys failed to detect these species. We found that with targeted surveys we were able to detect all three. These species are all closely tied to water and are potentially vulnerable to climate change and a diminished water resource. Any concerns are speculative however, because we lack basic life history knowledge. We recommend further monitoring and research to understand how to keep these unique species present on the landscape.

WILDLIFE RESEARCH AND SERVICE LEARNING IN UNDERGRADUATE COURSES: POTENTIAL AND PITFALLS

Michelle L. Anderson, Associate Professor of Biology, Department of Biology, The University of Montana Western, 710 South Atlantic, Dillon, Montana 59725

The benefit of authentic research for student learning in undergraduate biology curricula is well documented, with examples of innovative investigations at a wide variety of colleges and universities around the United States. Similar benefits in undergraduate wildlife programs are anticipated but less broadly documented. The block scheduling available at The University of Montana Western (UMW) provides unique opportunities to pursue long-term research projects across multiple science courses. Examples are presented of undergraduate research and management projects conducted in Southwest Montana in cooperation with the Fish and Wildlife Service, Forest Service, Bureau of Land Management, The Nature Conservancy and the Ecological Research as Education Network over the last three years. Research projects entail investigating wildlife habitat, non-game and game species. The potentials and pitfalls inherent in designing research protocols, collaborative investigations, peer mentoring, obtaining funding, and publishing research are reviewed. Prospects for refining existing projects and implementing new investigations will be discussed.

PRELIMINARY FINDINGS OF AN ELK BRUCELLOSIS SURVEILLANCE AND EPIDEMIOLOGY PROJECT IN SOUTHWESTERN MONTANA

Neil Anderson*, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
Julee Shamhart, Montana Fish, Wildlife and Parks, Dillon, MT 59725
Torrey Ritter, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
Jennifer Ramsey, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
Kelly Proffitt, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
Keri Carson, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
Craig Fager, Montana Fish, Wildlife and Parks, Dillon, MT 59725

Brucellosis is a bacterial disease that causes abortions in cattle, bison and elk. Transmission of the disease from wildlife to cattle has serious financial implications to producers and the livestock industry in Montana. Brucellosis in elk populations of southwestern Montana results in reduced tolerance for elk on private property and can influence management of elk populations. In the winter of 2010/11, Montana Fish, Wildlife and Parks initiated a five-year project with the goals of delineating the geographical distribution of brucellosis in elk populations, enhancing our understanding of how brucellosis functions in elk populations, and evaluating factors that may influence the spread and prevalence of brucellosis in elk. One-hundred adult female elk were captured in hunting districts (HD) 324 and 326 in the winter of 2010/11 with eight testing positive on blood tests(seropositive) in the field for exposure to *Brucella*. Ninety-three adult female elk were captured in HD 325 in the winter of 2011/2012, five of which were seropositive. Elk testing positive in the field were fitted with a GPS collar and, if pregnant, implanted with a vaginal implant transmitter (VIT). Seropositive pregnant elk were tracked from the ground and air 2-3 times per week in order to locate birth or abortion sites. *B. abortus* was not cultured from VITs or samples collected at birth sites in the first year of the project. *B. abortus* was cultured from tissues or VITs associated with two aborted calves in 2012. The known distribution of brucellosis in elk has expanded based on information obtained in this study.

HOME ALONE: INFLUENCE OF INDIVIDUAL, PACK, AND ENVIRONMENTAL VARIATION ON PUP ATTENDANCE IN GRAY WOLVES

David E. Ausband*, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812
Joel Ruprecht, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844
Michael S. Mitchell, US Geological Survey, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812
Sarah B. Bassing, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812
Oz Garton, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844
Pete Zager, Idaho Department of Fish and Game, Lewiston, Idaho, 83815

Pup-guarding is an important aspect of helping behavior exhibited in some cooperatively breeding species. Within cooperatively breeding species, groups of animals lacking the ability to adequately attend and guard young can have decreased fecundity. We studied pup attendance in gray wolves (*Canis lupus*) using location data from 17 GPS-radiocollared wolves from 7 packs in Idaho. Breeding females had the highest attendance rates, however once pups were weaned nonbreeding wolves increased their attendance. We hypothesize that attendance behavior of nonbreeding wolves has benefits for their own, subsequent pup-rearing. The dominant predictor of pup attendance rates after weaning was the number of helpers in the pack, where attendance rates of individuals dropped by 7.5% with each additional helper. Our results suggest that wolves in small packs experience a costly tradeoff when they forego foraging time in order to attend pups adequately. Preliminary results from additional analyses using data from wolves in Alberta, Idaho, Montana, and Yellowstone National Park indicate sex of the helper, genetic relatedness, and surrounding predator and prey densities may also influence pup attendance rates.

****HOW DO NONNATIVE PLANTS AFFECT SMALL MAMMALS? EFFECTS OF VEGETATION STRUCTURE ON ESCAPE ABILITY OF SMALL MAMMALS**

Dan A. Bachen*, Department of Ecology, Montana State University, Bozeman, Montana 59717
Andrea R. Litt, Department of Ecology, Montana State University, Bozeman, Montana 59717
Claire Gower, Montana Fish, Wildlife and Parks, Bozeman, Montana 59718

Nonnative plants can alter habitat of native animals through changes in vegetation structure and availability of food resources. Invasion of nonnative cheatgrass (*Bromus tectorum* L.) is an acute threat to persistence of native wildlife in the sagebrush-steppe ecosystem of southwestern Montana. Cheatgrass invasion increases vegetation density and litter depth between shrubs, potentially increasing risk of predation by impeding an animal's ability to escape. We examined how vegetation density and litter depth affects maximum sprint speed, as one component of a project investigating how changes in the structural complexity of vegetation due to cheatgrass invasion affects small mammals. Using artificial materials to mimic cheatgrass structure and litter, we timed deer mice (*Peromyscus maniculatus*) sprinting through a range of litter depths and structure densities along a 2 m-long track, to assess each animal's ability to flee from a predator. We found that median sprint time increased 15% (95% CI = 13 to 18%) for every additional 1000 stems/m^2; increases in litter depth up to 9 cm had little effect on sprint speed. If predation is a limiting factor for small mammal populations within sagebrush steppe, management tools that can reduce vegetation density of nonnative plants may be beneficial.

Litter removal may only benefit small mammals if accumulations are reduced to less than 9 cm in depth. Increasing our understanding of how small mammals respond to changes in vegetation architecture caused by nonnative plants may help inform management and restoration efforts, especially when complete eradication is unlikely.

VOLUNTEER CONTRIBUTIONS TO MONTANA'S STATEWIDE BAT MONITORING PROJECT

Bob Bastasz*, Northern Rocky Mountain Grotto of the National Speleological Society
Mandy Derber and Hans Bodenhamer, Bigfork Cave Club, Big Fork, MT
Lauri Hanauska-Brown, Montana Department of Fish, Wildlife and Parks, Helena, MT
Bryce Maxell, Montana Natural Heritage Program, Helena, MT

Over the last two years, the State of Montana has established a network of passive acoustic monitors to study bat activity patterns at selected locations throughout the state. These monitors, many of which are in remote areas, record bat calls each evening of the year. Their purpose is to document the number and species of bats as a function of time and location, with the intention of generating a statewide database on bat activity. These data could serve as an "early warning system" for the appearance of white-nose syndrome, a deadly fungal infection caused by *Geomyces destructans* that is ravaging bats in eastern portions of North America. WNS has not been detected in Montana, so the data being presently collected can be considered to be representative of bat behavior in the absence of the disease. A noticeable change in recorded bat activity could be an early indicator of the arrival of WNS. Whether or not WNS reaches Montana, the network is generating an extensive knowledge base about Montana's bats that will help address a variety of management issues.

The Montana caving community has provided help in installing and maintaining the bat monitoring network and in recording observations about bats. Cavers are familiar with the state's caves, are experienced in working safely in caves, and have an interest in cave biota and the welfare of bats. They are well-suited to assist in a number of capacities, including maintaining the monitoring equipment, recording observations of bats, identifying hibernacula, and installing data loggers. This talk will describe volunteer activities around the state and the partnership between cavers and state organizations to increase the effectiveness of the bat monitoring project.

PASSING THE STEWARDSHIP BATON

Thomas R. Baumeister, Montana WILD, Montana Fish, Wildlife & Parks, Helena, Montana 59620

"*Montana is wild, it's our home, and it's ours to learn from and care for."* This is the central theme FWP adopted to bring to life Montana WILD—the department's first conservation education center located in Helena. Housed in a historic building adjacent to Spring Meadow Lake State Park, the facility, the exhibit, and the programs honor the deep connection people have with Montana's fish and wildlife. Here we tell the story of how we came to have this richness today, how all citizens of the state have a part in this history and a stake in its future, and how through individual action we can achieve great things for ourselves and the future of fish and wildlife. Guided by core beliefs of the department and its hope for an informed and engaged citizenry, the statewide facility serves a variety of interests related to fish and wildlife. The objective for this presentation is to give an overview of what has been accomplished to date with regards to Montana WILD, to illuminate the challenges we face as professionals to help others commit to fish and wildlife, and to offer an inclusive framework for how to engender a compelling stewardship ethic.

THE SCIENCE – AND ART – OF MOOSE MANAGEMENT IN THE BIG HOLE VALLEY, MONTANA

Vanna Boccadori, Montana Department of Fish, Wildlife & Parks, Butte, MT 59701

Moose management can be challenging because of the difficulty of quantifying population trends consistently. Because of their solitary nature and penchant for fairly dense cover, moose can be hard to see. Also, their presence in more open habitat is highly dependent on weather conditions. Where done, aerial surveys serve more as an index of population trend than as a census and should be combined with other indices to make management decisions. In the Big Hole Valley in southwestern Montana, aerial survey data is combined with harvest data when setting license quotas. Specifically, three indices are used: calf:100 adult, days per hunter, and hunter success. Results from the past 4 years suggest that this suite of indices is effective at meeting management objectives.

****POPULATION DENSITY, GROUP SIZE OR SOMETHING IN BETWEEN: EFFECTS OF A VARIABLE SOCIAL STRUCTURE ON PARASITE TRANSMISSION**

Angela Brennan*, Department of Ecology, Montana State University, Bozeman, MT 59717
Paul Cross, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT 59715
Megan Higgs, Department of Mathematical Sciences, Montana State University, Bozeman, MT 59717
W. Hank Edwards, Wyoming Game and Fish Department, Laramie, WY 82071
Brandon Scurlock, Wyoming Game and Fish Department, Pinedale, WY 82941
Scott Creel, Department of Ecology, Montana State University, Bozeman, MT 59717

Critical to our understanding of disease dynamics and effective disease control strategies is the relationship between host density and parasite transmission rates. To accurately describe this relationship, it is important to measure host density at the scale in which transmission is occurring. In social species, for example, transmission may be more related to group size than the population as a whole. But when aggregation patterns vary in size across space and time, our ability to quantify the density-transmission relationship may depend on measuring density somewhere in between population density and group size. To address this issue, we examined elk (*Cervus elaphus*) populations in western Wyoming that have been exposed to the bacteria (*Brucella abortus*) that causes brucellosis. We measured elk density at multiple scales ranging from population density to group size, and evaluated the functional relationship between density and brucellosis seroprevalence. Our study found that low elk density did not explain why *Brucella* had not effectively invaded several populations. However, in populations with multiple years of seropositive test results, the rates of increase in seroprevalence saturate with increasing elk density regardless of the density measure used. The different densities were poorly correlated with one another, and therefore high elk densities at broad scales did not guarantee high elk densities at fine scales, but both may be important to the transmission of *Brucella*. This suggests that reducing or altering elk density may not effectively reduce transmission.

****CORRELATES OF RECRUITMENT IN MONTANA BIGHORN SHEEP POPULATIONS: AN INITIATIVE TO SYNTHESIZE MONTANA BIGHORN SHEEP RECRUITMENT DATA AND GAIN BIOLOGICAL INSIGHT**

Carson J. Butler *, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717
Robert A. Garrott, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717
Jay J. Rotella, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717

Bighorn sheep populations in Montana have been strongly affected by disease outbreaks in recent years, resulting in the death of approximately 1,500 bighorns as well as depressed recruitment rates in some affected herds. The ecology of these disease outbreaks is not well understood and there have been several proposals for a state-wide research project addressing disease ecology of bighorns in Montana. Such a project is a large investment and any extra knowledge of the bighorn populations that can be gained from existing data would improve study design and enhance the success of any future research effort. Last year we used management data to index bighorn recruitment rates of 23 bighorn herds in the Greater Yellowstone Area (GYA) and found strong correlations between recruitment and both annual and regional climate patterns. This year we have received funding from Montana Fish, Wildlife and Parks to conduct a similar analysis of bighorn recruitment rates across Montana. The planned analysis will investigate potential correlations between bighorn recruitment and climate covariates, similar to the GYA effort, but will also explore additional covariates to capture differences in management strategies, genetics, disease history, migration patterns, and population connectivity among the state's bighorn sheep populations. The presentation will focus on the goals of our work as well as the advantages of conducting preliminary data analysis prior to implementing large scale research projects.

CITIZEN SCIENTISTS ADD TO OUR UNDERSTANDING OF BIRD POPULATIONS AND STATUS ACROSS MONTANA (POSTER)

Amy B. Cilimburg, Montana Audubon, Missoula, MT 59802

Montana Audubon, our partners, Audubon Chapter members, and bird enthusiasts across the state are increasingly involved in contributing time and talents to understanding bird populations, habitat associations, and trends. Birders contribute sightings to *eBird* or *Tracker*, reporting their observations from field excursions and their backyards. This information helps inform Montana Species of Concern listings and influences bird conservation and science priorities in the state and beyond. Montana Audubon also encourages citizen monitoring projects for single species and guilds, from Black Swifts to Golden Eagles. We are now home to the Greater Sage-grouse Adopt-a-Lek program which coordinates citizen scientists to monitor sage-grouse on over 50 breeding leks across Montana every spring. Finally, our Audubon chapters adopt and monitor Important Bird Areas across the state in order to conserve species of conservation concern and their habitats. Find out more about these volunteer efforts.

INHABITING THE NEXUS OF WILDLIFE SCIENCE, POLICY, AND CONSERVATION

Amy B. Cilimburg, Montana Audubon, Missoula, MT 59802

As biologists, we have charismatic wildlife species, trials and tribulations from the field, data, and, hopefully, valuable conclusions. What is our role in connecting our work to conservation and policy issues and to the larger community? What and how can our scientific findings influence policy at the local, state, or federal level? In these times of climate disruption, dispassionate reiteration of our research makes less impact than revealing our research findings via a good story and message. For the past five years with Montana Audubon, Amy has worked at the nexus of climate policy, ornithology, wildlife conservation, and community organizing. She will share some best practices for climate communications, gleaned from the experts, so that different audiences (public lecture participants, cocktail party goers, skeptical uncles, newspaper readers, etc.) can take something away and be part of the solution. Citizen scientists, Black Swifts, and Corvids combine to provide examples of communicating wildlife science, climate impacts, and inspiring action and optimism.

TWENTY-THREE YEARS OF HARLEQUIN DUCK SURVEYS ON THE ROCKY MOUNTAIN FRONT: DO WE KNOW ANYTHING YET?

Wendy Clark, Wildlife Biologist, Rocky Mountain Ranger District, Lewis and Clark National Forest, Choteau, MT 59422

Harlequin duck surveys have been carried out continuously on the Rocky Mountain Ranger District (RMRD) for 23 years, beginning in 1990. Streams are surveyed on foot in spring to assess occupancy by breeding pairs, and in summer to count broods. Habitat and activity data have been collected for 260 separate observations (comprising over 700 individual ducks). We have summarized the habitats in which harlequins have been observed, including potential differences between pair and brood observations. Harlequins on the RMRD tend to be found in habitats similar to those described for other areas: in fast-moving segments of streams and in areas with shrub or tree overstory. Most observations are in areas accessible to, but not immediately adjacent to areas of human use. Most observations do not occur in proximity to within-stream woody debris, which may differ from findings elsewhere. We have not yet collected data with which to evaluate whether harlequin ducks actively select for any of these habitat characteristics. In 2007 three major fires burned on the RMRD, affecting several key harlequin breeding streams. We altered our survey areas to focus on the most historically productive stream system in the hopes of detecting any impacts of fire on harlequin occupancy or productivity. We have also begun to survey streams that have not been surveyed since the original 1990-1992 inventory. We provide possible explanations for the absence of harlequin ducks on several apparently suitable stream systems, and discuss the direction we hope to take with future surveys and analyses.

HOW WILL WILDLIFE CROSSINGS MITIGATE ROADS FOR WILDLIFE IN THE FACE OF CLIMATE CHANGE?

Patricia C. Cramer*, Wildland Resources Department, Utah State University, Logan, UT 84321
Robert F. Hamlin, Logan, Utah 84321

This paper will address the developing trends in wildlife crossing structure research across the western U.S. and along US 93 South in Montana. This discussion may help to better design and retrofit structures to facilitate wildlife movement in the face of climate change. The objectives of our wildlife crossing structure research across the west are to determine wildlife use of crossing structures and structure designs that work best in passing large and medium mammals. Many of today's wildlife crossing structures and existing culverts and bridges along roadways were designed before the science of transportation ecology had developed enough to understand what designs worked for different species. Our method of evaluating these new and existing structures is to place motion-sensed camera traps 10 meters from the entrances to the culverts and bridges to monitor wildlife reactions to the structures. Wildlife approaches, successful passages through the structure, and repels away from the structure are tallied for every individual. Species' reactions to culverts and bridges differ. White-tailed deer are willing to use many different sized culverts and bridges, while mule deer are more cautious. Carnivores use structures of all types, although the landscape factors such as human development may play a role in their willingness to use some structures. These and other results have greater implications for species adaptations to climate change: it will be critical that roads be permeable for the entire suites of species in an area as they need to move to adapt to changing conditions.

****IDENTIFYING FACTORS INFLUENCING PRESENCE AND REPRODUCTIVE SUCCESS OF A GOLDEN EAGLE POPULATION IN SOUTH CENTRAL MONTANA**

Ross Crandall*, Montana Cooperative Wildlife Research Unit, Missoula, MT 59812
Bryan Bedrosian, Craighead Beringia South, Kelly, WY 83011
Derek Craighead, Craighead Beringia South, Kelly, WY 83011

Golden Eagles (*Aquila chrysaetos*) in the western U.S.A. have received increased attention due to an apparent decline in the number of annual migrants and expected increased risk from energy development. Long-term research focused on resident, breeding Golden Eagles in this region is rare and sorely needed to assess the degree of population decline. In addition, managers require the identification of factors that influence presence and breeding success of Golden Eagles to create an effective management strategy. Beginning in 2010, we revisited a historically surveyed study site near Livingston, Montana. Our objective was to compare the current status of the Golden Eagle breeding population to that from the 1960's and to identify factors necessary for maintaining Golden Eagle populations. In the last 3 breeding seasons, we have documented a near 100% occupancy rate of historic territories and a marked increase in the number of breeding pairs. Our results also indicate that factors related to prey availability most strongly influence nest site selection and reproductive success. Based on our current results, we suggest Golden Eagle populations may remain strong in some locations and management strategies should focus on maintaining prey habitat.

ELK CONTACT PATTERNS AND POTENTIAL DISEASE TRANSMISSION

Paul C. Cross*, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT 59715
Tyler G. Creech, Oregon State University, Department of Fisheries and Wildlife, Corvallis, OR 97331
Michael R. Ebinger, Institute on Ecosystems, Montana State University, Bozeman, MT 59717
Kezia Manlove, Pennsylvania State University, Department of Biology, Huck Institutes of the Life Sciences, University Park, PA 16802
Kathryn Irvine, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT 59715
John Henningsen, University of Wyoming, Wyoming State Veterinary Laboratory, Laramie, WY 82070
Jared Rogerson, Wyoming Game and Fish Department, Pinedale, Wyoming 82941, USA
Brandon M. Scurlock, Wyoming Game and Fish Department, Wyoming 82941, USA
Scott Creel, Montana State University, Department of Ecology, Bozeman, MT 59717

Understanding the drivers of contact rates among individuals is critical to understanding disease dynamics and implementing targeted control measures. We studied the interaction patterns of 149 female elk (*Cervus elaphus*) distributed across five different regions of western Wyoming over three years, defining a contact as an approach within one body length (~2m). Using hierarchical models that account for correlations within individuals, pairs and groups, we found that pairwise contact rates within a group declined by a factor of three as group sizes increased 30-fold. Meanwhile, per capita contact rates increased with group size due to the increasing number of potential pairs. We found similar patterns for the duration of contacts. Supplemental feeding of elk had a limited impact on pairwise interaction rates and durations, but increased per capita rates more than two times higher. Variation in contact patterns were driven more by environmental factors such as group size than either individual or pairwise differences. Female elk in this region fall between the expectation of contact rates that linearly increase with group size (as assumed by pseudo-mass action models of disease transmission) or are constant with changes in group size (as assumed by frequency dependent transmission models). Our statistical approach decomposes the variation in contact rate into individual, dyadic, and environmental effects, which provides insight into those factors that are important for effective disease control programs.

LINKING HABITAT SELECTION AND PREDATION RISK TO SPATIAL VARIATION IN FITNESS FOR WOODLAND CARIBOU

Nicholas J. DeCesare*, Montana Fish, Wildlife & Parks, Missoula, Montana 59804
Mark Hebblewhite, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Mark Bradley, Parks Canada, Jasper National Park, Jasper, Alberta T0E 1E0 Canada
Dave Hervieux, Sustainable Resource Development, Government of Alberta, Grande Prairie, Alberta T8V 6J4 Canada
Marco Musiani, Faculty of Environmental Design, University of Calgary, Calgary, Alberta T2N 1N4 Canada

A central assumption underlying niche theory and the study of habitat selection is that selected habitats confer enhanced fitness. Here, we separately measured spatial patterns of both resource selection and predation risk and tested their relationships with a key demographic fitness trait, adult female survival, for a threatened ungulate, woodland caribou (*Rangifer tarandus caribou*). We used Cox-proportional hazards spatial survival modeling to assess support for various selection- and risk-based estimates of habitat quality using previously developed caribou resource selection functions and wolf predation risk models. Indeed we found positive relationships between the predicted values of a scale-integrated resource selection function and survival, yet subsequently incorporating predation risk greatly improved

models further. Predation risk was an additive source of hazard beyond that detected through selection alone, and selection thus shown to be non-ideal. Furthermore, by combining spatially-explicit adult female survival predictions with herd-specific estimates of recruitment in matrix population models, we demographically estimated a fitness landscape for this threatened species.

BRITISH COLUMBIA'S MOUNTAIN CARIBOU RECOVERY PROJECT – WHERE WE HAVE BEEN AND WHERE WE ARE GOING

Leo DeGroot, Mountain Caribou Project Lead, BC Ministry of Forest Lands and Natural Resource Operations, Nelson, British Columbia

The southern part of the Purcell Mountains has been identified provincially as the Southeast Kootenay planning unit for mountain caribou recovery. Within it, caribou are only known to remain within the Purcells-South herd near Cranbrook, and the 14 caribou there are normally separated into two bands. Recovery without population augmentation is very unlikely. Augmenting the herd, if successful, would dramatically increase genetic diversity, decrease the risk from random events, speed growth, and be consistent with provincial direction to augment herds having <50 caribou. Translocations of 15 to >100 caribou have been successful at many sites across North America, including locations where predators include wolves or cougars. This presentation provides a project update and details plans for future work.

****PRELIMINARY RESULTS OF OCCUPANCY SURVEYS FOR MODELING HABITAT SELECTION OF SYMPATRIC BIGHORN SHEEP AND MOUNTAIN GOATS IN THE GREATER YELLOWSTONE AREA**

Jesse D. DeVoe*, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717
Robert A. Garrott, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717
Jay J. Rotella, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717

Introduced and expanding mountain goat populations in the greater Yellowstone area (GYA) have generated significant concern regarding impacts to natural communities, and especially to native and restored bighorn sheep populations. In order to provide natural resource managers with useful and applicable information for managing and conserving these species, occupancy surveys based on rigorous field studies were implemented in 2011 and 2012 to develop summer habitat models for bighorn sheep and mountain goats in the GYA. To enhance the applicability and accuracy of these models, occupancy probabilities obtained from presence and absence observations are integrated with detection probabilities gained from double independent-observer sampling. Between the two field seasons, a total of 361 surveys were performed over 350 observer-days, capturing spatially-precise locations of 80 bighorn sheep groups and 138 mountain goat groups. Preliminary analyses of the data obtained to date were performed for each species to gauge the utility of the field studies and to provide insights for improved study design and implementation of future field work. This presentation reports on the accomplishments from the first two field seasons, including what we have learned from preliminary analyses and the plans for an additional field season for summer 2013.

HABITAT USE OF OVER-WINTERING ADULT GOLDEN EAGLES IN THE WESTERN U.S.

Robert Domenech*, Raptor View Research Institute, Missoula, Montana 59806
Bryan Bedrosian, Craighead-Beringia South, Kelly, WY 83011
Ross Crandall, Craighead-Beringia South, Kelly, WY 83011

A number of studies show declining migration count trends and breeding abundance in Golden Eagles (*Aquila chrysaetos*) in the West. We outfitted 13 adult, migrant Golden Eagles with transmitters from 2007-2012 with battery powered Argos Platform Terminal Transmitters (PTT) or 70g solar-powered GPS/PTTs. Eagles wintered across the West, from central Montana to Arkansas. We gathered data on winter territory size, time spent on wintering grounds, and the habitat use of eagles during the winter. We measured a large degree of variability in both winter home range size and duration of winter range use. We found an average 50% Minimum Convex Polygon (MCP) home range estimate of 1,680 km^2 (range 8 – 14,881 km^2) and an average 95% MCP of 6,578 km^2 (range 85 – 36,143 km^2). Winter home range estimates were extremely variable between individuals and even within the same individual between years. Eagles spent an average of 105 days on their wintering territories (range 60-179 days). We found the most common habitat types were pinyon-juniper, coniferous forest, grassland, shrub, and sagebrush habitats which all comprised ≥10% of core wintering areas. Several habitat types were correlated to latitude and longitude: the percentage of coastal habitat within winter home ranges increased as eagles wintered further south, riparian and logged habitats increased to the north and west, and shrub habitat percentage of the home range decreased with an increase in latitude. Understanding wintering needs of Golden Eagles is essential to the long-term health of this species across the West.

****CHANGES IN NEST DENSITY AND DAILY NEST SURVIVAL OF TWO WOODPECKER SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC**

Matthew Dresser*, Ecology Department, Montana State University, Bozeman, MT 59717
Jay Rotella, Ecology Department, Montana State University, Bozeman, MT 59717
Victoria Saab, USDA Forest Service, Rocky Mountain Research Station, Bozeman, MT 59717
Quresh Latif, USDA Forest Service, Rocky Mountain Research Station, Bozeman, MT 59717

The Mountain pine beetle (*Dendrotonus ponderosae*) is a bark beetle native to western North America capable of large-scale population eruptions, resulting in high tree (*Pinus* spp.) mortality that alters resource availability to wildlife, particularly snag-associated species. Many woodpecker species rely on conifer snags for nesting and foraging substrate. We studied nesting survival of two woodpecker species in relation to a recent mountain pine beetle outbreak in western Montana. American three-toed woodpecker (*Picoides dorsalis*) is a bark-drilling specialist that feeds on beetle larvae and frequently nests in conifer snags, whereas red-naped sapsucker (*Sphyrapicus nuchalis*) specializes on consuming sap of live trees and rarely nests in conifer snags. Based on *a priori* hypotheses we modeled daily nest survival (DSR) as a function of biotic (nest height) and temporal (beetle period [before and after outbreak], date trend, and a quadratic date trend) factors using seven competing models. Results for both species showed high model uncertainty and the constant DSR model was the most parsimonious model. These results did not support our predictions about beetle period or nest height affecting DSR, although DSR was lower during pre-outbreak (0.985, 95% CL [0.965, 0.995]) versus post-outbreak (0.993, 95% CL [0.981, 0.997]) for American three-toed woodpecker. Future analyses will investigate the effects of other covariates such as snag density, daily temperature, and precipitation on DSR. Our results will

inform management activities for post-beetle forests that will help maintain habitat of disturbance specialist species.

USING CLIMATE DATA TO UNDERSTAND THE RESPONSE BY WILDLIFE AND FISHERIES

Phil Farnes, Snowcap Hydrology, PO Box 691, Bozeman, MT 59771

Montana's water supply varies from about 40 to 160 percent average. This is due to a large variability in the mountain snowpack, spring and summer precipitation and temperature. Nearly all of these parameters that determine the runoff will impact fish and wildlife throughout the year. Time of various climatic events in Montana, such as when snowpack starts to accumulate, when it reaches it season's maximum, when it melts out, winter temperatures, when streams reach their annual peak flow, and when plants break dormancy (spring green-up), forage production, whether or not there is fall green-up and the time of fall green-up all have had a historical variation spanning about eight weeks. In addition, there is annual variation in climatic conditions across the state. Wildlife and fisheries managers need to take this variability into account when managing wildlife. Tools to help assess the potential variability and timing of various climatic, hydrologic and phenological parameters will be presented. Using observed climatic and hydrologic data collected over the past 100 years can be further interpreted to help understand and predict the response and effects on fish and wildlife. Relating these responses to these parameters provide better relationships than by using calendar dates.

MONITORING GREATER SAGE-GROUSE POPULATIONS AND HABITAT USE IN THE SOUTHEAST MONTANA SAGE-GROUSE CORE AREA

Melissa A. Foster*, Montana Department of Fish, Wildlife and Parks, Wibaux, Montana 59353
John T. Ensign, Montana Department of Fish, Wildlife and Parks, Miles City, Montana 59313
Darin Newton, Montana Department of Fish, Wildlife and Parks, Miles City, Montana 59313

Sage-Grouse core areas support Montana's highest densities of sage-grouse, and are deemed vitally important to sage-grouse conservation long term. The Southeast Montana Sage-Grouse Core Area (SEMT SGCA) consists of large expanses of intact sagebrush-steppe habitat and is important for connectivity among populations in Montana, South Dakota and Wyoming. Relatively little development has occurred in the area, but there is potential for energy development to have large-scale impacts on the area in the near future. Little was known about sage-grouse use of the area during critical periods outside of the breeding season or factors underlying local sage-grouse population dynamics. Therefore, we radio collared 94 sage-grouse hens between 2009-2011 to quantify movements, habitat use, and population vital rates.

Overall, hen locations tended to be within the SEMT SGCA during spring-summer and expanded to adjacent areas of Wyoming and South Dakota during winter. Wide annual fluctuations in weather conditions drove annual variation in population demographic rates, habitat conditions, and habitat use. Apparent nest success (34-68%) and average chick production per hen that began the breeding season (0.72-1.12 chicks/hen) varied among years with extreme to mild weather. Annual hen survival varied from a low of 46% under extreme winter conditions to >60% under milder weather. Vegetation characteristics at nest, brood-rearing, and winter locations will be presented. Results from this project will aid in land use planning, prioritization of conservation efforts, and provide information to assess the effects of future land use change. The project is conducted by MFWP and funded by the BLM.

TELEMETRY STUDIES OF MOUNTAIN UNGULATES IN THE GREATER YELLOWSTONE AREA: A PROGRESS REPORT

Robert A. Garrott*, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717
P. J. White, Yellowstone Center for Resources, Yellowstone National Park, Wyoming 82190
Jay J. Rotella, Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, Montana 59717

We report on the progress that has been made on initiating long-term telemetry studies of mountain goats and bighorn sheep in the GYA to better understand spatial ecology, demography, potential competition, and disease ecology. Six study areas representing a variety of ecological settings have been established throughout the GYA that include areas where bighorn sheep and mountain goats are sympatric as well as where each species exists in the absence of the other. We are employing a novel dual radio collar strategy and have successfully evaluated the use of drop net systems to capture groups of bighorn attracted to bait as an economical alternative to standard helicopter-based single animal capture techniques. Chemical immobilization of bighorn using BAM as an alternative to carfentanil was also tested and evaluated. A break-down Clover trap was designed for ease of transportation via horse for backcountry trapping and summer salt baiting for bighorn sheep and mountain goats was evaluated. We have initiated the first systematic disease sampling of mountain goats in the GYA using the standard protocols employed for bighorn sheep health assessments to evaluate the potential for mountain goats to influence the disease ecology of bighorn sheep in areas where they are sympatric. The research goals, strategies, and methodologies developed, tested, and employed on the collaborative GYA mountain ungulate research program are similar to those proposed for a long-term bighorn sheep research program in Montana.

BLACK-FOOTED FERRET RECOVERY: THINGS ARE LOOKING UP! (POSTER)

Lauri Hanauska-Brown, Montana Fish, Wildlife and Parks, Helena, MT 59620
Kristy Bly, World Wildlife Fund
Peter Husby, Natural Resources Conservation Service

The black-footed ferret is considered one of the most endangered mammals in the world. Hindering the success of recovery efforts is the presence of Sylvatic Plague and a general intolerance of the ferrets primary prey, the prairie dog. To date, the only tools against plague at reintroduction sites have been vaccination of ferrets prior to release, application of pesticides, and translocation of prairie dogs into sites following an epidemic plague event. In addition to the high cost of plague management, ferret recovery is hampered by loss of habitat to sod-busting and development and ESA regulations that make landowners wary of finding or hosting a listed species. However, in recent years, innovative approaches to plague management, prairie dog conservation and ESA regulation have laid a new path for ferret recovery across Western states. These approaches include the following: 1) An MOU signed in 2012 by the USFWS, NRCS, USGS, Wildlife Services, and the Western Association of Fish and Wildlife Agencies facilitating cooperative conservation efforts with willing landowners to maintain ranch land in prairie habitat and the livestock operations that they support *while* providing for the conservation and recovery of wildlife species associated with prairie dogs, 2) Development of a safe harbor agreement that would provide regulatory assurances to land owners willing to allow ferret re-introductions, and 3) Development of a sylvatic plague vaccine meant to be dispersed at ferret reintroduction sites. Successful implementation of these new tools could result in ferret recovery within the next decade.

****LIMITED MATERNAL GENE FLOW AMONGST ELK IN THE GREATER YELLOWSTONE ECOSYSTEM REVEALED BY MITOCHONDRIAL DNA**

Brian K. Hand*, Division of Biological Sciences, University of Montana, Missoula, MT, 59812
Gordon Luikart, Flathead Lake Biological Station, Fish and Wildlife Genomics Group, University of Montana, Polson, Montana 59860.

We quantified maternal patterns of population genetic structure to help understand gene flow among elk populations across the Greater Yellowstone Ecosystem. We sequenced 596 base pairs of the mitochondrial (mt)DNA control region of 407 elk from nine populations. Our analysis revealed high mtDNA diversity within populations including 12 haplotypes per population on average, and a mean haplotype diversity (i.e., gene diversity) of 0.84. The F_{ST} from mtDNA was high (mean F_{ST} = 0.162; P = 0.0001) compared to F_{ST} for nuclear microsatellites data (F_{ST} = 0.006, P = 0.125), which suggests relatively low female movement among populations, perhaps due to female philopatry. Genetic distance (mtDNA pair-wise F_{ST}) was not significantly correlated with geographic (Euclidean) distance between populations (Mantel's r = 0.274, P = 0.168). The lack of isolation-by-distance and large genetic distance between geographically close populations (<65 km) suggest that maternal gene flow is reduced by certain landscape features (e.g., large, non-forested valleys with roads), which is important for understanding and modeling landscape connectivity and related processes.

ELK HABITAT USE ON DEGRADED RANGELAND

Teagan Hayes*, MPG Ranch, Missoula, MT 59801
Philip Ramsey, MPG Ranch, Missoula, MT 59801

We monitored winter range use of elk (*Cervus elaphus*) in the Northern Sapphire Mountains of the Bitterroot Valley, Montana over the winters of 2011-2012 and 2012-13. The goal of the project was to acquire baseline data on elk habitat use and grazing preference on a 3,845 hectare former cattle ranch. The property includes 2,130 hectares of rangeland with altered plant communities due to intensive grazing, exotic forage grass seeding, and herbicide applications. Of these 2,130 hectares, cheatgrass (*Bromus tectorum*) dominates 32%, seeded exotic forage grasses dominate 20%, and perennial invaders dominate 6.8%. Pristine or less-degraded plant communities dominated by native grasses cover 681 hectares and irrigated agricultural crops cover 71 hectares. An average of around 300 elk spend most of the winter on or near the study site, and the highest number was 426, recorded in November 2011. We collected data through observation, scat density surveys, diet analysis, and forage availability estimates through biomass collection. Areas with high elk use are grouped by the dominant vegetation, slope, and aspect. Elk spent the most time feeding in lower elevation benchland and native bunchgrass communities, loafing on ridges and open areas typically with degraded to severely degraded vegetative communities, and traveling across exotic forage grasses and through draws with variable vegetation. Elk pellet cluster density was highest in lower elevation grassland and foothills and irrigated agricultural fields. This baseline data will allow us to assess elk response to restoration efforts that seek to replace many weed-dominated communities with diverse native vegetation.

EVALUATING BOTTOM-UP AND TOP-DOWN EFFECTS ON ELK SURVIVAL AND RECRUITMENT: YEAR TWO UPDATE OF A CASE STUDY IN THE BITTERROOT VALLEY

Mark Hebblewhite*, Wildlife Biology Program, University of Montana, Missoula, MT, 59812
Kelly Proffitt, Montana Fish, Wildlife, and Parks, Bozeman, MT, 59718
Ben Jimenez, Montana Fish, Wildlife, and Parks, Missoula, MT, 59804
Mike Thompson, Montana Fish, Wildlife, and Parks, Missoula, MT, 59804
Daniel Eacker, Wildlife Biology Program, University of Montana, Missoula, MT, 59812

Understanding the contribution of recruitment to population growth rate in ungulates is a fundamental challenge to wildlife managers attempting to integrate carnivore and ungulate management. Like much of western Montana, in the Bitterroot Valley, the decline of elk (*Cervus elaphus*) populations and calf recruitment occurred concurrently with wolf (*Canis lupus*) recovery. However, a multitude of abiotic, bottom-up and top-down factors likely affect recruitment rates. We studied cause-specific mortality of elk calves to understand the role of competing mortality risk on calf recruitment in the East Fork and West Fork of the Bitterroot Valley, Montana. A total of 66 and 76 neonatal elk calves were captured in spring 2011 and 2012, respectively, and an additional 31 and 29 six month olds in late November 2011 and 2012. We analyzed calf survival using a Weibull parametric survival model, and cause-specific mortality using cumulative incidence functions. Preliminary analyses for the first 20 months of the research indicate mountain lions as the leading cause of mortality for elk calves during both summer and winter. We are also evaluating the role of summer forage resources on maternal condition, calf birth weights and survival. Preliminary results from nutritional work suggest potential bottom-up differences influencing resilience of elk populations to top-down predation. Our study fills a critical knowledge gap regarding the role of summer vs winter mortality in elk and the role of nutrition. The study will complement previous studies and help wildlife managers integrate carnivore and ungulate management across western Montana following carnivore recovery.

****WHERE ARE LONG-TOED SALAMANDERS FOUND IN A GAME OF HIDE-AND-SEEK WITH TROUT? (POSTER)**

Erin Kenison*, Department of Ecology, Montana State University, Bozeman, Montana 59717
Andrea R. Litt, Department of Ecology, Montana State University, Bozeman, Montana 59717
David Pilliod, USGS Forest and Rangeland Ecosystem Science Center, Boise, Idaho 83706
Tom McMahon, Department of Ecology, Montana State University, Bozeman, Montana 59717

In many alpine lakes, trout have been introduced for recreational fishing and have replaced native amphibians as top predators. In these systems, trout are associated with reducing the abundance of amphibians and have extirpated populations of long-toed salamanders from many lakes. Although rare, salamander coexistence with trout may occur in some lakes where habitat characteristics such as emergent vegetation and physical barriers are present, as these environments can provide refugia from predation. We sought to identify what key habitat features might allow this co-occurrence. We sampled seven lakes with salamanders and fish and seven with only salamanders in northwestern Montana between July and August 2012. We used minnow traps to capture salamander larvae and we quantified habitat characteristics (e.g., vegetation density, structural complexity) where salamanders were captured. We compared capture rates and habitat characteristics to determine whether lakes with and without fish differed. Preliminary results suggest that salamander capture rates were higher in lakes with fish (33%, 95% CI = 13-84%), but salamanders were smaller, as larvae had 68% shorter tails (51-91%) in lakes with fish. Despite these differences, we did not detect any differences in habitat

characteristics. Unless minnow traps were used as refugia, our findings suggest that salamanders utilize similar habitat in these lakes regardless of the presence of fish. Future work will examine factors influencing salamander growth and tail length and determine whether adding habitat complexity is an effective strategy to facilitate coexistence of salamanders and fish.

HABITAT SHIFTS IN MONTANE RIPARIAN AREAS IN THE CENTENNIAL MOUNTAINS OF SOUTHWEST MONTANA

Nathan Korb*, The Nature Conservancy, Montana Chapter, Helena, MT 59601
Brad Bauer, The Nature Conservancy, Montana Chapter, Helena, MT 59601

Deciduous riparian communities (DRC) are functionally and biologically unique habitats that influence ecosystems at local and watershed scales. Since Euro-American settlement, fire exclusion has shifted montane forests in the Centennial Mountains of the Greater Yellowstone Ecosystem from mosaics with variable stand structure and composition, including deciduous communities, to more homogeneous, closed-canopy coniferous forests. Deciduous riparian communities differ from coniferous riparian habitats many ways: fire behavior, post-fire recovery, insect and bird diversity, contributions to aquatic detritus, light regimes of aquatic ecosystems, and habitat suitability for beaver. To characterize the extent of current and historic deciduous riparian communities, we sampled riparian communities along three priority montane streams in the Centennial Mountains, mapped willow and aspen skeletons, and dated dominant conifers. We found widespread shifts in the dominant vegetation at mid-elevation montane sites upstream of the sagebrush-forest ecotone, though less evidence of vegetation change at higher elevation montane sites. The shifts we documented have only occurred in recent decades due to the decomposition of our primary evidence: dead wood. The lower primary productivity associated with these shifts affects native westslope cutthroat trout, birds, bats, and ungulates. Shifts from deciduous shrubs and trees to closed-canopy conifer forest also increases likelihood of local high-intensity fires and increases recovery times after those disturbances. Promoting deciduous riparian communities through prescribed fire and mechanical removal of conifers can increase the productivity of riparian and aquatic systems, while also reducing threats to these systems from climate change, including uncharacteristically severe fire and water shortages.

DETERMINING RESILIENT WATERSHEDS FOR LONG-TERM CONSERVATION IN A CHANGING CLIMATE

Rebekah Levine, Department of Earth and Planetary Sciences, MSCO3-2040, Albuquerque, NM 87131, rebekahl@unm.edu
Nathan Korb*, The Nature Conservancy, Montana Chapter, Helena, MT 59601, nkorb@tnc.org
Brad Bauer, The Nature Conservancy, Montana Chapter, Helena, MT 59601, bdbauer@tnc.org

Streams and riparian areas are highly productive habitats for wildlife and fish. To maintain these critical habitats, rigorous prioritization of conservation and restoration efforts is necessary to make the best use of limited resources. In a changing climate, identifying sites with the ability to buffer change is essential for managing Rocky Mountain water resources. Watersheds in the northern Rockies require persistent snowpack for late-season stream flows and cool water temperatures, yet snowpacks are declining and climate models forecast that this trend will continue. We hypothesize that in the US Northern Rocky Mountains, high-elevation watersheds that receive less solar radiation due to slope, aspect, and shading by steep slopes will have significantly greater ability to maintain cooler water temperatures and higher late summer discharges under warming climate conditions. We also hypothesize that the magnitude of

the aspect-shading effect will override other controlling variables. A GIS model of southwest Montana was developed to select sites for preliminary testing of our framework. Discharge data was collected for six paired watersheds with opposing aspects, similar high elevation area, and similar geology. Preliminary results show that basins dominated by steep north and northeast slopes (> 50 %) produce baseflow discharges that are 2 to 4 times larger than baseflows in basins dominated by steep southerly aspects. The project is ongoing, but our framework based on topographic attributes may be successfully used to inform land managers and restoration efforts about which watersheds are most likely to support stream and riparian habitats under changing climate conditions.

ENSEMBLE HABITAT SUITABILITY MODELING TO GUIDE CONSERVATION OF BLACK-BACKED WOODPECKERS

Quresh S. Latif*, Rocky Mountain Research Station, U.S.F.S., Montana State University Campus, Bozeman, MT 59717
Victoria A Saab, Rocky Mountain Research Station, U.S.F.S., Montana State University Campus, Bozeman, MT 59717
Jonathan G. Dudley, Rocky Mountain Research Station, U.S.F.S., Boise, ID 83702
Jodie E. Canfield, Gallatin National Forest, U.S.F.S., Bozeman, MT 59771

Conservation of Black-backed woodpecker (*Picoides arcticus*), a burned-forest specialist, is challenged by the unpredictable availability of suitable habitat. Habitat models calibrated with data from previous wildfires can be used to predict habitat suitability in newly fire-affected areas. Predictive accuracy of habitat models depends on how well statistical relationships reflect actual ecological relationships. We predicted habitat suitability for Black-backed Woodpecker at Montana post-wildfire forests (≤ 6 years postfire) east of the continental divide using models calibrated with nest location data from wildlfire locations in Idaho, Oregon, and Washington. We developed 6 habitat models, including 1 partitioned Mahalanobis model, 2 Maxent models, and 3 weighted logistic regression models with combinations of 7 environmental variables describing burn severity, topography, and pre-fire canopy cover. We converted continuous habitat suitability indices (HSIs) into binary predictions (suitable or unsuitable) and combined predictions using and ensemble approach; we compiled the number of models (0–6) predicting locations (30×30-m pixels) as suitable. Habitat models represented different hypotheses regarding true ecological relationships, making inferences from ensemble predictions robust to uncertainties in the form of these relationships. Thirty-five percent of the area burned by eastside Montana wildfires was predicted suitable by either all seven habitat models or none of them (i.e. complete agreement among models). We recommend conservation of areas (e.g., exclusion of postfire salvage logging) that were consistently predicted suitable by most models, e.g., 32% of burned areas predicted suitable by ≥ 5 models. Additionally, we recommend surveying areas where models disagree to help validate and refine models.

BIOLOGY IS EASY, UNDERSTANDING PEOPLE IS HARD. MUSINGS OF A WOLF BIOLOGIST WITH A LOT OF WINDSHIELD TIME

Kent Laudon, Montana Fish, Wildlife & Parks, Kalispell, Montana 59901

Our ability as natural resource professionals to measure, analyze, and thereby describe natural world complexities has reached unprecedented levels. But simultaneously our poor understanding of how society assimilates information limits the efficacy of articulating those concepts to the public. Yet effective public dialogue is critical for informed natural resource management, conservation, and policy.

Our traditional public relations methods of continuously distributing information at lower comprehension levels may be inadequate. Here, I will discuss how the synergy of misinformation, groupthink, bias, politics, media, and the blogosphere impedes our ability to convey factual information to the masses. I hope to show why we need a new public communication approach and offer some examples as catalysts to initiate the conversation.

AVIAN MONITORING WITH AUTONOMOUS RECORDING UNITS IN THE BITTERROOT VALLEY, MONTANA (POSTER)

Debbie Leick*, MPG Ranch, Florence, Montana 59833
Kate Stone, MPG Ranch, Florence, Montana 59833

Monitoring avian species over a vast landscape challenges researchers and land managers. Many current monitoring programs rely on point counts, banding stations, and other methods requiring skilled observers. Autonomous recording units (ARUs) compliment data from these more common field techniques. In September 2012, MPG Ranch installed three ARUs at low-, mid- and high-elevation locations to supplement concurrent data collected at passerine banding stations. A preliminary analysis of migrating passerine nocturnal flight calls revealed distinct temporal and spatial trends between sites and through the season. We detected more sparrow, warbler and thrush flight calls in September than in October and at the low-elevation site than at the high-elevation site. We plan to compare this analysis to the banding data collected by the University of Montana's Avian Science Center for additional patterns. The ARUs also recorded several infrequently detected or new species on the ranch. We detected a Barn Owl 16 times at the low- and mid-elevation ARUs over a 29-day period in September and October. These detections represent the first documentation of a Barn Owl since property monitoring began in 2010. Additional acoustic monitoring will help determine if this was a migration or some other phenomena. The Common Poorwill was another uncommon species documented via ARUs. In the future, we plan to use ARUs to document the presence and vocalization phenology of several species (e.g., Flammulated Owl, Common Poorwill) breeding in difficult-to-access areas of the property. We also plan to acoustically monitor the 2013 spring passerine migration.

GRIZZLY BEAR POPULATION VITAL RATES AND TREND IN THE NORTHERN CONTINENTAL DIVIDE ECOSYSTEM, MONTANA

R. D. Mace. Research Biologist, Montana Fish, Wildlife and Parks, 59901

We estimated grizzly bear (*Ursus arctos*) population vital rates and trend for the Northern Continental Divide Ecosystem, Montana, between 2004–2009 by following radio-collared females and observing their fate and reproductive performance. Our estimates of dependent cub and yearling survival were 0.612 (95% CI = 0.300–0.818) and 0.682 (95% CI = 0.258–0.898). Our estimates of subadult and adult female survival were 0.852 (95% CI = 0.628–0.951) and 0.952 (95% CI = 0.892–0.980). From visual observations, we estimated a mean litter size of 2.00 cubs/litter. Accounting for cub mortality prior to the first observations of litters in spring, our adjusted mean litter size was 2.27 cubs/litter. We estimated the probabilities of females transitioning from one reproductive state to another between years. Using the stable state probability of 0.322 (95% CI = 0.262–0.382) for females with cub litters, our adjusted fecundity estimate (m_x) was 0.367 (95% CI = 0.273–0.461). Using our derived rates, we estimated that the population grew at a mean annual rate of approximately 3% (λ = 1.0306, 95% CI = 0.928–1.102), and 71.5% of 10,000 Monte Carlo simulations produced estimates of $\lambda > 1.0$. Our results indicate an increasing population trend of grizzly bears in the NCDE. Coupled with concurrent studies of population

size, we estimate that approximately 1,000 grizzly bears reside in and adjacent to this recovery area. We suggest that monitoring of population trend and other vital rates using radioed females be continued.

STATEWIDE EFFORTS TO MONITOR YEAR-ROUND BAT ACTIVITY PATTERNS AND CHARACTERIZE CAVE AND MINE ROOST HABITATS

Bryce Maxell*, Montana Natural Heritage Program, Helena, Montana 59620
Lauri Hanauska-Brown, Montana Fish, Wildlife, and Parks, Helena, Montana 59620
Amie Shovlain, Beaverhead-Deerlodge National Forest, Dillon, Montana 59725
Susan Lenard, Montana Natural Heritage Program, Helena, Montana 59620
Paul Hendricks, Montana Natural Heritage Program, Helena, Montana 59620
Don Sasse, Ashland Ranger District of Custer National Forest, Ashland, Montana 59003
Katie Iverson, Dillon Field Office of the Bureau of Land Management, Dillon, Montana 59725
Jeanne Spaur, Fort Peck Tribal Office of Environmental Protection, Poplar, Montana 59255
Christopher Servheen, U.S. Fish and Wildlife Service, Missoula, Montana 59812

Montana's bat populations face a wide array of conservation issues, including loss of roosting sites, pesticide impacts to prey species, collision and drowning hazards at sites where they forage and drink, barotrauma and collisions with wind turbines, and the potential arrival of *Geomyces destructans*, the cold-adapted soil fungus that causes White-Nose Syndrome and has decimated bat populations in eastern North America. These conservation issues, and the low reproductive output of bats, highlight the need to gather baseline information that can be used to mitigate impacts to populations. Beginning in the fall of 2011, a collaborative effort was initiated to document roost habitat characteristics and year-round spatial and temporal activity patterns of Montana's bats. To-date, collaborators have deployed over 30 temperature and relative humidity data loggers near known winter bat roosts; most known bat hibernacula in Montana are now being monitored. Collaborators have also established a nearly statewide array of 42 passive ultrasonic detector/recorder stations that are deployed year-round and powered by solar panels and deep cycle batteries. Through December 2012, these recording stations have resulted in more than 750,000 sound files containing nearly 3 terabytes of information. Highlights to-date include numerous first records of species in regions with previously limited bat survey effort, numerous first records of bat activity during the fall, winter, and spring months, documentation of temperatures at which bats are active year-round, documentation of winter bat roost temperatures, documentation of nightly activity patterns throughout the year, and the potential year-round presence of species previously considered migratory.

RECOVERY OF WOLVERINES IN THE WESTERN UNITED STATES: RECENT EXTIRPATION AND RE-COLONIZATION OR RANGE RETRACTION AND EXPANSION?

Kevin S. McKelvey*, U.S. Forest Service, Rocky Mountain Research Station, Missoula, Montana 59801
Keith B. Aubry, U.S. Forest Service, Pacific Northwest Research Station, Olympia, Washington 98512
Neil J. Anderson, Montana Fish, Wildlife, and Parks, Bozeman, Montana 59718
Anthony P. Clevenger, Western Transportation Institute, Montana State University, Bozeman, MT 59715
Jeffrey P. Copeland, The Wolverine Foundation, Tetonia, Idaho 83452
Kimberley S. Heinemeyer, Round River Conservation Studies, Salt Lake City, Utah 84103
Robert M. Inman, Wildlife Conservation Society and Grimsö Wildlife Research Station Department of Ecology, Swedish University of Agricultural Sciences, Ennis, Montana 59729
John R. Squires, U.S. Forest Service, Rocky Mountain Research Station, Missoula, Montana 59801
John S. Waller, National Park Service, Glacier National Park, West Glacier, Montana 59936
Kristine L. Pilgrim, U.S. Forest Service, Rocky Mountain Research Station, Missoula, Montana 59801
Michael K. Schwartz, U.S. Forest Service, Rocky Mountain Research Station, Missoula, Montana 59801

Wolverines were greatly reduced in number and possibly extirpated from the contiguous U.S. by the early 1900's. Wolverines currently occupy much of their historical range in Washington, Idaho, Montana, and Wyoming, but are absent from California, Utah, and Colorado. In response, the reintroduction of wolverines to California and Colorado is being considered. If wolverines are to be reintroduced, it will be necessary to determine the genetic affinities of historical and modern wolverine populations, and identify appropriate source populations. We amplified the mitochondrial control region of 13 museum specimens dating from the late 1800's to early 1900's and 202 wolverines from modern populations in the contiguous U.S. and Canada, and combined resulting data with previously published haplotypes. Collectively, these data indicated that historical wolverine populations in the contiguous U.S. were likely extirpated by the early 20th century. The "Cali1" haplotype previously identified in California museum specimens was also common in the southern Rocky Mountains, and likely evolved in isolation in the southern ice-free refugium that encompassed most of the contiguous U.S. during the last glaciation. Modern wolverines in the contiguous U.S. are primarily haplotype "A" which is the most common and widespread haplotype in Canada and Alaska. For the reintroduction of wolverines to California, Colorado, and other areas in the western U.S., potential source populations in the Canadian Rocky Mountains may provide the best mix of genetic diversity and appropriate learned behavior.

BIODEGRADABLE SHOOTING TARGETS ACIDIFY SOILS, LIMIT PLANT GROWTH, AND MOBILIZE LEAD

Michael R. McTee*, MPG Ranch, Florence, MT, 59833
Dan L. Mummey, MPG Ranch, Florence, MT, 59833
Philip W. Ramsey, MPG Ranch, Florence, MT, 59833

Environmental waste from recreational shotgun shooting includes lead pellet and target debris. The main risk of lead pellets is that they can be ingested by birds as they swallow pebbles and grit that aid in digestion. Another possible vector of toxicity is when acidic soil conditions mobilize lead ions from the solid pellets into the soil and groundwater. Historically, secondary waste resulted from petroleum pitch based targets that persisted in the environment for years. To reduce the environmental lifetime of targets, biodegradable targets were developed. At a former sporting clay shooting range in Florence, Montana, we found that as biodegradable targets degraded, their sulfuric components oxidized to release acid; as a result, soil pH was as low as 2. Target abundance correlated with decreased soil pH

(ρ=-0.681, P<0.001) and decreased plant cover (ρ=-0.770, P<0.001). These acidic soils increased the mobility of lead from shot pellets and now lead concentrations exceed background. Our results demonstrate that biodegradable shooting targets exacerbate the environmental hazards that result from lead shotfall. Careful considerations regarding target composition and shooting locations may minimize environmental exposure to toxicants.

A CORRECTION FOR OVERESTIMATION BIAS IN ESTIMATES OF BLACK-TAILED PRAIRIE DOG (*CYNOMYS LUDOVICIANUS*) ABUNDANCE BASED ON AERIAL SURVEYS OF COLONY SITES IN COLORADO AND MONTANA.

John Sidle, Grasslands Coordinator (ret.), USFS, Chadron, Nebraska
David Augustine, USDA Agricultural Research Service, Ft. Collins, Colorado
Douglas Johnson, USGS, Univ. Minnesota, St. Paul Minnesota
Sterling Miller*, National Wildlife Federation, Missoula, Montana 59802
Jack Cully, USGS, Kansas Coop Research Unit, KSU, Manhattan, Kansas
Richard Reading, Dept. Conservation Biology, Denver Zoological Foundation, Denver, Colorado

Estimates of abundance of black-tailed prairie dogs are obtained by estimating the area occupied by colonies. An approach for estimating this area used in Colorado and Montana was based on aerial survey transects that recorded the end points where transects intercepted and exited colony sites. Line intercept mathematical techniques were applied to these intercept data to obtain estimates of occupied area. We define a "colony site" as an aggregation of prairie dog burrows while a prairie dog "colony" is defined as the portion of a colony site that is occupied by living prairie dogs. Because of poisoning, plague and other factors, colony sites are commonly not completely occupied by colonies. In both Colorado and Montana, however, estimates obtained were estimates of the area occupied by colony sites that had some undetermined level of occupancy by colonies. We show for Colorado that the difference between estimates of area occupied by colonies was much less than the area occupied by colony sites. We provide an approach to correct estimates based on the extent of colony sites. This approach requires ground surveys of a sample of aerial intercepts of colony sites to document the proportion that is actually occupied by colonies of living black-tailed prairie dogs. Black-tailed prairie dogs were found as not-warranted for listing in 2004 in part because of inflated estimates of abundance obtained in Colorado that incorrectly equated the extent of colony-sites as equivalent to the extent of colonies in that state.

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****DECREASED PLANT AND ARTHROPOD RICHNESS IN LANDSCAPES DOMINATED BY OLD WORLD BLUESTEM GRASSES: IMPLICATIONS FOR WILDLIFE**

Adam B. Mitchell*, Department of Ecology, Montana State University, Bozeman, MT 59717
Andrea R. Litt, Department of Ecology, Montana State University, Bozeman, MT 59717
Anthony D. Falk, South Texas Natives, Caesar Kleberg Wildlife Research Institute, Kingsville, TX 78363
Forrest S. Smith, South Texas Natives, Caesar Kleberg Wildlife Research Institute, Kingsville, TX 78363

Old World bluestem grasses (OWBs, e.g., *Bothriochloa*, *Dichanthium* spp.) have become dominant throughout the southern and central Great Plains, altering native plant communities with concomitant effects for native wildlife. We examined plant and arthropod communities in areas dominated by native plants and areas dominated by OWBs at the Welder Wildlife Refuge in southern Texas. We sampled vegetation and arthropods on research plots (6 x 9-m, 5 each) every 4 weeks during summer 2011 and 2012. We found, on average, 2 (SE=0.2) more plant species, and 12-13 (SE=1.0) more arthropod species on native plant-dominated plots compared to OWB-dominated plots. Native plant-dominated plots also had 273 (SE=18.8) more individual arthropods in 2011, but 75 (SE=16.6) fewer than OWB-dominant plots in 2012, resulting from a population explosion and crash of woodlice in native plant-dominated plots. We recorded only 1 species of herbivorous arthropod from OWB-dominated plots in 2012; native plant-dominated plots had 5-6 (SE=0.68) additional herbivore species, suggesting that increased dominance by OWBs may create cascading effects on trophic dynamics. Because many species of wildlife depend on plants and arthropods for food, these changes in species richness and abundance suggest that restoration tools are required to reduce the competitive ability of OWBs. Traditional management strategies have not successfully reduced OWBs; as part of our research, we are modifying soil properties to attempt to provide novel management strategies for landowners to increase diversity of native species and habitat quality in grasslands impacted by OWBs.

INTACT PATHWAY SUCCESSFULLY BUFFERS SAGE-GROUSE MIGRATION

Rebecca E. Smith, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Dave E. Naugle*****, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
John C. Carlson, Bureau of Land Management, Montana/Dakotas State Office, Billings, Montana 59101
M. Randy Matchett, Charles M. Russell National Wildlife Refuge, U.S. Fish and Wildlife Service, Lewistown, Montana 59457
Pat J. Fargey, Grasslands National Park, Val Marie, Saskatchewan, Canada S0N 2T0

Landscape conservation is the mechanism for conserving migratory wildlife in sagebrush ecosystems. We studied a greater sage-grouse (*Centrocercus urophasianus*; hereafter 'sage-grouse') population with the longest-known annual migration, up to 240 km round-trip, between summer and winter ranges in Saskatchewan, Canada, and northcentral Montana, USA. We asked: Do birds fly quickly through a corridor, or do they use stopovers within a larger pathway? GPS-tracking revealed that migrating grouse frequent stopovers along multiple routes that coalesce to form an integrated pathway. Month-long fall migration in November contrasted with punctuated spring migration lasting ~2 weeks in late March/early April. Individual birds typically spent ~1 day at 9 different stopovers, migrating 71-91 km in

11-15 days. Migrating grouse used native sagebrush rangeland in proportion to its availability and avoided cropland and badlands. Birds responded to record-breaking snowfall in winter 2011 (>274 cm) by migrating another ≤50 km south onto windswept ridge tops where sagebrush remained above snow. Grouse selected habitat on Charles M. Russell National Wildlife Refuge most similar to typical winter habitat. Doing so was without consequence to winter survival; such was not the case for a nearby resident population. Newly identified winter range suggests that high site fidelity is tempered by an ability to adapt quickly when resources become scarce. We recommend public land policy that provides grazing opportunities while precluding large-scale energy development or whole scale removal of sagebrush. Management actions that maintain sagebrush as an emergency food source in newly identified sage-grouse wintering grounds will help conserve this migratory population.

****MONTANA PRAIRIE POTHOLE JOINT VENTURE BREEDING SHOREBIRD MONITORING PROJECT (POSTER)**

Megan O'Reilly*, U.S. Fish & Wildlife Service, Habitat and Population Evaluation Team (HAPET), Great Falls, Montana 59404
Sean Fields, U.S. Fish & Wildlife Service, Habitat and Population Evaluation Team (HAPET), Great Falls, Montana 59404

Populations of several shorebird species in the Prairie Pothole Region (PPR) appear to be declining, largely because of loss of grasslands and wetlands. Marbled godwit (*Limosa fedoa*), long-billed curlew (*Numenius americanus*), willet (*Tringa semipalmata*), Wilson's phalarope (*Phalaropus tricolor*), upland sandpiper (*Bartramia longicauda*), American avocet (*Recurvirostra americana*) and Wilson's snipe (*Gallinago delicata*) are listed as priority species by Partners in Flight or the U.S. Shorebird Plan. In 2004, the U.S. Fish & Wildlife Service, Habitat and Population Evaluation Team (HAPET) began conducting breeding shorebird surveys to complement existing waterfowl population and habitat evaluations for the partners of the Prairie Pothole Joint Venture in North Dakota, South Dakota and northeast Montana. Survey methodology was modeled after the Breeding Bird Survey (BBS) but modified to fit the breeding ecology of these shorebirds. In 2012, surveys were expanded to include the western portion of the Montana PPR. Data from these surveys will be used to estimate shorebird population densities and distribution; however, current survey methods do not take into account areas where shorebirds may have been present but undetected, possibly resulting in an underestimation of shorebird densities. Surveys will be modified in 2013 in an effort to allow for estimation of shorebird detection probabilities, while maintaining compatibility with previous data collection methods. Results from this research will allow land managers to integrate breeding shorebird conservation with ongoing waterfowl conservation actions in the Montana PPR. We summarize the objectives and field design of the project and report results of preliminary modeling from our 2012 efforts.

****ASSESSING GENETIC DIVERSITY BETWEEN BIGHORN SHEEP POPULATIONS IN WESTERN MONTANA (POSTER)**

Roxy S. Rademacher*, Student, Corvallis High School, Corvallis, Montana 59828
Allison M. Neils-LeMoine M.Sc., Corvallis High School, Corvallis, Montana 59828

This study investigates two remote bighorn sheep populations in the southern Bitterroot Valley affected by a pneumonia outbreak in 2010. Limited information is available regarding the genetic relatedness among bighorn sheep populations and how pneumonia related die offs could impact genetic diversity and herd resilience to future outbreaks. To contribute to local research efforts we developed scat

collection and DNA extraction protocol for advanced high school students in a community science program. This study gathers baseline information about the genetic relatedness between two relatively close but isolated populations, and will estimate the heterozygosity and the number of distinct alleles at several microsatellite loci. DNA from bighorn sheep scat was collected, extracted, and genotyped from samples in June of 2011 (n=19) and 2012 (n=25). The small sample size will reduce our ability to make broad conclusions; the number of samples represents about 20% of the estimated herd size in 2011 and 2012. Although our ability to make conclusions may be limited, this data could contribute to bighorn sheep management strategies for the Bitterroot and long term genetic monitoring for a sustainable population. Additional samples will be collected and analyzed yearly to look for changes in heterozygosity over time and in response to any future translocations.

MIGRATING AND OVERWINTERING POPULATIONS OF DIURNAL RAPTORS IN THE BITTERROOT VALLEY, MONTANA (POSTER)

Eric Rasmussen*, MPG Ranch, Florence, Montana 59833
Kate Stone, MPG Ranch, Florence, Montana 59833
Rob Domenech, Raptor View Research Institute, Missoula, Montana 59806
Adam Shreading, Raptor View Research Institute, Missoula, Montana 59806

We identified a major spring and fall migration of diurnal raptors over a low-elevation foothills site in the northeast Bitterroot Valley. We conducted full-time migration surveys in both seasons for 2 years. Red-tailed Hawks were the most abundant species counted in both seasons. During fall migration, species composition differed from other Montana hawk watch sites located on high-elevation ridges. We used a combination of survey techniques to assess overwintering populations of raptors in the Bitterroot Valley during the winter of 2012-2013. We developed an iPad application that allows us to map fine-scale occurrence of birds and used this method to document raptor presence at the north end of the valley. Citizen Scientists affiliated with Bitterroot Audubon performed systematic, broader-scale surveys at the south end of the valley. These two methods will likely document over 3,000 raptor observations by the end of winter 2013. Rough-legged and Red-tailed Hawks comprise the majority of raptor detections. We will examine these data for spatial and temporal trends in raptor occurrence.

HIGH, WIDE AND HANDSOME – A REVIEW OF WILDLIFE AND AQUATIC CROSSING TECHNOLOGY OVER THE LAST DECADE (2001-2011)

William (Bill) C. Ruediger*, Wildlife Biologist, Wildlife Consulting Resources, Missoula, MT 59802
Pat Basting, Missoula District Biologist, Montana Department of Transportation, Missoula, MT 59802

Ten years ago, at the 2001 International Conference on Ecology and Transportation in Keystone, Colorado, Ruediger (2001) presented a paper entitled High, Wide and Handsome: Designing More Effective Wildlife and Fish Crossings for Roads and Highways. At the time (2001), the paper provided a biologists perspective of how wildlife and fish crossing should be designed. Since that time, hundreds of wildlife and aquatic crossings have been built, monitored and researched. The authors will explore how wildlife and aquatic organism crossing knowledge has evolved from 2001 to 2011. The authors will explore how monitoring and research information gained over the last decade on structure height and width requirements, bottom material, location and structure type has modified current wildlife and aquatic crossing design. Information on noise impacts, moisture content of soil, light, human activities and vegetation associations relative to structure designs will be updated. Also, use of structures by elk (*Cervus elaphus)*, deer (*Odocoileus spp)*, moose (*Alces alces)*, antelope (*Antilocarpra americana)*, bighorn

sheep (*Ovis canadensis)* and various carnivores will be discussed based on current knowledge. The information presented will help transportation agencies, wildlife agencies and land management agencies design crossing structures that are effective in reducing animal-vehicle collisions, improving habitat and population connectivity, and are cost-effective. The authors have been involved with over 100 major wildlife and aquatic highway crossings in North America, particularly in the Rocky Mountain States, and have extensive experience in structure location, design, costs and the interagency coordination required to implement effective highway mitigation.

****DIFFERENCES IN BIRD DIVERSITY ON BISON VS. CATTLE GRAZED RANCHES IN NORTHEASTERN NEW MEXICO**

Jennifer Runnels*, Department of Natural Resources Management, New Mexico Highlands University, Las Vegas, NM 87701
Jesus Rivas, PhD, Department of Biology, New Mexico Highlands University, Las Vegas, NM 87701

Large ungulate grazing has played a significant role in shaping grassland habitats of the Great Plains in North America. American Bison (*Bos bison*) once roamed the plains in herds estimated to be around 30 million, playing a major role in maintaining abundance and diversity of plain's biota. Today most of these areas are primarily grazed by cattle. Changes in grass height, ground cover, and shrub abundance can have profound impacts on grassland wildlife species, especially birds. Grassland birds are some of the most threatened birds in North America due to habitat loss and overgrazing. Although bison and cattle are functionally similar as large grass-feeding herbivores, differences exist in grazing behavior that suggests bison may be a key species for maintaining diversity in grasslands. This study compared bird diversity on two neighboring ranches, one bison grazed, and the other cattle-grazed. Bird diversity was measured in riparian and grassland habitat using point-count surveys during 2011. We found statistical evidence that bird diversity was higher in grassland habitat on the bison grazed ranch. We also found that bird diversity was higher in grazed vs. nongrazed grassland on the cattle grazed ranch. These results suggest that low-intensity to moderate grazing by both cattle and bison supports grassland biodiversity, and further suggests that native grazers (bison) can help restore grassland plant communities and structures, reestablishing important habitat for birds and other wildlife.

OCCUPANCY DYNAMICS OF AVIAN SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC (POSTER)

Victoria A. Saab*, USDA Forest Service, Rocky Mountain Research Station, Bozeman, MT 59717
Brittany Mosher, Ecology Department, Montana State University, Bozeman, Montana 59717
Michael Lerch, Department of Mathematical Sciences, Montana State University, Bozeman, MT 59717
Jay Rotella, Department of Ecology, Montana State University, Bozeman, MT 59717
Quresh Latif, USDA Forest Service, Rocky Mountain Research Station, Bozeman, MT 59717

Recent epidemics of mountain pine beetles (*Dendroctonus ponderosae*) will fundamentally alter Rocky Mountain forests, impacting management decisions related to fire, logging, and wildlife habitat. We evaluated effects of a recent mountain pine beetle epidemic on occupancy dynamics of 46 avian species. Seventy-six point count stations were randomly located in four, 250 ha study units within pine (*Pinus* spp.) forests in the Elkhorn Mountains, Montana. Each point was visited 3 times during the breeding seasons (May-July) 2003-06 (pre-outbreak) and 2009-11 (post-outbreak). We used a Bayesian hierarchical model of multi-species occupancy that accounts for imperfect detection and allows for estimates of rare, as well as common species. Occupancy was modeled for all species with respect to

pre-outbreak years, year since the outbreak, and proportion of ponderosa pine. Results supported our prediction that occupancy rates would increase after the outbreak for bark-drilling woodpeckers (*Picoides* spp.). Occupancy rates of foliage-gleaning chickadees (*Poecile* spp.) and bark-gleaning nuthatches (*Sitta* spp.) declined soon after the peak in beetle-induced tree mortality (2008); however, their rates began to rise within 3 years. Bark-gleaning species' occupancy relationships with ponderosa pine changed after the outbreak. Our results will help inform forest management activities for the persistence of species that evolved with large-scale disturbances.

THE ACCOMPLISHMENTS OF A NETWORK— PRICELESS RESOURCES: A STRATEGIC FRAMEWORK FOR WETLAND AND RIPARIAN AREA CONSERVATION AND RESTORATION IN MONTANA 2008-2012—AND PRIORITIZATION FOR 2013-2017

Lynda A. Saul, Wetland Program Coordinator, Montana DEQ, Helena, MT 59620

The Montana Wetland Council provides a forum for scientists, mangers, regulators, and others to network and collectively advance wetland and riparian conservation. While these professions aren't typically known for their social dynamism, the passion for the resource holds together and propels this functioning network and has resulted in 3 National Wetland Award winners in the last 7 years. Five-year accomplishments include: Montana now has digital wetland and riparian maps for a majority of the state and these important aquatic resources are one of the state's supported 14 Montana Spatial Data Layers. Montana also has a new statewide In-Lieu Fee Program for impacts to aquatic resources throughout Montana under the auspices of the Corps' 404 and Section 10 regulatory programs. These and other accomplishments from the State's 2008-2012 Wetland and Riparian conservation strategy will be described along with what difference the accomplishments have made and opportunities they leverage for increased wildlife habitat protection and restoration. The next 5-year strategy is currently in the makings. Hear about the 2013-2017 draft priorities and share your input to shape the collective direction of the Montana Wetland Council network.

****PROACTIVE MANAGEMENT OF PNEUMONIA EPIZOOTICS IN BIGHORN SHEEP IN MONTANA—PROJECT UPDATE (POSTER)**

Sarah N. Sells*, Montana Cooperative Wildlife Research Unit, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Michael S. Mitchell, U.S. Geological Survey, Montana Cooperative Wildlife Research Unit, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Neil J. Anderson, Montana Fish, Wildlife and Parks, Bozeman, Montana 59718
Jenifer M. Ramsey, Montana Fish, Wildlife and Parks, Bozeman, Montana 59718
Justin A. Gude, Montana Fish, Wildlife and Parks, Helena, Montana 59620

Pneumonia epizootics are a major challenge for effective management of bighorn sheep. Approximately half of the herds in Montana have suffered die-offs since the 1980s, many of which were pneumonia events. A set of models that identify risk of pneumonia and the best management decisions given that risk would be of great value for proactive management of pneumonia epizootics. Our first objective is to design and test a risk model that will help predict a herd's risk of pneumonia. We hypothesize that various factors increase risk through pathogen exposure, pathogen spread, and disease susceptibility. Analysis of these factors comparing herds with and without recent pneumonia histories using Bayesian logistic regression will allow us to design a risk model. Our second objective is to develop a proactive decision model that incorporates estimates of pneumonia risk to help evaluate costs and benefits of alternative proactive actions appropriate to those estimates. We will use a Structured Decision Making

framework, which provides a deliberative, transparent, and defensible decision-making process that is particularly valuable in complex decision-making environments such as wildlife disease management. Together the resulting risk and decision models, to be completed this year, will help managers estimate pneumonia risk and identify the best management action based on both the severity of each herd's predicted risk and costs and benefits of competing management alternatives. Ultimately, this project will demonstrate the development and application of risk and decision models for proactive wildlife health programs in Montana Fish, Wildlife and Parks.

PROGRESS TOWARD GRIZZLY BEAR RECOVERY: THE CURRENT STATUS OF GRIZZLIES IN THE YELLOWSTONE AND THE NORTHERN CONTINENTAL DIVIDE ECOSYSTEMS

Chris Servheen*, US Fish and Wildlife Service, University of Montana, Missoula, MT 59812
Richard Mace*, Montana Fish, Wildlife, and Parks, Kalispell, MT 59901

The grizzly bear was listed as a threatened species in the lower 48 states in 1975. Formal recovery efforts started in 1981 with the completion of the first Recovery Plan. The state and federal agencies, tribes, and Canadian provinces were organized in 1983 into a cooperative structure called the Interagency Grizzly Bear Committee to work together to implement the Recovery Plan. At the time of listing, the exact number of grizzly bears was unknown but probable numbers in the Yellowstone ecosystem were approximately 250, in the Northern Continental Divide Ecosystem (NCDE) approximately 400. In 2012, population estimates in the Yellowstone ecosystem are approximately 700 and approximately 1000 in the NCDE. Both of these populations appear to be approaching the carrying capacity of their ecosystems as evidenced by reduced subadult survival in the core areas of the Yellowstone ecosystem and dispersal of primarily subadults into peripheral habitats in both ecosystems. The expanding range and numbers of grizzlies is resulting in re-occupancy of habitats in Montana where grizzly bears had been extirpated for over 100 years. The objective of the Endangered Species Act (ESA) is to get listed species to the point at which protection of the ESA is no longer required. We review progress toward recovery and delisting and the reasons the grizzlies in these ecosystems have recovered including mortality control, habitat management, nuisance bear management, and outreach and education. We also describe future management once recovery and delisting have been achieved and how this management will assure the long-term future of this species in Montana.

ELK MOVEMENTS AND BRUCELLOSIS TRANSMISSION RISK IN SOUTHWEST MONTANA

JULEE SHAMHART*, Montana Fish, Wildlife and Parks, Dillon, MT 59725
KELLY PROFFITT, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
NEIL ANDERSON, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
JENNIFER RAMSEY, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
KERI CARSON, Montana Fish, Wildlife and Parks, Bozeman, MT 59718
JUSTIN GUDE, Montana Fish, Wildlife and Parks, Helena, MT 59620

The presence of *Brucella abortus* within free-ranging elk populations is an important conservation and management issue because of the risk of brucellosis transmission to livestock. Understanding elk distributions is necessary to forecast elk and livestock spatial overlap and the potential for brucellosis transmission. As part of a 5-year brucellosis surveillance project, 30 adult female elk were captured and fitted with GPS collars in each of the winters of 2010, 2011 and 2012 in 3 southwest Montana study areas. We used elk location information to assess elk movements, and spatial overlap with livestock and adjacent elk herds. The elk movement results were further augmented with data from Wyoming and

Idaho elk herds. The elk movement data shows interchange of females between elk herds during the transmission risk period. Resource selection models predicting elk distribution and spatial overlap with livestock during the transmission risk period were developed and extrapolated across the designated brucellosis surveillance area of Montana. We used the elk location data collected in this study to validate and refine models predicting elk distributions and spatial overlap with livestock during the risk period. Predictive models may be used as a tool for focusing management actions aimed at minimizing elk and livestock spatial overlap during the transmission risk period.

ESTIMATING LYNX HABITAT UNDER FUTURE FIRE MANAGEMENT AND CLIMATE CHANGE SCENARIOS

Robin P. Silverstein, Missoula Fire Sciences Lab, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT 59801

Climate changes have the potential to considerably alter the habitat of Canada lynx (*Lynx canadensis*), which are dependent on snowshoe hare throughout their range. Both species occupy areas of high altitude forest with dense cover of shrubs and saplings. The Fish and Wildlife Service has designated critical habitat for lynx, but there is little research on how these areas will change with a changing climate. We use the simulation model FireBGCv2 to run scenarios comparing climate change, fuel treatments, and fire suppression. Our results suggest that fire suppression has the most important future benefit in maintaining lynx habitat, as allowing natural fires to burn reduces the quality of lynx habitat over a fifty year modeling period. Although fires can generate the early seral stage that defines quality lynx habitat, their frequency prevents much of the modeling landscape from reaching this stage. Simulation modeling can provide a valuable platform to view the future of lynx habitat under climate change, but the limitations are numerous.

****WINTER WHEAT – FINDING A BALANCE BETWEEN MODERN AGRICULTURE AND PRAIRIE NESTING DUCKS**

Brandi R. Skone*, Ecology Department, Montana State University, Bozeman, MT 59717
Jay J. Rotella, Ecology Department, Montana State University, Bozeman, MT 59717
Johann Walker, Ducks Unlimited, Bismarck, ND 58503

The Prairie Pothole Region (PPR) of North America is a highly valuable landscape for breeding waterfowl that has been predominantly converted to some form of agriculture in the last century. This is cause for concern since the extent of cropland has been strongly associated with declining numbers and nest success of ducks. With the recent increase in economic value of some cash crops and the potential to lose highly valuable nesting habitat in the Conservation Reserve Program (CRP), there has been an interest in evaluating alternative farming practices as potential breeding habitat for waterfowl. While past research has shown nest success of waterfowl to be very low in spring-seeded crops, limited research has assessed the potential of winter wheat, a fall-seeded crop, as a nesting habitat. We wanted to assess and compare the use and success of prairie-nesting ducks in winter wheat to perennial cover (CRP, grassland, etc.) in the PPR of North Dakota. We monitored duck nests (*Anas* spp.) in winter wheat (n=1,284) and perennial cover (n=3,244) from 2010-2012. We will use a model-selection based approach to evaluate nest survival after accounting for a variety of environmental (wetland density, vegetation density, etc.) and temporal covariates (initiation date, nest age, etc.) and predict that daily nest survival will be similar in both habitats. Results from this study will provide valuable insight for wildlife managers on the benefits and weaknesses of winter wheat as a breeding habitat for waterfowl.

EXPLORING ADAPTIVE MANAGEMENT FOR GREATER SAGE-GROUSE IN NORTHERN MONTANA IN THE FACE OF CLIMATE CHANGE (POSTER)

Richard S. Sojda*, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, Montana 59715
Timothy S. Dean, Department of Computer Science, Montana State University, Bozeman, Montana 59717
Jay B. Hestbeck, U.S. Geological Survey, Denver, Colorado 80225
Steven W. Hostetler, National Research Program, U.S. Geological Survey, Corvallis, Oregon 97331
Todd Kipfer, Montana Institute on Ecosystems, Montana State University, Bozeman, Montana 59717
Gregory T. Pederson, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, Montana 59715
Michael D. Reilly, College of Business, Montana State University, Bozeman, Montana 59715
Elizabeth A. Shanahan, Department of Political Science, Montana State University, Bozeman, Montana 59717
John W. Sheppard, Department of Computer Science, Montana State University, Bozeman, Montana 59717

A collaboration has begun in Montana among several state and federal agencies and non-governmental organizations interested in the management of Greater Sage-Grouse (*Centrocercus urophasianus*) in a 5,000,000+ acre (20,234+ hectares) landscape including the Charles M. Russell National Wildlife Refuge. The first step was conducting personal interviews with field biologists and managers in the general area to assess what management actions they are making. Using this information, we conducted an on-line survey to further identify those actions and how they are made. Finally, almost 40 managers and scientists met to discuss whether an adaptive management approach might be useful to gain an understanding of the interaction among habitats and management actions and how this will be affected by annual weather and climate patterns. A conceptual model of how these factors affect the life cycle of grouse has been drafted, and we are gathering comments on it. The intent is for that to be used as an ecological response model for assessing the effects of possible climate change scenarios. Future work will entail: (1)further delineation of management actions and the social networks associated with them, (2)building and evaluating a working model using rapid prototype methods, (3)conducting futures analyses of associated landscapes, (4)continuing to foster collaborative effort, and (5)working one-on-one with managers to evaluate model and adaptive management applicability using such tools as LCMAP (Landscape Conservation Management and Analysis Portal).

USING ADVANCED TECHNOLOGY TO EVALUATE THE EFFECTS OF RESTORATION TREATMENTS ON BIRD USE OF SHRUBBY DRAWS DURING FALL MIGRATION

Kate Stone, MPG Ranch, Florence, Montana 59833

In 2012, the MPG Ranch initiated efforts to restore ground cover and woody structure in several draws degraded by decades of cattle grazing. To evaluate the effects of restoration treatments, we are studying bird use of draws during fall migration, tracking changes in bird use as restoration progresses. To map bird occurrence at the scale of restoration treatments, we developed and tested an iPad application that allowed us to place bird detections directly onto high-resolution, geo-referenced aerial imagery. Along with an exact location, the application allows us to record descriptive information such as species, behavior, and substrate used. In our pilot season, we recorded observations of 1,061 birds. The Vesper Sparrow was the most commonly observed species. We were able to detect spatial and

temporal trends in bird use of shrubby draws, with notable clustering in areas of established woody vegetation. We also detected several species using shrubby draws during fall migration that would not typically be found in this habitat type in the breeding season. In the future, we will make quantitative associations between bird detections and the presence of features such as shrub and tree cover or the presence of water. Given what we deemed a successful pilot season, we plan to continue the use of the iPad application during subsequent fall migrations as draw conditions change and habitat conditions presumably improve.

TWENTY YEARS OF HUMAN-GRIZZLY BEAR CONFLICT MANAGEMENT IN NORTHWEST MONTANA

Lindsey A. Stutzman*, Montana Department of Fish, Wildlife & Parks, Kalispell, Montana 59901
Timothy L. Manley, Montana Department of Fish, Wildlife & Parks, Kalispell, Montana 59901

This paper examines and summarizes twenty years of human-grizzly bear conflicts and management actions in northwest Montana from 1993 through 2012. Initial responses to the reported conflicts usually involved identifying the attractant and securing or removing the attractant. In many situations, the decision was made to trap and capture the grizzly bear. A total of 193 individual grizzly bears were captured 344 times in management actions which ranged from grizzly bears frequenting yards to grizzly bears breaking into cabins. When grizzly bears were captured their fate depended upon their age, sex, level of conflict, and classification based on the Interagency Grizzly Bear Guidelines. Grizzly bears were released on-site, translocated, or removed from the population. Translocations included long distance out of home range moves to short distance moves within the home range. Aversive conditioning techniques were tried involving the use of bean bag and rubber bullet rounds, cracker shells, and Karelian Bear dogs. New technology such as remote cameras, automated traps, and use of DNA were also used on this project. The success or failure of the different management actions is discussed and recommendations are made for future human-grizzly bear conflict management actions.

MONTANA PERGRINE FALCON SURVEY: 2012

Jay S Sumner*, Montana Peregrine Institute, Arlee, Montana 59821
Ralph Rogers**,** Centmont Bioconsultants, Winifred, Montana 59489
Adam Shreading, Montana Peregrine Institute, Arlee, Montana 59821

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 nests recorded during the 2012 field season. Montana Peregrine Falcon surveys are conducted in conjunction with the USFWS national surveys scheduled every three years, beginning in 2002 and ending in 2015. 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.

HISTORY OF WOODLAND CARIBOU IN MONTANA

Timothy J. Thier*, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana 59901
Timothy L. Manley, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana 59901
James S. Williams, Montana Department of Fish, Wildlife and Parks, Kalispell, Montana 59901

Within the contiguous United States, woodland caribou were historically a resident of mature, deep-snow forests of northwest Montana, north Idaho and northeast Washington. Because of habitat changes, predation, and unregulated hunting, numbers dwindled to remnant populations or even extinction throughout their distribution within the U.S. By the 1950's, any caribou that might be observed in Montana were considered transitory from either southern British Columbia or north Idaho, where remnant populations still remain. In this paper, we review historical and current records of woodland caribou in Montana, discuss their biological requirements and legal status, and offer comments on future recovery efforts.

****NESTING ECOLOGY OF SPINY SOFTSHELL TURTLES (*Apalone spinifera hartwegi*) ON THE MISSOURI RIVER IN MONTANA: ZOOGEOGRAPHIC AND MANAGEMENT IMPLICATIONS**

Brian J. Tornabene*, Montana Cooperative Fisheries Research Unit, Department of Ecology, 301 Lewis Hall, Montana State University, Bozeman, Montana 59717, brian.tornabene@gmail.com
Robert G. Bramblett, Department of Ecology, 301 Lewis Hall, Montana State University, Bozeman, Montana 59717
Stephen A. Leathe, PPL Montana, 336 Rainbow Dam Road, Great Falls, Montana 59404
Alexander V. Zale, U.S. Geological Survey, Montana Cooperative Fisheries Research Unit, Department of Ecology, 301 Lewis Hall, Montana State University, Bozeman, Montana, 59717

The nesting ecology of western spiny softshell turtles in Montana, where they are at the northern extent of their range and a state Species of Concern, is poorly known. We used telemetry, visual surveys, observation from shore-based blinds, and remote cameras to document nesting behavior, habitat, and timing in a 97-kilometer reach of the Missouri River. We located 25 nests in 2011 and 97 in 2012. Most nests were in mixed-gravel substrates; only 3% were in pure sand. Vegetative cover at nest sites was sparse. Mean distance of nests to the water's edge was 13.7 m and mean height above the water surface elevation was 0.7 m. Proportion of nests found on island and mainland habitats were similar in 2011, but 90% of nests were on islands in 2012. Predation occurred on 46 nests; mainland nests incurred higher predation rates than island nests. Nesting followed annual peak river stage, and mostly occurred in the afternoon. Durations of nesting, incubation, and emergence periods were similar in both years, but nesting and emergence occurred about three weeks later in 2011 than in 2012. Only 36% of nests were successful in 2011, but 60% were successful in 2012. Flooding in 2011 probably decreased nesting effort and success by reducing habitat availability and delaying the onset of nesting, thereby prematurely ending incubation. However, flood events maintain and create nesting habitats by clearing vegetation and depositing substrates. Premature termination of incubation suggests that the northern range of this species is probably limited by successful incubation.

MONTANA GOLDEN EAGLE CONSERVATION GUIDELINES (POSTER)

Catherine S. Wightman*, Montana Fish, Wildlife and Parks, Helena, Montana 59620
Jeff Berglund, U.S. Fish and Wildlife Service, Helena, Montana 59601
Bryan Bedrosian, Craighead-Beringia South, Jackson, Wyoming 83011
John Carlson, Bureau of Land Management, Billings, Montana 59101
Lauri Hanauska-Brown, Montana Fish, Wildlife and Parks, Helena, Montana 59620
Sam Milodragovich, Northwestern Energy, Butte, Montana 59701
Alan R. Harmata, Montana State University, Bozeman, Montana 59717

The Montana Golden Eagle Working Group is preparing guidelines to address conservation concerns for golden eagles (*Aquila chrysaetos*) related to land use change and population-level mortality factors. The guidelines focus primarily on avoiding, minimizing and mitigating adverse impacts to golden eagles. The U.S. Fish and Wildlife Service Draft Conservation Plan Guidance explains the Service's approach to issuing programmatic permits for eagle take and provides adaptive management guidance for the conservation of golden eagles related to land-based wind energy facilities. The Montana guidelines are intended to address a wider array of golden eagle conservation concerns and potential anthropogenic impacts, and compliment implementation of the industry-focused Draft Eagle Conservation Plan Guidance in Montana. We will present a summary of the status of and threats to golden eagle populations and habitats. Then we will discuss our draft conservation guidelines that outline strategies for maximizing reproductive potential and survival of the eagle population in Montana. We also will present some options for mitigation when negative impacts to eagles cannot be avoided or minimized.

WOLVERINE FOOD HABITS AND FORAGING STRATEGIES IN GLACIER NATIONAL PARK, MONTANA

Richard E.Yates*, United States Department of Agriculture Forest Service, Rocky Mountain Research Station, Missoula, MT 59801
Jeffrey P. Copeland, United States Department of Agriculture Forest Service, Rocky Mountain Research Station, Missoula, MT 59801
John R. Squires, United States Department of Agriculture Forest Service, Rocky Mountain Research Station, Missoula, MT 59801

From 2003-2007 we captured and instrumented 28 wolverines (*Gulo gulo*) in Glacier National Park to investigate reproduction and recruitment. We collected 189 scat samples at reproductive den, forage and rendezvous sites, and documented 90 prey species through observation and prey remains found at similar sites. Seasonal scat analysis provided evidence of differences in prey species consumed during winter (N=170), summer (N=19), and reproductive den (N=103) periods. Ungulates were the most frequently observed prey found in all scats (71%; N=135), with Cervid remains being observed most often (37%; N=70). Hibernating rodents (ground squirrels and marmots) (36%; N=68) were the next most utilized prey, with the third most documented prey being mice and voles (31%; N=56). Vegetation (72%; N=169), soil material (31%; N=59), and bone (90%; N=171) were also found in scats. Seasonal importance of prey was documented, with ungulates being the most observed prey in winter scats (75%; N=128) and den period scats (79%; N=81), and hibernating rodents being most observed in summer scats (47%; N=9). A similar condition was found with analysis of all prey remains (N=90); ungulates were consumed most often (69%; N=63), with hibernating rodents as the second most documented prey (12%; N=11). Wolverines exhibited seasonal dietary shifts in that ungulates were consumed most frequently during winter (77%; N=55) and the den period (78%; N=17), with hibernating rodents the

most frequent prey documented in summer (50%; N=9). Wolverine foraging strategies, including searching tree wells, fishing, decapitation, and food caching are also discussed.

UNTANGLING ROCKY MOUNTAIN ELK ECOLOGY AND POPULATION DYNAMICS: A REGIONAL SYNTHESIS ACROSS THE NORTHWESTERN U.S.

Western Elk Research Collaborative (representatives from 7 state wildlife management agencies 4 Cooperative Wildlife Research Units, 1 university, National Park Service)
Pete Zager*, Idaho Department of Fish and Game, Lewiston, Idaho 83501.
Mike Mitchell, US Geological Survey, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812

The Western Elk Research Collaborative (WERC) is a group of state and federal biologists and university faculty that is pooling Rocky Mountain elk data from 7 states to understand factors affecting elk population dynamics at broad spatial and temporal scales. These "value-added" analyses leverage the considerable investment collaborators made to develop their respective datasets. Our initial efforts pooled data from 12 elk populations to evaluate calf survival and cause-specific mortality (Journal of Animal Ecology 80:1246-1257) and 45 datasets to assess adult female survival and cause-specific mortality (Journal of Applied Ecology in press). We will briefly describe those findings. We also seek to understand how reproductive output varies across space and time as a function of factors such as weather, plant productivity, and predation. Therefore, we are assembling population and reproduction data from our 7 state study area. The spatial and temporal (up to 25 years) scales are unique and may provide insight into the effects of climate change on elk population dynamics. As a direct result of the exceptional cooperation and communication among collaborators … a signature success of WERC … we are developing an unprecedented Rocky Mountain elk dataset that will provide a fertile arena to investigate relevant management and research questions.

****CAMOUFLAGE MISMATCH IN SEASONAL COAT COLOR DUE TO DECREASED SNOW DURATION**

L. Scott Mills, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Marketa Zimova*, Wildlife Biology Program, University of Montana, Missoula, Montana 59812
Jared Oyler, Department of Ecosystem and Conservation Sciences, University of Montana, Missoula, Montana 59812
Steven Running, Department of Ecosystem and Conservation Sciences, University of Montana, Missoula, Montana 59812
John Abatzoglou, Department of Geography, University of Idaho, Moscow, Idaho 83844
Paul Lukacs, Wildlife Biology Program, University of Montana, Missoula, Montana 59812

As a result of climate change, the duration of the ground snow cover in the temperate regions has shortened. We describe a novel and striking climate change effect on wildlife, whereby seasonal coat color becomes mismatched with background snow or lack of snow. Our objective was to quantify for snowshoe hares *(Lepus americanus)* the phenology of seasonal coat color change and potential for coat color mismatch, as first step in exploring whether hares can adapt to a decreasing snowpack. We quantified snowshoe hare molt phenology, mismatch and survival for three years at two sites in western Montana, USA. We monitored over 450 hares weekly with radiotelemetry, quantifying the progression of the molts and snow cover. We observed considerable mismatch between hare coat color and their background during spring and fall seasons. Some level of plasticity was observed in the rate of the spring molt which mitigated the color mismatch. By contrast, onset of coat color molts remained constant. We

used global circulation model downscaling at ecologically relevant scales (30m resolution) to predict changes in snowpack hares are likely to face in the future. According to our analysis annual average duration of snowpack will decrease by 29-35 days by mid-century and 40 - 69 days by the end of the century. Without evolution in coat color phenology, the reduced snow duration will increase the number of days that white hares will be mismatched on a snowless background by 3 – 8 fold.