March 4th – 7th, 2014

52nd Annual Conference

Bozeman, MT

Montana Chapter of The Wildlife Society

Splitting the Baby?

Public Trust, Multiple Use, and Current Policy in Wildlife Management

About the conference logo artist

Shayna Parker is a 26 year old, enrolled member of the Confederated Salish and Kootenai Tribes (Bitterroot Salish and Pend d'Oreille, specifically). Born and raised on the Flathead Indian Reservation, she developed an interest and talent in art at a very young age. By age 11 she was winning design contests, and her 1st professional design was done at age 15. Shayna studied Fine Art and Design at Montana State University. Her passions lie in designing, painting, sketching, photography and cooking; and actively working on pencil portraits, paintings and 2-D design. Shayna currently works for the Confederated Salish and Kootenai Tribes Division of Fish, Wildlife, Recreation, and Conservation.

"The 2014 MTTWS conference logo design was a challenge for me, as it incorporated a variety of management concepts and challenges into one logo, but I enjoyed it and am happy with the outcome," – Shayna Parker

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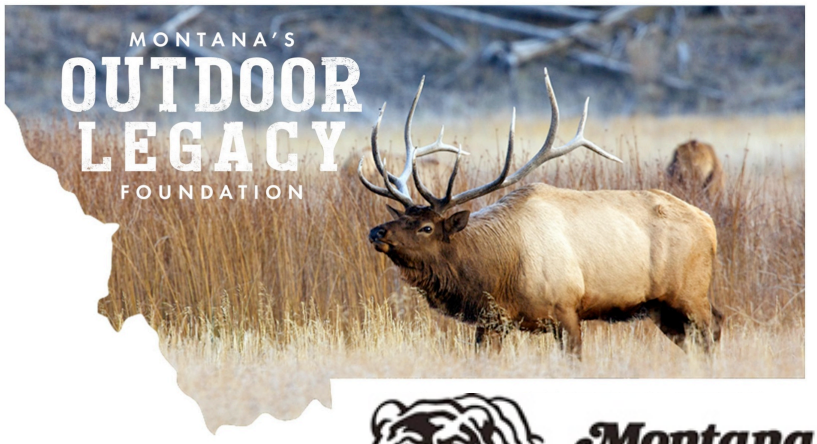

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Notes from the Prez

The conference theme: What the heck does it mean???

I gape at the complex tapestry of wildlife policy that has been woven over the past century in our state, and the concepts that color it from much further back and wider in history. Whether considering the interplay of Native American hunting rights with state game management regulations and private land rights during my Master's research, working on NEPA analyses for the Forest Service, or interpreting ESA wording for wolf depredation response during my time with FWP, I always felt uneasy when it came to understanding where I fit into the policy picture as a wildlife biologist.

When I had to come up with a conference theme, it was those experiences that boiled to the top and left me with this raft of disquietude to examine for clues. Underneath it all I wondered whether the concept we work toward as management biologists, essentially the orchestration of human activity for the perpetuity of wildlife and its habitat, ultimately works in the favor of wildlife? Or, will wildlife and its habitat, so beloved by so many people for so many reasons, ultimately be torn asunder in the gaping maw of clashing policy?

I pictured the tale of King Solomon facing two women both desperately bereaving a lost infant and a living one. As he raised his hand to split the living infant in two - a fair compromise – the true mother, as the tale goes, reneged her claim on the child in order to save its life. As biologists and citizens, we strain to influence wildlife and habitat constituencies through both the concepts of public trust and multiple use; to redirect a most basic human desire to hold something, use something, own something that fulfills them, and channel it productively. But we are constantly pushed and pulled by forces beyond our control that are also driven by this same desire. In the face of this, can we even hope to split the baby, to manage wildlife, like sagacious Solomon? What do we need to know about ourselves, our constituencies, our political history and current surroundings in order to be successful in our work? I don't have answers, just questions. I hope that our plenary panel both offers a long perspective as well as inspires a creative inquisitiveness in us that will help us navigate our work world with humble sagacity and abundant enthusiasm.

The conference logo: And what the heck does THAT mean???

When I asked Whisper Means for help coming up with conference artwork, her advice to me was to choose an animal that I felt embodied the conference theme. I was fortunate enough to spend 6 seasons involved with the FWP wolf program during the most controversial years of its existence, and there is no question those years have been influential in my existence. The past decade of wolf wars has changed the game for wildlife management and how the public, the legislature, and the courts interact with the broad concepts of multiple use and public trust. And at the end of it all, can we say that the wolf has won the war or that it was a casualty of it?

Some early sketches by Shayna Parker struck a chord in me – it was something in their circular nature. As I looked for other ideas the of a serpent eating its tail, the Ouroboros, reminded me of a dream I had one night on the trapline that shook me deeply, of wolves and death and heads and tails. The Ouroboros symbolizes cyclicality, which is inherent in the

natural world at many scales. It also feels inherent in the listing of the wolf as an endangered species, and is not a circumstance to aspire to in wildlife management policy. But the Ouroboros, too, represents the idea of something persisting with inextinguishable force, not necessarily for good or ill, but with verve. Such is the relationship between wolf and man. There was born the wolf Ouroboros. Incorporated into the belly of the wolf are the scales of justice – take them for what you want them to be – law, vigilantism, reason, justification. Beneath it, elk antlers – take them for what you want them to be – the cradle of the North American Model or just the leftovers of a tasty meal. Behind it, a fence – to keep things in, keep them out, demarcate or divide. And surrounding it all, a camera lens with a dazzling flash – one of the most powerful tools of influence and ownership.

This design, Shayna's interpretation of the verbal and visual thoughts I laid out for her, feels thankfully much more optimistic than my ominous offerings. I thank her tremendously for bringing her talent to this conference artwork. I hope you enjoy it. You can even take it with you anywhere you go by purchasing a bag at the registration desk. It's sure to be a conversation starter.

--Kristina Boyd, President, MT Chapter of TWS

2014 Elections

NOMINEES FOR PRESIDENT-ELECT

Brent Lonner. Growing up in MT, I have had the opportunity to live, recreate and work in multiple areas within this state. Through these experiences along with other travels, I have found that Montana provides unique and diverse natural resource recreational and work opportunities not found in many places. For the past seven years I have served as an area wildlife biologist for MT Fish, Wildlife and Parks working in the southern Rocky Mtn. Front area. This position has provided me with ample opportunity to work in a varied suite of habitats and associated wildlife. This work has also provided opportunity to work with a diverse set of individuals, agencies and other groups. Prior to this work and in addition to other seasonal positions, I obtained a Bachelor's degree in Fish and Wildlife Management at Montana State University in 1999. In 2004, I was given the opportunity to obtain my Master's degree and completed this in 2006, graduating from the University of Montana (with field work completed out of Montana Tech studying Seroprevalence of Hantavirus in resident and dispersing deer mice). I have been a member of MT TWS for the past 10 years and believe that active participation in organizations such as this is an excellent way to utilize my experiences to help further the goals of MT TWS and our diverse membership. The Wildlife Society is a science-based organization that provides its membership the opportunity to offer respected viewpoints on wildlife issues. If elected, I would consider it an honor to serve the membership of MT TWS and to be a part of fostering the professional development opportunities MT TWS provides for its members.

Chuck Bowey. Born in north Idaho, Chuck grew to love and respect the natural world. He attended the University of Idaho, where he earned his B.S. degree in Wildlife Resources. While a student, he served as both Vice President and President of the Student Chapter of The Wildlife Society. After graduation he worked seasonally and then full time with the USDA Forest Service as a wildlife biologist, working in that capacity for 10 years. In 1998, he made a major career change and started a ranch management company called Ranch Resources, where he is responsible for the management of natural resources on over 40 ranches in Montana and Wyoming. In 2003 Chuck attained his

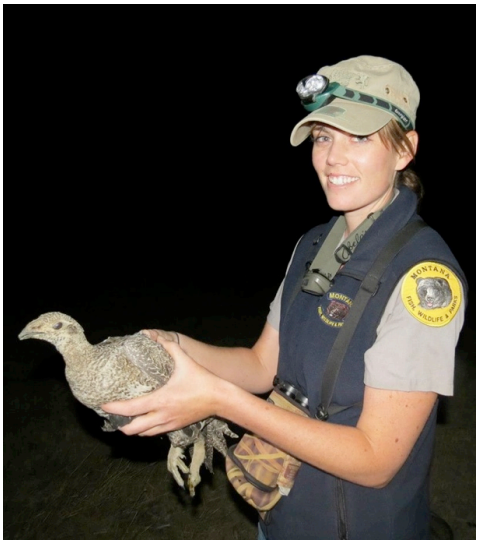
Certified Wildlife Biologist designation and currently serves as Treasurer for the Montana Chapter of The Wildlife Society.

Chuck is responsible for managing wildlife and natural resources and integrating these practices with ongoing commercial agricultural operations. In 2007 Chuck earned the Accredited Farm Manager designation from the American Society of Farm Managers and Rural Appraisers. This designation centers on agricultural economics, including developing balance sheets, income statements, budgeting, depreciation, asset management, lease administration, etc… In his current position, Chuck manages over $400 million dollars in ranch assets.

Chuck lives in Bozeman, Montana and has three children, ages 14 to 19. When not working, he spends his time with his family. They enjoy camping, fishing, packing mules, hiking, skiing and hunting. He is civic-minded and serves on various boards including the Camp No Limits Foundation Board, a national board of directors for programs directed at children with limb loss, 4H and FFA Market Livestock Program Boards, Ruby Valley Park Board, as well as the local Board of Commissioners for the Ruby Valley Conservation District.

Chuck's wildlife and natural resource management experience combined with his volunteer positions provides him a unique perspective in further serving on the Board of the Montana Chapter of The Wildlife Society.

NOMINEE FOR TREASURER



Sonja Smith earned her Bachelor's Degree in Wildlife, Watershed, and Rangeland Resources (Wildlife Science option) at the University of Arizona (UA) in 2008. While attending the UA, she was active in both student chapters of The Wildlife Society (serving as Secretary and President) and the American Fisheries Society (serving as President). She also gained field experience working with passerine birds in southeastern Arizona, Mexican wolf conflict in eastern Arizona, and sable antelope and impala in South Africa. Upon graduation from UA, she began her Master's program in Wildlife Biology at the University of Montana (UM), living on the East Front of the Rocky Mountains near Dupuyer, MT and completing her thesis titled "Winter habitat use by mule deer in Idaho and Montana," in December 2011. At that time, she accepted an area biologist position with Montana Fish, Wildlife, and Parks, and is currently based in Lewistown, MT. In her free time, she enjoys outdoor activities like horseback riding, archery, hiking, hunting, and fly-fishing.

CONFERENCE SCHEDULE

WORKSHOP	OVERLAP	GROUP MEETING	SOCIAL	OVERLAP	EVENT

Time	Monday	Tuesday	Wednesday	Thursday	Friday
700				Board Room **Business Meeting** Bfast by TWS	
800				**START** **CONCURRENT** **SESSIONS**	
900			State Room **Resume &** **Interview**	Sess 1 - MSU Sess 2 - Jefferson	**START** **CONCURRENT** **SESSIONS**
1000			**Workshop** Montana Room **Partners of the**	**BREAK**	Sess 1 - MSU Sess 2 - Jefferson
1100			**Americas** **Working Group**		**BREAK** **CONCURRENT** **SESSIONS**
1200		**REGISTRATION TABLE OPENS**	Gallatin Room **LUNCH** Buffet by TWS	Gallatin Room **LUNCH** Buffet by TWS	**END** **MEETING CONCLUDES**
1300		MSU Rooms **Bat**	MSU Rooms		
1400		**Working Group**	**PLENARY**	**BREAK**	
1500				**CONCURRENT**	
1600			Board Room **MT Assoc of F&W Bios**	**SESSIONS** **END** Hallway	
1700			Gallatin Room **Student / Prof**	**Poster Session** Gallatin Room **Silent**	
1800		Gallatin Room **Welcome**	**Mixer** Buffet provided by TWS	**Auction & Awards**	
1900		**Reception** Buffet provided by TWS	MSU Rooms **Quiz Bowl**	**Banquet**	
2000					

PLENARY SESSION

This year's plenary will be an exposition and discussion on how wildlife policy is made and how wildlife and habitat managers are affected by policy, multiple-use stakeholders of all sorts, and the concept of wildlife in the public trust. Where do we fit in the big picture, how do we balance the many strains on our job missions, and what can we do on a day-to-day basis to help keep the future of wildlife intact?

1:00 : Welcome

1:10 : **MIKE PHILLIPS**
M.S., MT State Senator, Executive Director of the Turner Endangered Species Fund
"Politics, science, and wildlife conservation"

1:30 : **CHRIS SMITH**
M.S., C.W.B, Wildife Management Institute Field Representative, Past Deputy Director of FWP, 1998-2011
"The Influence of Policies and Paradigms on Wildlife Management in Montana"

1:50 : **LAURI HANAUSKA-BROWN**
M.S., FWP Nongame Wildlife Management Bureau Chief
"Nongame Species Management within FWP: Who Should Care and Why"

2:10 : **JACK WARD THOMAS**
Ph.D., C.W.B, Past Chief of the USFS, 1993-1996, and Past President of TWS, 1976-1977
"The Future of National Forests: Who Will Answer an Uncertain Trumpet?"

2:30 : **DAN TYRES**,
PH.D., Grizzly Bear Coordinator for the USFS, Affiliate Faculty at Montana State University
"A Collaborative Approach to Wildlife Management"

2:50 : Questions & Discussion

3:50 : Conclusions, Announcements, Adjournment

Evening Activities

4:00 : Meeting of the Montana Association of Fish and Wildlife Biologists

5:00 : Student/Professional Mixer

7:00 : Quiz Bowl

Awards Banquet

Our Awards Banquet speaker this year is also one of the Plenary panelists. Mike Phillips will take off his Montana Senatorial hat and don his Turner Endangered Species Fund ED hat to talk about private land management in the context of this year's conference theme.

6:00 : Dinner service begins

6:30 : **Mike Philips**
M.S., MT State Senator, Executive Director of the Turner Endangered Species Fund
"Wolf Recovery: A Lens to Many Matters of Concern"

7:15 : Dessert service begins

7:30 : Awards

- Distinguished Service for cumulative, past, current, and/or continuing achievements in wildlife conservation.
- Wildlife Biologist of the Year for significant achievements in wildlife conservation anytime during the five years immediately preceeding the award presentation.
- Bob Watts Communication for significant communication in media such as professional publications, popular wildlife articles, books, movies, or videos that have a relatively wide audience.
- Best Student Presentation
- Best Student Poster

ORAL PRESENTATIONS

Moderators are in parentheses

**** indicates student presenters to be judged**

Thursday, March 6, 2014	SESSION 1 MSU ROOMS (Ben Turnock)	SESSION 2 JEFFERSON ROOM (TBD)
8:00 AM	J. Cunningham - BIGHORN SHEEP TRANSLOCATION: TWO CASE STUDIES FROM THE GROUND	M. Larson - NATURAL NEST-SITE CHARACTERISTICS OF TWO SMALL FOREST OWLS WITH IMPLICATIONS FOR CONSERVATION AND MANAGEMENT
8:20 AM	**J. DeVoe - MODELING SUMMER HABITAT SELECTION OF SYMPATRIC BIGHORN SHEEP AND MOUNTAIN GOATS IN THE GREATER YELLOWSTONE AREA	Q. Latif - AVIAN COMMUNITY CHANGES IN RELATION TO DIFFERENT FOREST FIRE CONDITIONS IN CENTRAL IDAHO
8:40 AM	**C. Butler - CORRELATES OF RECRUITMENT IN MONTANA BIGHORN SHEEP POPULATIONS	J. Larson - INVESTIGATIONS OF THE BREEDING ECOLOGY OF THE NORTHERN HAWK OWL IN WESTERN MONTANA
9:00 AM	**S. Sells - A RISK MODEL FOR PROACTIVE MANAGEMENT OF PNEUMONIA EPIZOOTICS IN BIGHORN SHEEP	J. Smith, L. Berkeley, & H. Goosey - A DEMONSTRATION OF USING PARTNERSHIPS AND PRIVATE LANDS CONSERVATION TO EVALUATE LIVESTOCK GRAZING AS A MANAGEMENT TOOL FOR GREATER SAGE-GROUSE IN CENTRAL MONTANA.
9:20 AM	**K. Manlove - CONTACT NETWORKS AND MORTALITY PATTERNS SUGGEST PNEUMONIA-CAUSING PATHOGENS MAY PERSIST IN WILD BIGHORN SHEEP	
9:40 AM	R. Garrott - MONTANA'S NEW STATE-WIDE BIGHORN SHEEP RESEARCH INITIATIVE	C. Burnett - HABITAT CHARACTERISTICS OF A SOUTHERN FRINGE GREATER SAGE-GROUSE POPULATION: IMPLICATIONS FOR RANGE-WIDE MANAGEMENT
10:00 AM	**BREAK (Dale Becker)**	**BREAK (Tim Manley)**
10:20 AM	J. Bailey - THE FUTURE OF AMERICAN BISON: DOMESTICATED OR WILD?	**D. Bachen - INDIRECT EFFECTS OF NONNATIVE BROME GRASSES ON SMALL MAMMALS IN SAGEBRUSH STEPPE ECOSYSTEMS
10:40 AM	P. Cross - ANNUAL TIMING OF ELK ABORTIONS AND POTENTIAL BRUCELLOSIS RISK	P. Farnes - RELATING CLIMATE DATA TO WHITEBARK PINE CONE PRODUCTION IN SOUTH-CENTRAL MONTANA
11:00 AM	P. Kamath - GENOMICS OF BRUCELLOSIS IN WILDLIFE AND LIVESTOCK OF THE GREATER YELLOWSTONE ECOSYSTEM	C. Costello - INFLUENCE OF WHITEBARK PINE DECLINE ON FALL HABITAT USE AND MOVEMENTS OF GRIZZLY BEARS IN THE GREATER YELLOWSTONE ECOSYSTEM
11:20 AM	N. Anderson & Q. Kujala - BRUCELLOSIS IN MONTANA ELK: FACTORS THAT INFLUENCE DISEASE PREVALENCE, AND THE SOCIAL AND POLITICAL INFLUENCES AND ISSUES ASSOCIATED WITH MANAGING A DISEASE OF CONCERN FOR LIVESTOCK IN A FREE-RANGING ELK POPULATION.	F. van Manen - DENSITY DEPENDENCE, WHITEBARK PINE DECLINE, AND VITAL RATES OF GRIZZLY BEARS IN THE GREATER YELLOWSTONE ECOSYSTEM
11:40 AM		M. Haroldson - TRENDS IN CAUSES AND DISTRIBUTION, AND EFFECTS OF WHITEBARK PINE DECLINE ON GRIZZLY BEAR MORTALITY IN THE GREATER YELLOWSTONE ECOSYSTEM
12:00 AM	**LUNCH**	**LUNCH**

Thursday, March 6, 2014	SESSION 1 MSU ROOMS (Lorin Hicks)	SESSION 2 JEFFERSON ROOM (Janene Litchtenberg)
1:00 PM	R. Ream - MONTANA CLIMATE VARIABILITY: A CHALLENGE FOR BIG GAME MANAGEMENT	A. Cilimburg & A. Seaman - MONTANA AUDUBON'S RIPARIAN BIRD RESEARCH AND CONSERVATION: WHAT'S NEW, WHAT'S NEXT?
1:20 PM	N. Garcia & J. Cunningham - AFTER 70 YEARS OF DATA: WHAT DO WE KNOW AND WHAT DO WE THINK WE KNOW ABOUT ELK HABITAT AND VEGETATION IN THE GALLATIN CANYON?	
1:40 PM		L. Bate & A. Cilimburg - BLACK SWIFTS IN MONTANA: FINDING NEW NESTING SITES AND WHAT'S NEXT FOR THIS ELUSIVE BIRD
2:00 PM	J. Canfield - U.S FOREST SERVICE AND MONTANA DEPARTMENT OF FISH WILDLIFE AND PARKS COLLABORATIVE OVERVIEW AND RECOMMENDATIONS FOR ELK HABITAT MANAGEMENT ON THE CUSTER, GALLATIN, HELENA, AND LEWIS AND CLARK NATIONAL FORESTS	D. Bergeron - KOOTENAI RIVER OPERATIONAL LOSS ASSESSMENT METHODOLOGY AND ITS APPLICATION TO HABITAT RESTORATION
2:20 PM	**BREAK (Melissa Foster)**	**BREAK (Whisper Means)**
2:40 PM	**D. Eacker - COMPENSATORY MORTALITY IN A MULTIPLE CARNIVORE SYSTEM: CONSEQUENCES FOR ELK CALF SURVIVAL AND ELK POPULATION DYNAMICS IN THE SOUTHERN BITTERROOT VALLEY	W. Hansen & L. Bate - REPRODUCTIVE BIOLOGY OF BREEDING HARLEQUIN DUCKS IN GLACIER NATIONAL PARK
3:00 PM	**M. Ebinger - ESTIMATING GRIZZLY BEAR USE OF LARGE UNGULATE CARCASSES WITH GPS TELEMETRY DATA	
3:20 PM	A. Mulder - WESTERN MONTANAN RANCHER'S, HUNTER'S, AND TRAPPER'S WOLF TOLERANCE IN LIGHT OF PUBLIC HUNTING AND TRAPPING	M. O'Reilly - MONTANA PRAIRIE POTHOLE JOINT VENTURE BREEDING SHOREBIRD PROJECT
3:40 PM	K. Podruzny - PREDICTING ABUNDANCE OF GRAY WOLVES IN MONTANA USING HUNTER OBSERVATIONS AND FIELD MONITORING	M. Schertz - WESTERN PAINTED TURTLE DISTRIBUTION AT MPG RANCH
4:00 PM	L. Bate - GLACIER NATIONAL PARK BAT INVENTORY AND MONITORING PROJECT	**E. Kenison - INVESTIGATING COEXISTENCE BETWEEN TROUT AND LONG-TOED SALAMANDERS AND THE INDIRECT EFFECTS OF FISH PREDATORS
4:20 PM	B. Maxell - MONTANA'S BAT AND WHITE-NOSE SYNDROME SURVEILLANCE EFFORTS	OPEN
4:00–6:00 PM : Poster Session **Thursday Evening: Silent Auction & Awards Banquet**		

Friday, March 7, 2014	SESSION 1 MSU ROOMS (Amy Macloed)	SESSION 2 JEFFERSON ROOM (JoAnn Dullum)
9:00 AM	K. Boyd & R. Hojem - GRIZZLY BEAR ABUNDANCE AND DENSITY IN THE CABINET-YAAK ECOSYSTEM	B. Maxell - MONTANA'S MAPVIEWER WEB APPLICATION: DIRECT ACCESS TO 1.4 MILLION ANIMAL OBSERVATIONS, WETLAND AND LAND COVER MAPPING, LAND MANAGEMENT, AND GEOREFERENCED PHOTOS
9:20 AM		B. Brock - NEW GIS TOOLS FOR IMPLEMENTING BROAD-SCALE WILDLIFE CONNECTIVITY MODELS IN LAND USE PLANNING AND MANAGEMENT
9:40 AM	T. Graves - COUNTING BEARS, P'S AND Q'S: AN EFFICIENT SAMPLE DESIGN FOR A SPATIAL CAPTURE RECAPTURE HAIR SNAG STUDY OF GRIZZLY BEARS	J. Carlson & M. Comer - BLM PLANNING AND IMPLEMENTATION: SUCCESSES, CHALLENGES AND OPPORTUNITIES
10:00 AM	J. Waller - DECADAL GROWTH OF TRAFFIC VOLUMES ON US HIGHWAY 2 AND IMPLICATIONS FOR GRIZZLY BEAR HABITAT CONNECTIVITY	
10:20 AM	J. Waller - DENSITY AND ABUNDANCE OF WOLVERINES IN GLACIER NATIONAL PARK, MONTANA, USA	V. Edwards & M. Valliant - MULTIPLE USE ON MOUNT JUMBO IN MISSOULA, MT—BALANCING WILDLIFE RESOURCE VALUES, PUBLIC RECREATIONAL OPPORTUNITIES, AND LAND MANAGEMENT
10:40 AM	R. Inman - DEVELOPING PRIORITIES FOR METAPOPULATION CONSERVATION AT THE LANDSCAPE SCALE: WOLVERINES IN THE WESTERN UNITED STATES	
11:00 AM	**BREAK (Bob Inman)**	**BREAK (Megan O'Reilly)**
11:20 AM	K. Proffitt & J. Kolbe - APPLYING NEW RESEARCH METHODS TO INFORM MOUNTAIN LION HARVEST MANAGEMENT IN WESTERN MONTANA	K. Stone - RAPTOR USE OF WATER SOURCES AS DOCUMENTED VIA A REMOTE CAMERA NETWORK
11:40 AM		A. Shreading - SATELLITE TELEMETRY PROVIDES INSIGHT INTO WHERE WESTERN MONTANA OSPREY SPEND THE WINTER
12:00 PM	M. Barnes - LIVESTOCK MANAGEMENT FOR COEXISTENCE WITH LARGE CARNIVORES, HEALTHY LAND AND PRODUCTIVE RANCHES: A VIEWPOINT	K. Stone - USING CITIZEN SCIENTISTS TO MONITOR BALD EAGLE AND OSPREY NESTS IN WESTERN MONTANA

Poster Presentations

****Indicates student presenter to be judged**

Thursday, March 6, 4:00-6:00 PM
J. Bailey - THE FUTURE OF AMERICAN BISON: DOMESTICATED OR WILD?
M. Bowser - MONITORING HUCKLEBERRY IN NORTHWEST MONTANA TO INVESTIGATE RESPONSE TO VEGETATIVE TREATMENTS
**C. de Caussin - BEAVER IN THE UPPER MADISON BEAVER MANAGEMENT AREA OUTSIDE OF WEST YELLOWSTONE, MONTANA
**M. Dresser - MODELING DAILY NEST SURVIVAL OF FIVE WOODPECKER SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC NEAR HELENA, MT
C. Hammond - STATUS UPDATE FOR COMMON LOONS IN MONTANA AND IMPLICATIONS FOR RESTORING LOONS TO THEIR FORMER BREEDING RANGE
**R. Hinderer - UNDERSTANDING MOVEMENT PATTERNS OF CHIRICAHUA LEOPARD FROGS (LITHOBATES CHIRICAHUENSIS) TO PROMOTE SPECIES PERSISTENCE IN DESERT ECOSYSTEMS
**A. Kehoe - LANDSCAPE HETEROGENEITY AT WHITE-HEADED WOODPECKER NEST SITES IN WEST-CENTRAL IDAHO
D. Leick - ACOUSTIC MONITORING OF NOCTURNAL MIGRANTS IN THE BITTERROOT VALLEY, MONTANA (POSTER)
B. Maxell - MONTANA'S BAT AND WHITE-NOSE SYNDROME SURVEILLANCE EFFORTS
B. Maxell - MONTANA'S MAPVIEWER WEB APPLICATION
J. Smith - SOD-BUSTING AND SAGE-GROUSE: ESTIMATING HISTORICAL IMPACTS AND PLANNING FOR THE FUTURE

Abstracts

ALPHABETICAL BY PRESENTER'S LAST NAME
*** indicates presenter**
**** indicates student presentation/poster**

BRUCELLOSIS IN MONTANA ELK: FACTORS THAT INFLUENCE DISEASE PREVALENCE, AND THE SOCIAL AND POLITICAL INFLUENCES AND ISSUES ASSOCIATED WITH MANAGING A DISEASE OF CONCERN FOR LIVESTOCK IN A FREE-RANGING ELK POPULATION.

Neil Anderson*, Montana Fish, Wildlife and Parks, Bozeman
Quentin Kujala*, Montana Fish, Wildlife and Parks, Helena
Kelly Proffitt, Montana Fish, Wildlife and Parks, Bozeman
Julee Shamhart, Montana Fish, Wildlife and Parks, Bozeman
Paul Lukacs, Ecosystem and Conservation Sciences, University of Montana, Missoula
Margaret Riordan, Montana Cooperative Wildlife Unit, University of Montana, Missoula
Justin Gude, Montana Fish, Wildlife and Parks, Helena

Brucellosis is a bacterial disease that affects elk, bison and domestic cattle. Transmitted primarily through contact with birth tissues, the disease is a significant livestock disease resulting in significant costs to producers and is a U. S. Department of Agriculture eradication program disease. Brucellosis was first documented in wildlife in the Greater Yellowstone Area (GYA) in the early 1900's and was brought into the region by livestock producers. The disease has since been eradicated in livestock, but persists in elk and bison populations of the GYA. Recently the seroprevalence of brucellosis in free-ranging elk populations of Montana has increased and its range has likely expanded resulting in increased pressure on Montana Fish, Wildlife and Parks (MFWP) to manage the disease in elk. We evaluated factors that potentially influence elk aggregation behaviors and the consequences of these factors on seroprevalence. We used a Bayesian spatial model to estimate seroprevalence across the designated surveillance area. This research approach allowed seroprevalence to be estimated for the first time in areas with limited surveillance data. The socio-political influences associated with managing wildlife potentially infected with a disease that threatens the cattle industry of Montana, the available tools for managing the disease in elk, and MFWP's current strategy for managing brucellosis in one of Montana greatest public trusts is discussed.

****INDIRECT EFFECTS OF NONNATIVE BROME GRASSES ON SMALL MAMMALS IN SAGEBRUSH STEPPE ECOSYSTEMS**

Dan A. Bachen*, Department of Ecology, Montana State University, Bozeman
Andrea R. Litt, Department of Ecology, Montana State University, Bozeman
Claire Gower, Montana Fish, Wildlife and Parks, Bozeman
Megan Higgs, Department of Mathematical Sciences, Montana State University, Bozeman

Nonnative plants can affect habitat quality for native animals directly, by altering available resources like cover or food, and indirectly, by changing access to these resources and altering species interactions. Understanding these diverse effects is crucial to develop management techniques and maintain ecosystem processes. In sagebrush steppe, brome grasses such as cheatgrass (*Bromus tectorum*) and smooth brome (*Bromus inermis*) can invade and form dense stands, increasing the depth and persistence of litter, as well as the density of standing vegetation. These structural changes alter abundance and composition of the small mammal community. We used a series of experiments to explore whether changes in vegetation structure associated with the invasion of brome grasses would alter foraging and predation risk for small mammals. In the first experiment, we placed a known amount of grain at stations with increased litter or stem density and measured how much grain was removed overnight. Increased litter impeded foraging; rodents removed 2.8

g (95% CI = 2.09 to 3.05) less grain from these stations. In the second experiment, we timed animals fleeing a simulated predator through various densities of litter or stems and found that dense stems impeded movement more than litter. Based on these experiments, dense monocultures of brome grasses may reduce habitat quality for small mammals by making foraging less efficient and increasing vulnerability to predators. Management techniques for brome grasses should focus on reducing stem density where predation limits small mammal populations and litter where small mammals are food-limited.

THE FUTURE OF AMERICAN BISON: DOMESTICATED OR WILD? (ORAL PRESENTATION & POSTER)

James A. Bailey, Wildlife Biologist Retired, Belgrade, MT

I proceed from 3 assumptions: (1) Natural selection is necessary to maintain wild bison. (2) We don't leave bison to future generations; we leave the bison genome. (3) Wildness is the opposite, in a continuum, from domestication. South of Canada, more than 200,000 bison are being domesticated in about 4500 private, commercial herds. In contrast, there are about 44 conservation herds owned by government agencies, the Nature Conservancy and American Prairie Reserve. In these conservation herds, natural selection is weakened or replaced by synergistic actions of (1) cattle-gene introgression; (2) founder effects; (3) inbreeding; (4) genetic drift; and (5) artificial selection. I review the prevalence of 12 management practices diminishing natural selection in these conservation herds, and promote a broader understanding and appreciation of the needs and values of wildness in American bison.

LIVESTOCK MANAGEMENT FOR COEXISTENCE WITH LARGE CARNIVORES, HEALTHY LAND AND PRODUCTIVE RANCHES: A VIEWPOINT

Matt Barnes, Rangeland Stewardship Program, Keystone Conservation, Bozeman, MT

The livestock – large carnivore coexistence field can be more effective by expanding from a direct focus on carnivores and predation-prevention tools to the context of livestock management and the broader social-ecological systems of ranches and rural communities. Ranchers may be able to apply many of the same approaches that work for rangeland health and livestock production to reduce conflicts with large carnivores. Generally, in the presence of their predators, wild grazing animals tend to form large, dense herds that then move around the landscape to seek fresh forage, avoid fouled areas, and escape predators. They also tend to have their young in short, synchronized birthing seasons (predator satiation). Grazing management involving high stocking density and frequent movement, such as rotational grazing and herding with low-stress livestock handling, can improve rangeland health and livestock production, by managing the distribution of grazing across time, space, and plant species. Short calving seasons can increase livestock production and reduce labor inputs, especially when timed to coincide with peak availability of forage quality. Livestock management, including grazing management and calving in short seasons that correspond with those of wild ungulates, may directly and synergistically reduce predation risk, while simultaneously establishing a management context in which other predation-prevention practices and tools can be used more effectively. Pilot projects on summer cattle range in western Montana involving increased stocking density through intensification of existing grazing rotations with herding suggest methods that can be used to improve grazing distribution and prevent depredations.

BLACK SWIFTS IN MONTANA: FINDING NEW NESTING SITES AND WHAT'S NEXT FOR THIS ELUSIVE BIRD

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Until a few years ago, Black Swifts (*Cypseloides niger*) were only known to nest at three sites in Montana. With concerted efforts over the last few years by Montana Fish Wildlife and Parks, Glacier National Park, and intrepid volunteers, we have now added to our known nesting sites in

Montana. Black Swifts nest behind waterfalls, often in remote and challenging terrain. Through these recent efforts, we have learned how best to successfully identify possible nesting sites, increasing our understanding of where this rarest of birds breeds in Montana. Black Swifts are a Montana Species of Concern because of their small population size, restricted breeding range, lack of monitoring, and threats from a changing climate. We explore these issues and share plans for a collaborative research and outreach effort for 2014 and beyond. We also examine how Montana's findings fit into a broader, regional effort to better understand and conserve this species.

GLACIER NATIONAL PARK BAT INVENTORY AND MONITORING PROJECT

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Prior to 2011, no formal bat surveys had been conducted in Glacier National Park (GNP). Given concerns about high bat mortalities due to the continual spread of white-nose syndrome (WNS) and placement of wind energy facilities, it was critical to learn about GNP's bat diversity, abundance, and distributions before these risks could potentially impact our populations. Of the 11 potential species in GNP, six are Montana (or potential) species of concern. Three years of surveys have now been completed. Survey techniques included mist-netting, acoustic surveys, bridge, building, and cave inspections. To date, we have mist-netted bats over 44 nights in 24 sample units (grid cells-each unit 10 km^2) in GNP, processing a total of 700 individuals. Results indicate no sign of WNS. In addition, we conducted nighttime acoustic surveys at 97 different locations within 31 grid cells. Thus far, we have confirmed nine different bat species throughout the park and added three new bat species to the mammals list for GNP. Acoustic surveys have also confirmed the presence of hibernating bats in the winter. The two most commonly captured bats were the little brown myotis (*Myotis lucifugus*) and the hoary bat (*Lasiurus cinereus*). GNP may be one of the most substantial migratory routes for hoary bats across North America. Plans include continuing with the inventory phase by surveying additional grid cells using both acoustic and visual techniques, and focusing on long-term monitoring using acoustic sampling and systematic and repeatable counts of little brown bat maternity roosts.

KOOTENAI RIVER OPERATIONAL LOSS ASSESSMENT METHODOLOGY AND ITS APPLICATION TO HABITAT RESTORATION

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Libby dam regulates in-stream flow of the Kootenai River through Montana, Idaho, and into Canada. The floodplain and associated biotic communities are strongly influenced by riverine system alterations. In order to assist with habitat restoration work, an assessment tool was developed that defines ecologically functional impacts to the Kootenai River floodplain and its vegetative, aquatic, and wildlife communities. This assessment tool includes; hydrologic models for historic flows, anthropomorphic floodplain alterations, post-dam flows, and sturgeon flow releases; an Index of Biological Integrity for insect and avian communities; vegetative cover estimates within sample plots; and an index of human disturbance. In addition, summary indices of ecological integrity were compiled. This assessment tool is being used to identify areas on the Kootenai River for habitat restoration and/or protection. Some of the tool's uses and implications are identified.

MONITORING HUCKLEBERRY IN NORTHWEST MONTANA TO INVESTIGATE RESPONSE TO VEGETATIVE TREATMENTS (POSTER)

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The remote and ecologically rich forests of northwest Montana are home to an endangered population of grizzly bears. Within the Cabinet/Yaak ecosystem, recent research suggests an average population estimate of 45 bears. While grizzly bear core-areas and security requirements have been identified in the Cabinet/Yaak ecosystem, figuring out how to best manage the lush vegetation that provides foraging opportunities within that defined habitat has yet to occur. Large portions of this designated habitat are in need of ecological restoration. Since a high percentage of the Cabinet/Yaak grizzly bear's diet is supplied through berries, grasses, and forbs, it is crucial to develop the knowledge today that can transform portions of the forest back into the edible landscapes that were once historically abundant. Because huckleberries (Vaccinium spp.) comprise a substantial amount of the annual diet volume for Cabinet/Yaak grizzly bears, land managers are beginning to design projects with the intention of increasing the amount of huckleberry foraging opportunities on the forest. Strong anecdotal evidence suggests that huckleberry prefers minimal overstory, yet few studies have been undertaken that document the plant's response to management. Addressed is a partnership that has formed between the Yaak Valley Forest Council, US Forest Service, and the US Fish Wildlife Service in order to monitor and document the effects the vegetative treatments have on huckleberry abundance.

GRIZZLY BEAR ABUNDANCE AND DENSITY IN THE CABINET-YAAK ECOSYSTEM

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Cabinet-Yaak Grizzly Bear DNA Project Study Team[1]

We use genetic detection data from concurrent hair corral and bear rub sampling to provide abundance and density estimates for the threatened grizzly bear (*Ursus arctos*) populations in the Cabinet Mountain and Yaak regions in northwestern Montana and northern Idaho collectively known as the Cabinet-Yaak Ecosystem (CYE). We used Huggins models in Program MARK and model averaging to generate region- and sex-specific abundance estimates. To estimate the average number of bears present, we estimated mean bear residency on our sampling grid from telemetry data and used it to correct our super population estimates for lack of geographic closure. Total grizzly bear abundance in the CYE in 2012 was 49 (95% CI: 44-62) with an average of 45 (95% CI: 42-65) present at any one time. Population size in the Cabinet and Yaak regions was equal: Cabinet: 22 (95% CI: 20-36); Yaak: 22 (95% CI: 22-39). Grizzly bear density in the CYE was 4.5 (95% CI: 3.7-5.3) grizzly bears/1,000 km^2. With parentage analysis, we document the first natural migrants to the critically low and interbred Cabinet population and the Yaak population by bears born to parents in neighboring populations. These events support data from other sources suggesting that the expansion of neighboring populations may eventually help sustain the CYE populations.

[1] The Cabinet-Yaak Grizzly Bear DNA Project Study Team provides interagency oversight to this study and facilitates communication among project partners. Members are: K. Kendall-Leader (US Geological Survey (USGS)), L. Allen (US Forest Service (USFS)-Idaho Panhandle NF), K. Annis (MT Fish, Wildlife, and Parks (MFWP)), R. Baty (MT Dept. Natural Resource Conservation), Q. Carver (USFS-Kootenai NF), D. Dinning (Boundary County Commission, ID), R. Downey (Lincoln County Commission, MT), **R. Hojem*** (USFS-Lolo NF), W. Kasworm (US Fish and Wildlife Service), R. Mace (MFWP), N. Merz (Kootenai Tribe of Idaho), M. Mitchell (USGS), L. Postulka (US Customs and Border Protection (USCBP)), M. Proctor (Birchdale Ecological), D. Roll (Libby, MT), W. Wakkinen (ID Fish and Game), B Woelfel (USCBP).

NEW GIS TOOLS FOR IMPLEMENTING BROAD-SCALE WILDLIFE CONNECTIVITY MODELS IN LAND USE PLANNING AND MANAGEMENT

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Wildlife habitat connectivity at regional scales is necessary for the conservation of wide-ranging species and to provide opportunities for species to respond to a changing climate. Conservation planning and wildlife management must incorporate a broad-scale perspective to provide the best chance for long-term persistence of complete species assemblages. Much of the crucial linkage habitat in the U.S. Northern Rockies occurs on private lands at lower elevations. Therefore, land use decisions that ultimate influence broad-scale connectivity occur at fine (parcel level) scales. The ability to integrate broad-scale conservation planning that wildlife need with the scales where decisions are made has been difficult. New GIS tools provide advances in multi-scale conservation planning. These tools assist decision makers in identifying opportunities, setting priorities, and targeting actions at very fine scales but within the context of regional planning. These tools also facilitate scenario analysis to allow practitioners to as "what if" questions and help them understand potential outcomes of proposed actions.

HABITAT CHARACTERISTICS OF A SOUTHERN FRINGE GREATER SAGE-GROUSE POPULATION: IMPLICATIONS FOR RANGE-WIDE MANAGEMENT

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Range-wide declines in Greater Sage-Grouse (*Centrocercus urophasianus*) populations have prompted extensive research on sage-grouse habitat use. However, habitat use information for fringe populations is limited. We examined nest, brood-rearing, and summer habitat use in a fringe sage-grouse population in southern Utah. We tracked 66 birds (17 females, 49 males) via VHF telemetry and surveyed vegetation plots at nest (n = 9), brood-rearing (n = 13), summer (n = 53), and random (n = 75) locations in 2011 and 2012. Although hens did not select for measured habitat characteristics (shrub, forb, grass, and bare ground) at nest sites, they did select for higher forb cover at brood-rearing sites as compared with random sites. The canopy cover of forbs and grasses at nest and brood-rearing sites was lower than range-wide habitat recommendations, while the shrub cover was greater. Non-reproductive sage-grouse selected for lower shrub but higher forb and grass cover as compared with random sites. Their roost sites were characterized by higher shrub and lower forb and grass cover than range-wide recommendations for productive habitat. Discrepancies between sage-grouse habitat use in this population and range-wide recommendations may be explained by differing ecosystem dynamics in southern Utah, as well as unique habitat use patterns observed in fringe populations. The use of agricultural fields for summer habitat exemplifies a local adaptation to the absence of productive habitat that has unique management implications. This study highlights the importance of adaptive management techniques that address unique habitat preferences in local populations, particularly for a sensitive species.

****CORRELATES OF RECRUITMENT IN MONTANA BIGHORN SHEEP POPULATIONS**

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Relatively little is known about bighorn sheep population dynamics across Montana. In an effort to improve understanding of bighorn recruitment, we summarized demographic data collected by Montana

Fish, Wildlife and Parks for 48 bighorn populations in five ecological regions (eco-regions) across Montana. For 22 bighorn populations, data were adequate for use in multiple linear regression estimation of baseline recruitment rates (indexed by lamb:ewe ratios) and to evaluate relationships between recruitment rates and annual variation in weather conditions and all-age disease die-off events. After accounting for all-age disease die-off events, recruitment rates of populations in three eco-regions were very similar, one had lower recruitment rates than all others in the state, and one had recruitment rates that were not comparable to others due to timing of data collection. There was substantial variation in baseline recruitment rates of populations within eco-regions. After all-age disease die-off events, recruitment rates were typically severely reduced for multiple years. Recruitment rates of individual populations were related to the average number of animals counted in a population, with small populations having lower baseline recruitment rates than those for larger populations. We failed to detect consistent correlations between recruitment and annual weather conditions across populations. We suspect that the small size of many bighorn populations in Montana limits biological insight that can be gained, as accurate demographic data are difficult to collect from small populations, and small populations can be strongly influenced by unpredictable, chance events.

U.S FOREST SERVICE AND MONTANA DEPARTMENT OF FISH WILDLIFE AND PARKS COLLABORATIVE OVERVIEW AND RECOMMENDATIONS FOR ELK HABITAT MANAGEMENT ON THE CUSTER, GALLATIN, HELENA, AND LEWIS AND CLARK NATIONAL FORESTS

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A group of wildlife biologists from the Forest Service (FS) and Montana Department Fish, Wildlife, and Parks (MDFWP) have compiled recommendations for elk habitat management. While we focus on elk habitat considerations in this effort, we do not advocate for single species management. We advocate for ecologically appropriate habitat management under an umbrella of landscape scale ecosystem management, which focuses on providing a range of habitats to support all fauna native to the landscape, including elk. The recommendations are based on the most current available information and the collective experiences of these biologists. They considered contemporary issues and circumstances such as increases in recreation of all types on these National Forests, changes in the numbers and distribution of elk, the restoration of large predators, the current mountain pine beetle epidemic, and small and large fires on the Custer, Helena, Lewis and Clark, and Gallatin National Forests in the Northern Region of the Forest Service. The shared goal of the two agencies is to provide for elk and other big game on National Forest System (NFS) lands throughout the year, recognizing that with the multiple use mandate of the Forest Service, management for elk will be one of many considerations on NFS lands. The overview and recommendations address an appropriate elk analysis unit, management of cover and recreation on winter ranges, security during the archery and rifle hunting seasons, motorized route management relative to habitat effectiveness, cover on spring-summer-fall ranges, cover patch size, and forage considerations.

BLM PLANNING AND IMPLEMENTATION: SUCCESSES, CHALLENGES AND OPPORTUNITIES

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This presentation discusses/illustrates the Bureau of Land Management (BLM) multiple use issue analysis and resolution at two different scales: the Resource Management Plan (RMP) policy scale and the

applied project scale. BLM RMPs will be discussed with specific examples of how RMPs guide future management decisions. Greater Sage Grouse will be used as a primary example. Seven RMPs in the Montana/Dakotas had drafts for RMP revisions or Greater Sage-Grouse RMP amendments in 2013. Guidance contained in the RMP establishes sideboards for project alternatives and what may be considered. The Crooked Creek Project in the Lewistown Field Office will be covered to illustrate how projects are planned within the framework of an RMP to achieve specific conditions on the ground and the tools, information, and experience used to develop these actions. Finally, examples of applied efforts to improve wildlife habitat across BLM lands in the Montana/Dakotas will be demonstrated.

MONTANA AUDUBON'S RIPARIAN BIRD RESEARCH AND CONSERVATION: WHAT'S NEW, WHAT'S NEXT?

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Audubon's Important Bird Area (IBA) program is a data-driven, science-based approach for on-the-ground conservation projects. We will describe how our current IBA program is working: how we collect bird data, use these data to map key riparian areas, connect with our partners and volunteers, work toward habitat protection and enhancement, and use our knowledge to affect policy. We report on recent data collection efforts on key species, including Lewis's Woodpeckers (*Melanerpes lewis*), Red-headed Woodpeckers (*Melanerpes erythrocephalus*), and Black-billed Cuckoos (*Coccyzus erythropthalmus*). We will also share various educational products and stories that resonate with those who care about birds, own and manage the land, and who advocate for wildlife conservation—from Best Management Practice brochures to multi-media films. Finally, we outline how we are prioritizing our IBA work and plans for the future.

INFLUENCE OF WHITEBARK PINE DECLINE ON FALL HABITAT USE AND MOVEMENTS OF GRIZZLY BEARS IN THE GREATER YELLOWSTONE ECOSYSTEM

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Seeds of whitebark pine (WBP; *Pinus albicaulis*) are a major food item for grizzly bears (*Ursus arctos*) in the greater Yellowstone ecosystem. Higher rates of bear mortality and bear-human conflicts are linked with low WBP productivity. Recently, infestations of mountain pine beetle (*Dendroctonus ponderosae*) have killed many mature, cone-bearing WBP trees. We investigated whether this decline caused bears to reduce their use of WBP and increase use of areas near humans. We used 52,332 GPS locations of 72 individuals (89 bear-years) monitored during fall (15 Aug–30 Sep) to examine temporal changes in habitat use and movements during 2000–2011. We calculated a Manley-Chesson (MC) index for selectivity of mapped WBP habitats for each individual within its 100% local convex hull home range, and determined dates of WBP use. One third of sampled grizzly bears had fall ranges with little or no mapped WBP habitat. Most other bears (72%) had a MC index above 0.5, indicating selection for WBP habitats. Over the study period, mean MC index decreased and median date of WBP use shifted about 1 week later. We detected no trends in movement indices over time. Outside of national parks, 78% of bears selected for secure habitat (areas ≥500 m from roads), but

mean MC index decreased over the study period during years of good WBP productivity. The foraging plasticity of grizzly bears likely allowed them to adjust to declining WBP. However, the reduction in mortality risk associated with use of WBP habitat may be diminishing for bears in multiple-use areas.

ANNUAL TIMING OF ELK ABORTIONS AND POTENTIAL BRUCELLOSIS RISK

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The transmission of *Brucella abortus*, the bacteria causing brucellosis, occurs through abortion events. In this study, we investigated the timing of those abortion events using vaginal implant transmitters (VITs) in pregnant elk from the Jackson and Pinedale regions of Wyoming. From 2006 to 2013, we captured 463 pregnant female elk and 136 of those were seropositive (29%, 95% CI = [25, 34]). We had a total of 29 abortion events with 20% (95%CI = [13, 29]) of seropositive elk aborting compared to 2.2% (95% CI =[0.8, 4.5]) of seronegative elk aborting. VIT data are left-truncated, right and interval censored. We analyzed these data in a Bayesian framework borrowing from the survival analysis literature to estimate the baseline hazard and how it changes during the year. When we conducted a joint analysis of both abortions and births our preliminary results indicated that elk abortions are concentrated in March and April. Only 3 abortions occurred after May 20th and one may have occurred as late as July 10th. These results are relevant to mitigating the risk of transmission between elk and cattle. Future work can build upon these results to assess the amount of brucellosis transmission risk during the winter on private land compared to public grazing allotments, which are used later in the year.

BIGHORN SHEEP TRANSLOCATION: TWO CASE STUDIES FROM THE GROUND

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Bighorn sheep translocation is a major tool towards meeting bighorn population recovery goals statewide. However, finding and establishing release sites requires navigating a complex series of biological, political, and social evaluations. Here, we present two case studies of bighorn sheep relocation proposals in southwestern Montana followed from the idea phase through (near) resolution: the Bridger Mountains and the Madison Mountains. Both historic bighorn winter ranges, these two proposed locations differed in their biological, political, and social considerations. We discuss the model and timeline we used to meet biological criteria (defined by Montana's Bighorn Sheep Conservation Strategy), political checks proposed in Montana's Senate Bill 83 (mandatory criteria for bighorn sheep transplantation), and the social needs of landowners, Montana's sportsmen and the Fish, Wildlife and Parks commission. This involved defining the proposed habitat (or affected area), contacting all landowners within or near the expected habitat, involving all stakeholders (county commissioners, sportsmen, Montana Woolgrowers, the U.S. Forest Service, and others), identifying domestic sheep herds nearby to quantify disease risk (and determining how to mitigate such risk if possible), assessing other major issues (highways, predators, subdivisions), developing the Environmental Assessment, employing landowner agreements, and finalizing the project. These case studies provide information to other biologists seeking to release bighorn in their areas. Recognition of non-biological needs and careful *a priori* evaluation can save time and effort and maximize the chance of biological success.

****BEAVER IN THE UPPER MADISON BEAVER MANAGEMENT AREA OUTSIDE OF WEST YELLOWSTONE, MONTANA (POSTER)**

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Through the late 1960s and early 1970s, trappers harvested most of the beaver in the Hebgen Lake watershed outside of West Yellowstone, Montana. In an attempt to bring back the beaver, Montana Fish, Wildlife, and Parks and the Forest Service established the Upper Madison Beaver Management Area (UMBMA) to regulate the number of the licenses made available to trappers. Both agencies wanted beaver on the landscape because of the important role beaver play in watershed ecology. By building dams, beavers raise water levels which improve wetland habitat for birds, fish, moose, and other animal species. My project included surveying one kilometer of good beaver habitat in the major drainages throughout the Hebgen lake watershed while looking for different beaver signs. These signs include recent beaver clippings in the willow, caches (piles of willow where beaver store there winter food supply), slides (folded down grass where beaver enter river), active lodges, and active dams. The objective of my paper was to evaluate the status of the beaver population by looking at the indices of presence to help FWP decide whether reintroductions and/or changes in the trapping season regulations are necessary.

****MODELING SUMMER HABITAT SELECTION OF SYMPATRIC BIGHORN SHEEP AND MOUNTAIN GOATS IN THE GREATER YELLOWSTONE AREA**

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With introduced mountain goat populations continuing to expand throughout the mountainous regions of the greater Yellowstone area (GYA), wildlife managers have expressed a need for reliable information to understand mountain goat ecology specific to this region as well as any potential impacts to native species and communities, especially to native and restored bighorn sheep populations. In response to this need for ecological knowledge, we developed and implemented rigorous occupancy survey methodologies in two study areas for three field seasons (2011-2013). A total of 611 surveys were performed over 550 observer-days, capturing spatially-precise locations of 128 bighorn sheep groups and 286 mountain goat groups. These data are being used to develop fine-scale summer habitat-selection models for both mountain goats and bighorn sheep that account for imperfect detection. This presentation reports on the accomplishments from the three field seasons, including what we have learned from preliminary analyses and the next steps to completing a full analysis of the data. Products from this research will provide insight into the potential for resource competition between bighorn sheep and mountain goats. The development of a mountain goat habitat-selection model will also allow prediction of range expansion of mountain goats into the extensive ranges of bighorn sheep in the eastern mountains of the GYA where small numbers of colonizing mountain goats have recently been observed.

****MODELING DAILY NEST SURVIVAL OF FIVE WOODPECKER SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC NEAR HELENA, MT (POSTER)**

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Forested ecosystems of Western North America have experienced increased periodicity and severity of disturbances in recent years. Large-scale mountain pine beetle (*Dendroctonus ponderosae*) epidemics affecting hundreds of thousands of forested hectares in the American and Canadian Rockies have been attributed to favorable climatic conditions. Ecosystem processes of these forested landscapes are potentially becoming altered. Wildlife responses, however, to beetle disturbance are not yet well understood. Because of their sensitivity to changes in forest conditions, as well as their ability to create valuable habitat for several other forest-dwelling species, our study focused on woodpeckers as disturbance specialists. Owing to differences among life history characteristics, we grouped 5 focal woodpecker species into 3 assemblages based on feeding and habitat requirements and predicted responses to beetle epidemic conditions. Based on *a priori* hypotheses, we modeled daily nest survival (DSR) of each assemblage as a function of several temporal and spatial covariates, including remotely sensed data, abiotic factors, and beetle epidemic conditions at two spatial scales. To rank the support for each candidate model, we used Akaike's Information Criterion corrected for small sample size (AICc) and used the principle of parsimony to arrive at a final inferential model. Results suggest that abiotic weather and local habitat features were important to include in models of DSR, whereas a number of other covariates containing information about the timing and nature of the beetle epidemic were not useful. Our results will inform management activities for post-beetle forests that will help maintain habitat of disturbance specialist species.

****COMPENSATORY MORTALITY IN A MULTIPLE CARNIVORE SYSTEM: CONSEQUENCES FOR ELK CALF SURVIVAL AND ELK POPULATION DYNAMICS IN THE SOUTHERN BITTERROOT VALLEY**

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The recent expansion of large carnivores in North America may dramatically alter the population dynamics of their primary ungulate prey species. In response to declining elk calf recruitment in the southern Bitterroot Valley of Montana, we initiated a 3-year study to determine the relative importance of top-down and bottom-up processes in explaining elk recruitment rates. We predicted that forage quality would interact with predation risk across the landscape, causing predation on elk calves to become more compensatory in areas of higher forage quality. Continuous-time survival modeling will be used to estimate the relative importance of bottom-up and top-down processes in explaining calf survival, and test the interaction of predation risk and forage quality. Overall, male elk calves have a 62.7% higher risk of mortality than females, and annual survival rates have significantly varied among years, with estimates of 0.27 in 2011, 0.42 in 2012, and 0.55 thus far in 2013. Mountain lions are the most important mortality source for elk calves, with cause-specific mortality rates of 0.17 for lions; 0.04 for black bears; 0.03 for wolves; 0.08 for unknown predators; 0.10 for unknown; 0.04 for natural, non-predation; and 0.008 for human-related events. The calf survival data, together with adult survival, nutrition, and carnivore population data, will be used to develop an integrated population model to forecast the effect of habitat and carnivore densities on elk population trends. This tool may help managers balance carnivore and ungulate population objectives and is applicable across all areas experiencing carnivore recovery.

****ESTIMATING GRIZZLY BEAR USE OF LARGE UNGULATE CARCASSES WITH GPS TELEMETRY DATA**

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Ungulate meat is among the most calorie-rich food sources available to grizzly bears (*Ursus arctos*) in the greater Yellowstone ecosystem (GYE). However, the ephemeral and unpredictable nature of carcasses makes them difficult to study and their influence on grizzly bear foraging and spatial ecology is poorly understood. We developed a spatial-clustering technique specifically for detecting grizzly bear use of large ungulate carcasses using Global Positioning System (GPS) telemetry locations (n = 54 bear years). We used the DBScan algorithm to identify GPS clusters of individual bears (n = 2,038) and intersected these clusters with an independent dataset of site visits to recent bear movement paths based from randomly selected days (n = 732 site visits; 2004–2011) resulting in 174 clusters associated with field measured bear behavior. Using a suite of predictor variables derived from GPS telemetry locations (e.g., duration of cluster, area used, activity sensor values, re-visitation rate), we used multinomial logistic regression to predict the probability of belonging to each of the 5 response classes (resting, multiple-use, low-biomass carcass, high-biomass carcass, old carcass). Focusing on the high-biomass carcass category, for which our top model correctly classified 88% of the carcasses correctly, we applied our approach to a larger dataset of GPS data to examine trends in large-ungulate carcass using of grizzly bears in the GYE from 2002-2011. We found quantitative support for a positive effect of year and mortality adjusted white bark pine cone counts on the carcass-use index during the fall months (September and October) from 2002-2011.

MULTIPLE USE ON MOUNT JUMBO IN MISSOULA, MT—BALANCING WILDLIFE RESOURCE VALUES, PUBLIC RECREATIONAL OPPORTUNITIES, AND LAND MANAGEMENT

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Between 1996 and 1998, the City of Missoula, Montana Fish, Wildlife and Parks (MFWP), and the U.S. Forest Service acquired 1,650 acres on Mount Jumbo in the northern Missoula Valley to protect winter range for elk and other wildlife, to preserve the viewshed and its associated habitats, and to provide public recreational access and opportunities. Multi-governmental management of the mountain has included establishing a public lands advisory committee, implementing a conservation lands management plan, establishing a bighorn sheep/domestic sheep interaction policy, and instituting a seasonal public closure and educational program to protect wintering ungulates. Over time, the need and political pressures to manage forested habitats on these lands in the wildland-urban interface have pushed land management and conservation efforts to the next level, especially on the City's conservation lands. To ensure that additional forest management treatments do not negatively affect the Jumbo elk herd and other wildlife, the City of Missoula and MFWP personnel have increased elk survey and inventory efforts on the mountain and incorporated a citizen scientist-based program to not only gather important management data, but also to expand public involvement, awareness and education of the overall resource values of the area. This presentation will include discussions on the cooperative management strategies implemented to conserve the wildlife resources of Mount Jumbo, while balancing public recreational opportunities and forest and other habitat management prescriptions.

RELATING CLIMATE DATA TO WHITEBARK PINE CONE PRODUCTION IN SOUTH-CENTRAL MONTANA

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Whitebark Pine is a critical species for Grizzly and Black Bears in the Greater Yellowstone Area. Being able to predict the number of cones that will be produced in a year or two would help with the management of these species. There is a strong correlation between cone production and Black Bear harvest. Climatic variables from SNOTEL stations can provide an insight into cone production. If there are not enough growing degree days to start fall cones, there will be no cones produced in year three. Critical parameters that reduce cone production include poor soil moisture during year two and three and number of days with rain during pollination in year two. Cold spring temperatures can also reduce cone production. Within Whitebark Pine transects, individual trees may produce a different number of cones. These can be related to tree age and/or increased moisture from upslope areas. Cone production from ten Whitebark Pine transects in the Rock Creek-Stillwater-Boulder area of south central Montana observed by Montana Department of Fish, Wildlife and Parks has been compared to climatic data from three NRCS SNOTEL stations in the vicinity. The effects of various parameters on cone production and results of estimating the cone crop will be presented.

AFTER 70 YEARS OF DATA: WHAT DO WE KNOW AND WHAT DO WE THINK WE KNOW ABOUT ELK HABITAT AND VEGETATION IN THE GALLATIN CANYON?

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Many agency biologists use wildlife exclosures to draw inferences about wildlife habitat relative to herbivore population densities and the effect of soil and vegetation manipulation on plant community recovery. When herbivore density is high, vegetative suppression is expected, and even erosion and soil loss may be suggested. As herbivore populations decrease, cascading trophic effects on trees, shrubs, and grasses may be hypothesized. In a case study using nearly 100 years of elk data and 70 years of vegetation data from wildlife exclosures in the Gallatin Canyon, we present qualitative and quantitative assessments of a series of hypotheses about elk relationships to the landscape. When elk numbers were high, U.S. Forest Service and Montana Fish, Wildlife & Parks performed experimental vegetative treatments to improve range conditions: red fescue seeding, planting caragena, contour plowing to limit soil loss, sagebrush removal, and testing snow fences to trap snow to retain moisture. Several exclosures were equipped with soil traps to monitor soil erosion, hypothesized to come from range overuse by elk. After the 1990's, multiple landscape-level changes, including wolf reintroduction, resulted in substantial elk population declines. Wintering elk numbers decreased from a long-term average of 1,600 to fewer than 500. Given elk numbers declined by 2/3, biologists hypothesized a trophic cascade would release to later vegetation series or climax communities. We examine the results of the early habitat manipulations and discuss their implications. We describe how several of the hypotheses were not borne out in the data when examining the entire ecological picture.

MONTANA'S NEW STATE-WIDE BIGHORN SHEEP RESEARCH INITIATIVE

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Bighorn sheep conservation and management in Montana has been, and continues to be, a challenge. The majority of Montana's bighorn sheep populations are patchily distributed across the state and are relatively small, with many populations static or periodically experiencing dramatic declines despite the fact that adequate habitat seems to be abundant. Wildlife managers and biologists are routinely making decisions on bighorn sheep population augmentation and restoration, harvest, habitat management, disease prevention and response, and other conservation actions without adequate knowledge of the drivers of demographic processes that inform management of many of Montana's more successfully restored ungulate species. Field studies of bighorn sheep in Montana have been limited primarily to short-term, master's thesis projects focused on a specific herd. A 6-year research program has been designed and funded on the premise that research insights that are broadly applicable for management and conservation are best obtained by addressing the same questions in multiple populations representing differing demographic characteristics, ecological settings, and management histories that capture the range of variation realized by the species of interest. The research program will involve field studies of seven bighorn sheep herds in Montana, with data on each herd collected over a 5-year period. Herds were selected to capture a wide range of variability in disease outbreak history, habitat types, and herd attributes in an effort to maximize our ability to partition and quantify the potential relative effects of these factors on lamb and adult survival, recruitment, and population dynamics.

COUNTING BEARS, P'S AND Q'S: AN EFFICIENT SAMPLE DESIGN FOR A SPATIAL CAPTURE RECAPTURE HAIR SNAG STUDY OF GRIZZLY BEARS

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Accurate assessment of abundance can be expensive and managers often seek to minimize costs. Because spatial capture recapture (SCR) methods explicitly account for variation in trap effort in space and time and permit the use of covariates to explain abundance, substantial flexibility in design and thus reduction in costs may be possible. Estimates of grizzly bear densities and abundances in 4 management units in Alberta were very low (superpopulation N = 47-133) in the latest studies occurring from 2004-2008. Since these first provincial population estimates were obtained, management, landscape, and habitat conditions have changed. Managers would like updated abundance information but also seek to reduce the costs of acquiring these data. We assessed 1) the behavior of SCR models across several general sample designs and 2) whether we could eliminate sampling in helicopter-access-only areas in the Yellowhead management unit while maintaining accurate estimates. We used a combination of retrospective subsampling of existing data from a 2004 sampling effort and simulations to evaluate several designs. Placing sampling arrays in areas with high densities of bears decreased variance, while the fine-scale configuration of traps did not greatly influence estimates. Simulations of designs for Alberta with more intensive sampling of only the areas accessible by road and no sampling of more expensive helicopter-access-only areas provided robust estimates with little loss in precision. We will describe the framework and assumptions of SCR models with covariates for abundance in comparison with traditional capture recapture models.

STATUS UPDATE FOR COMMON LOONS IN MONTANA AND IMPLICATIONS FOR RESTORING LOONS TO THEIR FORMER BREEDING RANGE (POSTER)

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The majority of the western United States' breeding Common Loons (*Gavia immer*) breed on lakes located in northwestern Montana (72 pairs, 68.6%) with Washington, Wyoming, and Idaho having only 17 (16.2%), 14 (13.3%) and 2 (2.0%) territorial pairs, respectively. Recently, there have been enough continuous years of sustainable chick production in Montana (ranging between 0.66 and 0.70 chicks fledged per territorial pair) that an increase in territorial pairs is expected. Territorial pair numbers, however, have increased only slightly. Another possibility, despite loons being poor dispersers with strong breeding site fidelity, is that loons have colonized lakes south of their known breeding locations (and north of Wyoming's breeding population). To address this possibility, in 2013, the Biodiversity Research Institute (BRI) surveyed 28 suitable lakes in southwestern Montana. No loon pairs were found on any of these lakes, suggesting loons have not expanded their range. Therefore, Montana Department of Fish, Wildlife and Parks, the Montana Common Loon Working Group, the Ricketts Conservation Foundation, and BRI are working cooperatively to investigate reasons for this finding. BRI has initiated a large-scale conservation study for the Common Loon across North America, with MT, WY, ID, and WA as a focus area. Together, these organizations hope to: further investigate these questions in the western US, to create solutions that strengthen current populations, and to one day restore loons to their former breeding range.

REPRODUCTIVE BIOLOGY OF BREEDING HARLEQUIN DUCKS IN GLACIER NATIONAL PARK

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Glacier National Park and The University of Montana partnered up in 2011-2013 to study the reproductive biology of Harlequin Ducks (*Histrionicus histrionicus*) breeding on Upper McDonald Creek (UMC) in Glacier National Park. The Harlequin Duck exhibits unusual migratory patterns compared to other ducks, moving east to west, rather than north to south; these birds winter along North America's Pacific coast, then move inland to breed on alpine streams. The objectives of this study were to understand the environmental, physiological, and anthropogenic influences on reproduction. During the course of this study, 138 Harlequin Ducks were trapped and banded. We also attached radio transmitters to breeding females (n = 43) to enable daily tracking, behavioral observations, and nest discovery. Over the course of the study our team discovered 11 nests, tracked two broods, and located four females on their wintering grounds. With the use of radio telemetry, we documented novel habitat use and nesting habitat. Human presence along UMC is widespread. We used occupancy and presence/absence techniques to analyze these influences. To validate assumptions of stream flow on reproductive success, we used a 23 year data set collected by park personnel and citizen scientists to confirm these assumptions. We found a strong relationship between unpredictable stream flow and reduced reproductive success. To further understand reproductive dynamics, we measured corticosterone concentrations in feathers, which significantly predicted reproductive decision. We address the management implications from this study for future Harlequin Duck conservation.

TRENDS IN CAUSES AND DISTRIBUTION, AND EFFECTS OF WHITEBARK PINE DECLINE ON GRIZZLY BEAR MORTALITY IN THE GREATER YELLOWSTONE ECOSYSTEM

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Documented grizzly bear (*Ursus arctos*) mortalities have been increasing in recent years in the Greater Yellowstone Ecosystem (GYE), due, in part, to increases in bear numbers and range expansion. Previous research has documented that variable seed production of whitebark pine (WBP; *Pinus albicaulis*), an important fall food, is inversely related to grizzly bear fall mortality. However, WBP has experienced widespread mortality during the last decade because of mountain pine beetle (*Dendroctonus ponderosae*) infestations. We investigated trends in causes and distribution of human-caused mortalities for independent-aged (≥2 years old) grizzly bears in the GYE during 1975–2012, and the effect of WBP cone production on numbers of fall (> 1 August) mortalities (n = 172) during the period of WBP decline (2000-2012) using Poisson regression. During 1975–1982, 91% of mortalities occurred within the Grizzly Bear Recovery Zone and primary causes were poaching/malicious killings and losses related to conflicts with livestock. During the 2 most recent decades most mortalities were associated with ungulate hunting, usually involving self-defense kills, or anthropogenic sites, and an increasing percentage of mortalities occurred outside the recovery zone. Using predictor variables of cone production, sex, location in or out of the Recovery Zone, and year suggests: 1) annual cone production was still predictive of human-caused fall mortalities, 2) no evidence of a difference in annual numbers of fall mortalities between males and females, and 3) an increase in annual mortalities over the study period, with most of this increase outside the Recovery Zone.

****UNDERSTANDING MOVEMENT PATTERNS OF CHIRICAHUA LEOPARD FROGS (*LITHOBATES CHIRICAHUENSIS*) TO PROMOTE SPECIES PERSISTENCE IN DESERT ECOSYSTEMS (POSTER)**

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One-third of the described species of amphibians worldwide are threatened with extinction, including the Chiricahua leopard frog (*Lithobates chiricahuensis*). This frog is highly aquatic, found in portions of Arizona and New Mexico, and listed as threatened under the Endangered Species Act. Currently, habitat for the Chiricahua leopard frog generally is restricted to anthropogenic sources of water, including tanks maintained for livestock. Movement habits of this frog and patterns of dispersal between disjunct water sources are not well understood. On the Ladder Ranch, a working bison ranch in southern New Mexico, we constructed pitfall traps to capture frogs leaving stock tanks. We attached radio transmitters to 14 individuals during the summer of 2013 to study the potential for movement between widely-spaced tanks. Individuals captured in stock tanks (*n*=11) showed very high site fidelity, never leaving their source location while carrying transmitters up to 18 days. Individuals captured in a nearby creek (*n*=3) moved as much as 2800 m over a 17-day period. Daily movements of these individuals varied greatly (mean=121 m, SD=249) and do not appear to be related to temperature or precipitation. During the 2014 field season, we will attempt to track a larger number of animals moving along the creek corridor and to nearby tanks. Quantifying movement abilities of native amphibians will allow biologists to manage anthropogenic water sources to support movement between habitat patches and maintain functioning metapopulations, while preserving important features of the Ranch for livestock use.

DEVELOPING PRIORITIES FOR METAPOPULATION CONSERVATION AT THE LANDSCAPE SCALE: WOLVERINES IN THE WESTERN UNITED STATES

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Wildlife populations are often influenced by multiple political jurisdictions. This is particularly true for wide-ranging, low-density carnivores whose populations have often contracted and remain threatened, heightening the need for geographically coordinated priorities at the landscape scale. Yet even as modern policies facilitate species recoveries, gaps in knowledge of historical distributions, population capacities, and potential for genetic exchange inhibit development of population-level conservation priorities. Wolverines are an 8–18 kg terrestrial weasel (Mustelidae) that naturally exist at low densities (5/1000 km2) in cold, often snow-covered areas. Wolverines were extirpated, or nearly so, from the contiguous United States by 1930. We used a resource selection function to (1) predict habitat suitable for survival, reproduction and dispersal of wolverines across the western US, (2) make a rough estimate of population capacity, and (3) develop conservation priorities at the metapopulation scale. Primary wolverine habitat (survival) existed in island-like fashion across the western US, and we estimated capacity to be 644 wolverines (95% CI = 506–1881). We estimated current population size to be approximately half of capacity. Areas we predicted suitable for male dispersal linked all patches, but some potential core areas appear to be relatively isolated for females. Reintroduction of wolverines to the Southern Rockies and Sierra- Nevadas has the potential to increase population size by >50% and these regions may be robust to climate change. The Central Linkage Region is an area of great importance for metapopulation function, thus warranting collaborative strategies for maintaining high survival rates, high reproductive rates, and dispersal capabilities. Our analysis can help identify dispersal corridors, release locations for reintroductions, and monitoring targets. The process we used can serve as an example for developing collaborative, landscape scale, conservation priorities for data-sparse metapopulations.

GENOMICS OF BRUCELLOSIS IN WILDLIFE AND LIVESTOCK OF THE GREATER YELLOWSTONE ECOSYSTEM

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Brucellosis, a disease caused by the bacterium *Brucella abortus*, has recently been expanding its distribution in the Greater Yellowstone Ecosystem (GYE), with increased outbreaks in cattle and rising seroprevalence in elk over the past decade. Genetic studies suggest elk are a primary source of recent transmission to cattle. However, these studies are based on Variable Number Tandem Repeat (VNTR) data, which are limited in assessing and quantifying transmission among species. The goal of this study was to (*i*) investigate the introduction history of *B. abortus* in the GYE, (*ii*) identify *B. abortus* lineages associated with host species and/or geographic localities, and (*iii*) quantify transmission across wildlife and livestock host species and populations. We sequenced *B. abortus* whole genomes (*n*= 207) derived from isolates collected from three host species (bison, elk, cattle) over the past 30 years, throughout the GYE. We identified genetic variation among isolates, and applied a spatial diffusion phylogeographic modeling approach that incorporated temporal information from sampling. Based on these data, our results suggest four divergent *Brucella* lineages, with a time to most recent common ancestor of ~130 years ago, possibly representing a minimum of four brucellosis introductions into the GYE. Two *Brucella* lineages were generally clustered by geography. Evidence for cross-species transmission was detected among all species, though most events occur within species and herds. Understanding transmission dynamics is imperative for implementing effective control measures and may assist in identifying source populations responsible for past and future brucellosis infections in wildlife and outbreaks in livestock.

****LANDSCAPE HETEROGENEITY AT WHITE-HEADED WOODPECKER NEST SITES IN WEST-CENTRAL IDAHO (POSTER)**

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The white-headed woodpecker (*Picoides albolarvatus*) is a regional endemic species of dry conifer forests in the Inland Pacific Northwest, where forest restoration activities are increasingly common. Recent efforts to mitigate severe fire effects and restore ecological function in these forests have prompted land managers to consider the implications of forest management actions on a range of resources, including wildlife. Identifying the associations of sensitive wildlife species with the structure and distribution of resources across landscapes is necessary for scientifically-sound management decisions. We examined the heterogeneity and proportion of open- and closed- canopy forest patches surrounding white-headed woodpecker nest sites during 2012 and 2013. We used logistic regression to compare differences between nest (n = 34) and non-nest (n = 184) sites. We found a stronger positive relationship with low canopy closure within 1-ha of nest sites compared with non-nest sites (nests: $\bar{x}$ = 0.49, SD = 0.43; non-nests: $\bar{x}$ = 0.06, SD = 0.16; $p < 0.001$). We also measured a stronger positive relationship with the edge density

between low and moderate canopy patches within a 1-km radius of nest sites compared with non-nest sites (nests: $\bar{x}$ = 30.0 meters/ha, SD = 14.6; non-nests: $\bar{x}$ = 18.4 m/ha, SD = 14.9; $p < 0.001$). Our results are consistent with studies of nesting white-headed woodpeckers in Oregon. These data will help further validate and refine habitat suitability models across their northern range and contribute towards effective management decisions that will benefit the white-headed woodpecker.

****INVESTIGATING COEXISTENCE BETWEEN TROUT AND LONG-TOED SALAMANDERS AND THE INDIRECT EFFECTS OF FISH PREDATORS**

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In many, formerly fishless lakes in western North America, trout have been introduced for recreational fishing, replacing native amphibians as top predators. Trout are associated with reducing the abundance of amphibians and have extirpated populations of long-toed salamanders (*Ambystoma macrodactylum*). Salamanders and trout may coexist in some lakes, as larvae often are able to alter foraging behavior, use of open water, and time in refugia in response to predatory cues. However, salamanders are still subject to attacks and may have different body morphology in environments with fish. We sought to estimate minimum population sizes of long-toed salamanders, as well as investigate indirect effects of fish on salamander morphology. We sampled lakes with and without fish in northwestern Montana during the summers of 2012 and 2013. We caught salamander larvae using minnow traps, took several body measurements, and compared capture rates and morphological measurements between lakes with and without fish. Preliminary results suggest that more salamanders were captured per trap in lakes with fish (1.8 salamanders/trap, 95% CI = 1.3-2.4), compared to lakes without fish (0.58 salamanders/trap, 0.36-0.81), which could reflect higher population sizes or increased use of traps as refugia. However, salamanders in lakes with fish were smaller: they weighed less, had shorter snout-vent lengths, and had shorter and narrower tails. Even if salamanders are more abundant in lakes with fish, growth may be reduced. Further research into the coexistence of long-toed salamanders and trout may aid in developing conservation strategies for these and other amphibians affected by novel predators.

INVESTIGATIONS OF THE BREEDING ECOLOGY OF THE NORTHERN HAWK OWL IN WESTERN MONTANA

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In North America, the Northern Hawk Owl (*Surnia ulula*) primarily breeds in the boreal regions of Alaska and Canada. It also can move southward into the contiguous lower 48 United States, occasionally breeding in states of northern latitude. In the contiguous states, Northern Hawk Owl nests are primarily documented in Montana and Minnesota. This study describes nest-site characteristics, habitat associations, breeding diet, and distribution of 15 Northern Hawk Owl nests from Glacier National Park and surrounding areas in northwestern Montana.

NATURAL NEST-SITE CHARACTERISTICS OF TWO SMALL FOREST OWLS WITH IMPLICATIONS FOR CONSERVATION AND MANAGEMENT

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Natural nest cavities of the Northern Saw-whet Owl *(Aegolius acadicus)* and the Northern Pygmy-Owl *(Glacidium gnoma)* were characterized using several variables measured from 79 nests. Northern Saw-whet Owls appear to prefer larger diameter trees, with larger cavity openings, and deeper cavities compared to the Northern Pygmy-Owls. Pygmy-owls also use a higher proportion of living trees with natural (i.e., not excavated) cavities compared to saw-whet owls. Tree height, nest height, and the number of cavities located on a snag were consistent between the two species. Internal examination of hundreds of cavities within owl territories shows that many cavities which appear appropriate for nesting owls are unusable. Leaving dead or dying trees for cavity nesting species is a common practice for forest managers in the West. However, criteria for "wildlife habitat" trees often adhere to a one-size-fits-all approach; retained cavities are selected based on external assessment alone. The dissimilarity in nest-site selection by these two species, and the fact that cavities show great variability in internal condition, underscore the need for forest managers to select a diverse array of trees for cavity nesting birds in western forests.

AVIAN COMMUNITY CHANGES IN RELATION TO DIFFERENT FOREST FIRE CONDITIONS IN CENTRAL IDAHO

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Wildfire is an important driver of forest bird communities in western North America. To fully understand wildfire effects, more studies comparing species-specific responses across space, time, and a range of burn severities are needed. We analyzed point count data (n = 809 point × year survey occasions; 2002–2010) from central Idaho to examine forest bird community responses to fire. Using community occupancy models, we analyzed changes in point occupancy before and after prescribed burning and wildfire, and along a post-wildfire burn-severity gradient. Occupancy patterns were largely consistent with those expected from species life histories. Cavity nesters and aerial insectivores (Mountain Bluebird [*Sialia currucoides*; n = 37 survey occasions detected], House Wren [*Troglodytes aedon*; n = 15], Olive-sided Flycatcher [*Contopus cooperi*; n = 15]) responded positively to fire consistent with increases in nesting substrate and foraging opportunities expected for these species. Shrub-nesting species (Lazuli Bunting [*Passerina amoena*; n = 75], Black-headed Grosbeak [*Pheucticus melanocephalus*; n = 29]) exhibited lagged positive responses with the expected lag in shrub development after wildfire. In contrast, canopy-nesting foliage gleaners and pine-seed consumers (Clark's Nutcracker [*Nucifraga Columbiana*; n = 50], Townsend's Warbler [*Setophaga townsendi*; n = 133]) responded negatively to wildfire. More species responded positively than negatively to fire, and responses to high-severity wildfire were stronger than to prescribed burning. Consequently, species richness increased by approximately 3 species from low- to high-severity burned points and pre- to post-wildfire years. Our results suggest high-severity wildfires generate important habitat for many species, contributing positively to avian diversity.

ACOUSTIC MONITORING OF NOCTURNAL MIGRANTS IN THE BITTERROOT VALLEY, MONTANA (POSTER)

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Acoustic monitoring of passerine nocturnal migration represents a unique and passive way to study bird movements. As migrant songbirds pass over the landscape, many emit nocturnal flight calls (NFCs) to presumably echolocate and maintain communication with other birds. Capture of these calls with autonomous recording units (ARUs) allows generation of spectrograms, and species-level identification. In September 2012, MPG Ranch began an NFC monitoring project that now includes the fall 2012, spring 2013 and fall 2013 migrations. Each season, we installed three ARUs at low-, mid-, and high-elevation sites, and extracted over 2700 NFCs from the recordings. Analyses indicate spatial and temporal trends between sites and between seasons. We detected substantially fewer NFCs during the spring migration compared to the fall seasons. Spring migrant NFC detections were consistent throughout the season at the low-

elevation site, but only occurred later in the season at the higher elevation sites. During fall migration 2013, peak migration occurred in late August to mid-September when the mid-elevation site consistently saw higher numbers of NFCs than the low- and high-elevation sites. The low-elevation site continues to detect previously undocumented species on the property, including the Barn Owl and Virginia Rail. In 2014, we plan to monitor fall and spring migration to determine if spatial and temporal trends persist.

****CONTACT NETWORKS AND MORTALITY PATTERNS SUGGEST PNEUMONIA-CAUSING PATHOGENS MAY PERSIST IN WILD BIGHORN SHEEP**

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Efficacy of disease control efforts is often contingent on whether the disease persists locally in the host population or is repeatedly introduced from an alternative host species. Local persistence is partially determined by the interaction between host contact structure and disease transmission rates: relatively isolated host groups facilitate pathogen persistence by slowing the rate at which highly transmissible pathogens access new susceptibles; alternatively, isolated host groups impede persistence for pathogens with low transmission rates by limiting the number of available hosts and forcing premature fade-out. Here, we use long-term data from the Hells Canyon region to investigate whether variable host contact patterns are associated with survival outcomes for 46 cohorts of bighorn sheep (*Ovis canadensis*) lambs subject to recurrent pneumonia outbreaks. We build social contact networks for each lamb cohort, and quantify variation in lamb mortality attributable to populations, years, and groups. We then refine estimates of chronic carriage rates in ewes, and disease-induced mortality rates in lambs, by finding parameters for the disease process that produce lamb morality rates similar to those observed when simulated on the observed host contact networks. Our results suggest that summer lamb hazards are spatially structured at the subpopulation level: 92.5% of the variation in lamb hazards during pneumonia outbreak years was attributable to sub-population-level groups, whereas 1.7% and 5.6% were attributable to year and population, respectively. Additionally, the posterior distribution generated by our disease transmission model suggests that pneumonia-causing pathogens may persist locally in bighorn sheep populations, even during apparently healthy years.

MONTANA'S BAT AND WHITE-NOSE SYNDROME SURVEILLANCE EFFORTS (ORAL PRESENTATION & POSTER)

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Lauri Hanauska-Brown, Montana Fish, Wildlife, and Parks, Helena
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Jake Chaffin, Montana/Dakotas State BLM Office, Billings, MT
Christopher Servheen, U.S. Fish and Wildlife Service, Missoula, MT
Bigfork High School Cave Club, http://bigforkhighschoolcaveclub.weebly.com
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Montana's bat populations face a wide array of conservation issues, including loss of roosting sites, collision and drowning hazards at sites where they forage and drink, barotrauma and collision hazards at wind farms, and the potential arrival of *Pseudogymnoascus 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 statewide array of 50 passive ultrasonic detector/recorder stations that are deployed year-round and powered by solar panels and deep cycle batteries. Through January 2014, these recording stations have resulted in more than 2.35 million sound files containing more than 7.5 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.

MONTANA'S MAPVIEWER WEB APPLICATION: DIRECT ACCESS TO 1.4 MILLION ANIMAL OBSERVATIONS, WETLAND AND LAND COVER MAPPING, LAND MANAGEMENT, AND GEOREFERENCED PHOTOS (ORAL PRESENTATION & POSTER)

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Dave Ratz, Montana Natural Heritage Program, Helena
Karen Coleman, Montana Natural Heritage Program, Helena
Allan Cox, Montana Natural Heritage Program, Helena
Linda Vance, Montana Natural Heritage Program, Helena
Karen Newlon, Montana Natural Heritage Program, Helena

The Montana Natural Heritage Program (MTNHP) was established by the Montana State Legislature in 1983 and charged with statutory responsibility for the acquisition, storage, and retrieval of information documenting Montana's flora, fauna and biological communities (Montana Code Annotated 90-15). In order to track the distribution and status of species, MTNHP has developed databases containing nearly 1.5 million animal observation records and over 160,000 locations where a formally structured animal survey protocol has been followed. This information is used to create a variety of other data products, including, range maps, species occurrence areas used in environmental review processes, and predicted distribution models. Agency biologists and resource managers have direct access to this information as well as more than 2.2 million acres of mapped wetland and riparian areas, statewide landcover mapping, land management information, and georeferenced photos on MTNHP's new MAPVIEWER web application. MAPVIEWER is compatible with Internet Explorer, Mozilla Firefox, and Google Chrome and will eventually be compatible with touch screen devices. Users can submit animal observations, search for a place names and map coordinates, get summaries of land cover and land management within preselected areas, select different wetland types for viewing, overlay a variety of information layers, create a variety of customized queries, and generate image, pdf, and excel reports through the application.

WESTERN MONTANAN RANCHER'S, HUNTER'S, AND TRAPPER'S WOLF TOLERANCE IN LIGHT OF PUBLIC HUNTING AND TRAPPING

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Len Broberg, Environmental Studies Department, University of Montana
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The Public Trust Doctrine placed wildlife in trust, via state control and regulation, for the benefit of the people. Managing agencies that lose sight of the importance of public acceptance of predator policies and management actions may find themselves legislatively or judicially subverted. This study examines how the Montana public wolf hunting and trapping seasons have affected tolerance of

gray wolves (*Canis lupus*) among rural resident ranchers, hunters, and trappers. Twenty residents from the Blackfoot, Bitterroot, and Ninemile Valleys were qualitatively interviewed over the summer and fall of 2013. Potential participants were initially identified using purposive sampling, with subsequent interviewees located through snowball sampling. Preliminary results show that the hunting and trapping seasons have not yet caused changes in attitudes towards wolves in these groups; however losing the hunting and trapping seasons would have a negative impact. The majority of interviewees stated a desire for some avenue of management and control of the Montana wolf population. One apparent theme was that residents are more likely to accept hunting as a means of lethal control over trapping due to concerns of indiscriminate, inhumane take. Wolf presence conjures up a mixture of both awe and fear in these groups. Ranchers are primarily concerned with the threat to livestock and livelihood, while hunters and trappers are uneasy about predator and big game balance on the landscape. As intended, the public wolf hunting and trapping seasons allow ranchers, hunters, and trappers to feel some measure of control over the perceived threat of wolf presence.

MONTANA PRAIRIE POTHOLE JOINT VENTURE BREEDING SHOREBIRD PROJECT

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Sean Fields, U.S. Fish & Wildlife Service, Habitat and Population Evaluation Team, Great Falls, MT

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 2012, the U.S. Fish & Wildlife Service's Habitat and Population Evaluation Team began conducting breeding shorebird surveys in the western portion of the Montana PPR to complement existing surveys for partners of the Prairie Pothole Joint Venture in North Dakota, South Dakota, and northeast Montana. The purpose of these surveys is to provide data for development of habitat models identifying priority conservation areas where habitat needs overlap for breeding shorebirds and breeding waterfowl. Results will allow land managers to integrate breeding shorebird conservation with ongoing waterfowl conservation actions in the Montana PPR. This is a long-term adaptive process that includes updating models with annually collected survey data to inform and improve model performance. We summarize the objectives and field design of the project and report results of preliminary modeling from our 2012/2013 efforts.

PREDICTING ABUNDANCE OF GRAY WOLVES IN MONTANA USING HUNTER OBSERVATIONS AND FIELD MONITORING

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From the early 1980s to present, wolf numbers in Montana have been documented by attempting to locate and count all individuals. These counts represented minimums with unknown error. We describe a method using observations by hunters, in conjunction with field monitoring to estimate wolf population size and distribution in a more systematic way. Our method consists of three general steps: 1) use a multi-

season occupancy model to estimate the area occupied by wolves in packs using locations reported by a random sample of hunters, 2) estimate the numbers of wolf packs by dividing area occupied by average territory size from field monitoring, then 3) estimate the numbers of wolves by multiplying the number of estimated packs by average pack size from field monitoring. Estimated area occupied by packs increased between 2007 and 2012. From 2007 to 2009, mean estimated territory size from 38 closely monitored packs was 599.83 km^2. Dividing estimated area occupied by mean territory size resulted in an increase in estimated packs between 2007 and 2012, exceeding minimum counts. From 1994 to 2011, complete counts were obtained from 413 packs within or bordering Montana, and mean pack size was estimated at 6.32 animals. Multiplying estimated packs by mean pack size resulted in an increase in estimated population size between 2007 and 2012, exceeding minimum counts. MFWP's method to estimate the wolf population is cost effective and incorporates public participation with field monitoring. Future application will test the effects of harvest and removals on occupancy, colonization, and local extinction.

APPLYING NEW RESEARCH METHODS TO INFORM MOUNTAIN LION HARVEST MANAGEMENT IN WESTERN MONTANA

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The lack of reliable methods to accurately estimate mountain lion abundance has made lion management one of the most contentious wildlife issues in western Montana over the last 20 years. Lion harvest prescriptions and hunting season structure varied widely during that period because social factors drove management decisions in the absence of objective population data. During winter 2012-2013, we used a DNA-based spatial capture-recapture (SCR) approach to estimate mountain lion abundance in hunting districts 250 and 270 in the southern Bitterroot Watershed of western Montana. Mountain lion hair, scat, and muscle samples were collected for genetic analysis to identify individuals. We developed extensions to standard SCR models to accommodate simultaneous sampling and harvest events and incorporate existing information regarding mountain lion habitat quality. We estimated the abundance of 85 (95% CI = 54, 141) independent mountain lions in hunting district 250 and 82 (95% CI = 51, 137) in hunting district 270. These results are 2 - 3 times higher than previously reported mountain lion abundance in this area and correspond to density estimates of 4.6 and 5.4 lions per 100 km^2. Because current harvest regulations in western Montana were developed under the assumption of lower population abundance, lion management objectives are unlikely to be met unless harvest prescriptions are adjusted to account for this new understanding of lion population status. More broadly, the analytic improvements in SCR methods will enhance the ability of wildlife managers to reliably and economically estimate abundance of harvested species.

MONTANA CLIMATE VARIABILITY: A CHALLENGE FOR BIG GAME MANAGEMENT

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In recent decades changes in climate have influenced wildlife populations worldwide. This paper presents recent climate data sets for Montana with an emphasis on some ways changes in climate have impacted big game populations and management in our state. Length of growing season, winter severity, time of spring green-up, summer heat, drought, all may have direct or indirect impacts on wildlife populations. Indirect impacts include disease and disease vectors. These changes have implications for how we

manage hunting and fishing opportunities. Recent declines in some of our big game species may be attributed in part to climate change. Hunting quotas and seasons have been modified to ameliorate some of the population changes. Further modifications in hunting season structure may be required to maintain hunting opportunities and sustain big game populations.

WESTERN PAINTED TURTLE DISTRIBUTION AT MPG RANCH (POSTER)

Matthew Schertz, Herpetologist, MPG Operations Missoula, MT

This study seeks to understand Western Painted Turtle Distribution at MPG Ranch, a 9,500 acre conservation property in the Northern Sapphires. The recent completion of a large pond in our Clubhouse Floodplain provided a larger habitat for Western Painted Turtles. Prior to the pond's completion no more than 16 turtles basked at any one time in the smaller pools of this floodplain. After the completion of the pond in early 2012, 57 turtles concurrently basked on a sunny spring day. MPG staff sought to better understand Western Painted Turtle distribution after the completion of the pond. How many turtles live at the pond? Are these turtles now able to remain in the pond throughout their life cycle? What specific advantages does this pond provide for a resident population? How can we further promote turtle habitat in the Clubhouse Floodplain? In order to begin answering these questions staff set up multiple basking traps in the Clubhouse Pond. For two years we marked and measured 90 adult and sub-adult turtles caught in the traps during the summer months. Our initial findings should help us begin to answer these questions.

****A RISK MODEL FOR PROACTIVE MANAGEMENT OF PNEUMONIA EPIZOOTICS IN BIGHORN SHEEP**

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Pneumonia epizootics are a major challenge for management of bighorn sheep. Risk factors associated with the disease are poorly understood, making pneumonia epizootics hard to predict; such epizootics are thus managed reactively rather than proactively. We developed a model that identifies risk factors and addresses biological questions about risk. Using Bayesian logistic regression with repeated measures, we found that private land, weed control using domestic sheep or goats, pneumonia history, and herd density were associated with risk of pneumonia in 43 herds in Montana that experienced 22 epizootics out of 637 herd years from 1979–2013. Within high-risk areas occupied by herds, risk increased with greater amounts of private land and use of domestic sheep or goats for weed control. Herds had >10 times greater odds of having a pneumonia epizootic if they or neighboring herds within high-risk areas had a history of pneumonia. Risk greatly increased when herds were at high density, with nearly 15 times greater odds of pneumonia compared to herds at low density. Number of federal sheep and goat allotments, proximity to nearest herds, ram:ewe ratios, normality of winter and spring precipitation, and herds with native versus mixed or reintroduced origin were not associated with increased risk. We conclude that factors associated with risk of pneumonia are complex and may not always be from the most obvious sources. The ability to identify high risk herds will help determine where to focus management efforts and what risk factors most affect each herd, facilitating more effective, proactive management.

SATELLITE TELEMETRY PROVIDES INSIGHT INTO WHERE WESTERN MONTANA OSPREY SPEND THE WINTER

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During a long-term study of Osprey (*Pandion haliaetus*) in western Montana on demography and ecotoxicology, migratory information on several birds was collected. It is important to know where these birds migrate and spend the winter because 2/3 of their lives are spent outside Montana. Since virtually nothing was known about where these birds go when they leave the state, in 2012 and 2013 we put satellite transmitters on two families of Osprey (adults and chicks) from nests near Florence, Montana. Telemetry data show that these birds migrate south through a fairly narrow corridor to Arizona and New Mexico, but then go in different directions: some individuals spend the winter in Texas, and others migrate to Mexico and as far south as the Nicaragua-Costa Rica border on both the Atlantic and Pacific coasts. Migration pathways of the adults were very similar for both south-bound and north-bound migrations across multiple years.

SOD-BUSTING AND SAGE-GROUSE: ESTIMATING HISTORICAL IMPACTS AND PLANNING FOR THE FUTURE (POSTER)

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A conservation strategy for Greater Sage-Grouse (*Centrocercus urophasianus*) in the Great Plains, where conversion of native rangeland to cropland is an accelerating agent of land use change, must anticipate impacts of future sod-busting on populations. We use resource selection functions (RSF) to estimate the scale and magnitude of the effect of sod-busting on the distribution of sage-grouse leks in the Great Plains Management Zone and estimate impacts of future cropland expansion. Active leks were used to develop a distribution envelope based on topographic and climatic variables from which random pseudo-absences were drawn to fit a used-available RSF. Models with proportion cropland at scales from 800 m to 8.5 km were compared using AIC_c to determine the most supported scale at which cropland influences lek occurrence. Finally, we develop a buildout scenario based on a cropland suitability model to estimate potential impacts of future sod-busting on known leks. Negative effects of cropland on lek occurrence were evident at all scales tested. The 6.4 km scale was most supported, and impacts were severe, with the relative probability of lek occurrence falling by 50% when about 20% of the landscape within 6.4 km was in cropland. These results, which highlight the large scale and magnitude of impacts of cropland on sage-grouse populations, are needed to evaluate the potential contribution of conservation easements and land-use policy to local and range-wide sage-grouse conservation goals. Population-level benefits of targeted conservation implementation are explored.

A DEMONSTRATION OF USING PARTNERSHIPS AND PRIVATE LANDS CONSERVATION TO EVALUATE LIVESTOCK GRAZING AS A MANAGEMENT TOOL FOR GREATER SAGE-GROUSE IN CENTRAL MONTANA.

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Partnerships across agencies and land ownerships established to maintain wildlife-compatible "working landscapes" are critical for conserving and managing wildlife in the West. Preliminary results from the first three years of a 10-yr study in central Montana demonstrate this management approach. We are evaluating prescribed grazing systems implemented by NRCS's Sage Grouse Initiative (SGI) that are designed to improve hiding cover and food availability for Greater Sage-Grouse (*Centrocercus urophasianus*) during critical life stages via voluntary, incentive-based modifications of livestock grazing management. Extensive vegetation sampling across 8 SGI-enrolled ranches and 20 non-enrolled ranches in 2013 revealed significant increases in residual grass height, live grass height, and herbaceous vegetation cover on SGI-enrolled lands. In 2011-2013, we monitored adult female sage-grouse and chicks with radiotelemetry to measure vital rates and habitat use. Annual hen survival ranged from 57-74%, nest success ranged from 12-61%, and chick survival ranged from 9-23%. Using an information theoretic approach in program MARK, the top-ranked nest success model showed that grass height was positively correlated with nest success. During late nesting to early brood rearing periods of 2012 and 2013 we used pitfall traps to collected ground-dwelling arthropods from cattle grazed and rest-rotation phase pastures enrolled in the SGI program. Collected arthropods were identified and appropriate specimens were classified as sage-grouse chick food items. During both years of study, food item catches were greatest ($P < 0.03$) in rested versus grazed pastures indicating that strategic pasture rest may increase the availability of sage-grouse chick food resources.

USING CITIZEN SCIENTISTS TO MONITOR BALD EAGLE AND OSPREY NESTS IN WESTERN MONTANA

Katharine Stone, Bitterroot Audubon Society, Hamilton, MT

Montana has witnessed a remarkable recovery of Bald Eagles (*Haliaeetus leucocephalus*) following Endangered Species Act protection. With over 600 territories to monitor, managing agencies currently struggle to collect data on territory occupancy, productivity, and range expansion. In 2013, the Bitterroot Audubon Society initiated a Citizen Science effort to assist Montana Fish, Wildlife, and Parks in Bald Eagle monitoring efforts. Because of an overwhelming public interest, we also used volunteers to collect information on Osprey (*Pandion haliaetus*) nests. Volunteers ranged in age from 8 to 80. Most had little or no birding experience prior to project participation. Volunteers collected information on 35 Bald Eagle territories, documenting nest occupancy, phenology, cause and timing of failures, and productivity. Volunteers mapped and observed behavior at over 100 Osprey nests throughout western Montana. Bitterroot Audubon plans to continue and expand this project during the 2014 breeding season.

RAPTOR USE OF WATER SOURCES AS DOCUMENTED VIA A REMOTE CAMERA NETWORK

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Alan Ramsey, MPG Ranch, Florence, MT

The MPG Ranch maintains a large network of over 200 remote cameras on two properties in western Montana. We use these cameras to document the occurrence of rare or unusual wildlife, the phenology of life history activities, and wildlife use of areas of interest. Over the course of 3 years, our cameras have documented raptors frequently visiting natural and man-made water sources. Most of our common, resident raptors visit water sources for activities such as bathing, preening, drinking, and hunting. Camera stations at natural water sources near breeding territories of Cooper's Hawks (*Accipiter cooperii*), Northern Goshawks (*Accipiter gentilis*), Northern Saw-whet Owls (*Aegolius acadicus*), and Western Screech-Owls (*Megascops kennicottii*) recorded routine visits to water during the breeding season. These behaviors are difficult for observers to see in the field, and their documentation adds insight into our overall understanding of the life history and habitat needs of raptor species. Frequent use of stock tanks underscores the importance of providing escape structures to reduce mortality risk.

DENSITY DEPENDENCE, WHITEBARK PINE DECLINE, AND VITAL RATES OF GRIZZLY BEARS IN THE GREATER YELLOWSTONE ECOSYSTEM

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Recent evidence suggests annual population growth of the grizzly bear (*Ursus arctos*) population in the Greater Yellowstone Ecosystem has slowed from 4.1–7.6% during 1983–2001 to 0.3–2.2% during 2002–2011. Substantial changes in availability of an important fall food has occurred over the past decade. Whitebark pine (*Pinus albicaulis*), a highly variable but important fall food source for grizzly bears, has experienced substantial mortality due to a mountain pine beetle (*Dendroctonus ponderosae*) outbreak that started in the early 2000s. Concurrent with changes in food resources, the grizzly bear population has reached high densities in some areas and has continued to expand, now occupying >50,000 km^2. We tested research hypotheses to examine if changes in vital rates detected during the past decade were more associated with grizzly bear density versus a whitebark pine decline. We focused our assessment on known-fate data to estimate survival of cubs-of-the-year, yearlings, and independent bears (≥2 yrs) and reproductive transition of females from having no offspring to having cubs. We observed a change in survival of independent bears between the periods of 1983–2001 and 2002–2012, which was mostly a function of increased male survival; female survival did not change. Cub survival and reproductive transition declined during the last decade and were associated with an index of grizzly bear density, which indicated increasing density over time. We found no support that the decline in these vital rates was associated with the index of whitebark decline.

DECADAL GROWTH OF TRAFFIC VOLUMES ON US HIGHWAY 2 AND IMPLICATIONS FOR GRIZZLY BEAR HABITAT CONNECTIVITY

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I monitored traffic volumes on US Highway 2 between East and West Glacier, Montana, 1998-2001 as part of a study of the effects of transportation infrastructure on grizzly bears. I found that traffic volumes were below that where connectivity was impeded, but that some impacts to grizzly bear movement patterns could be measured. During the summers of 2012 and 2013 I replicated the traffic volume monitoring last conducted in 2001. I found that traffic volumes had increased dramatically, nearly doubling in some instances, and that some characteristics of traffic flow had changed. I discuss the implications of this growth in traffic to grizzly bear habitat connectivity.

DENSITY AND ABUNDANCE OF WOLVERINES IN GLACIER NATIONAL PARK, MONTANA, USA

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Michael K. Schwartz, USFS Rocky Mountain Research Station, Missoula, MT

Wolverines (*Gulo gulo*) are a rare mustelid carnivore inhabiting the northern US Rocky Mountains. Because they may be closely tied to areas with persistent snow pack, and because these areas may diminish due to climate change, wolverines are a candidate for listing under the U.S. Endangered Species Act. Glacier National Park (GNP) contains over 4,000 km2 of rugged mountain terrain straddling the Continental Divide immediately south of the U.S./Canada border. Much of this terrain is considered wolverine habitat, and GNP may contain a significant portion of the U.S. wolverine population. GNP, in collaboration with the

U.S. Forest Service Rocky Mountain Research Station, and following on the heels of a telemetry-based research project conducted in GNP 2003-2008, began a non-invasive DNA-based wolverine population monitoring program in 2009. The objectives of the program were to identify effective methods of non-invasive monitoring and then use these to estimate population size and density. Using primarily volunteer labor, we began by placing baited hair-snag stations along lakeshores where we felt we might intercept wolverines during winter 2009. This evolved into a systematic survey of the park using a 10 x 10 km sampling grid over putative wolverine habitat during the winters of 2011 and 2012. We then applied a multi-faceted mark-recapture analysis to the accumulated data. Here, we present the findings from this effort, including estimates of population size, density, and trend, and insights concerning wolverine population monitoring.

Notes

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