49th Annual Meeting of the Montana Chapter of The Wildlife Society

Multiplying Human Impacts Bordering Open Space: Challenges for wildlife habitat and connectivity protection

February 22-25, 2011

Missoula, MT

Holiday Inn Downtown at the Park

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About The Wildlife Society and the Montana Chapter

The Wildlife Society (TWS) is an international professional society established in 1937. The Society's membership of more than 9,600 includes research scientists, educators, communications specialists, managers, conservation law enforcement officers, administrators, and students in more than 60 countries. The principle objectives of The Wildlife Society are:

1. To develop and promote sound stewardship of wildlife resources and of the environments upon which wildlife and humans depend;

2. To undertake a role in preventing human-induced environmental degradation;

3. To increase awareness and appreciation of wildlife values; and

4. To seek the highest standards in all activities of the wildlife profession.

The Montana Chapter of The Wildlife Society was chartered in 1962 and formally organized with the election of our first officers in 1963. Adoption of chapter bylaws occurred in 1964. The mission of the Montana Chapter of The Wildlife Society is to serve and represent wildlife professionals in all areas of wildlife conservation and resource management. Goals of the Montana Wildlife Society include:

1. Develop and maintain a program that facilitates continuing education and professional development of wildlife professionals.

2. Promote sound stewardship of wildlife and their habitats through the application of scientific information.

3. Increase public awareness and appreciation of wildlife.

4. Develop an active and diverse membership and maintain an organization that provides excellent service to members.

The Montana Chapter of the Wildlife Society sponsors our winter conference each year. This conference provides a forum for invited speakers and member presentations. Topics focus on those issues of particular importance or interest to Montana. Our chapter is as strong as our members and participation. We have numerous committees that can use participation; there are elected positions which we encourage acceptance of nominations; and the presentation of your research and management are always needed to continue communication between agencies and the various wildlife organizations in the state! Please see your Committees Page to find our more about the various committees in your chapter as well as chair person contacts.

Greetings and welcome to the 49th Annual Meeting of the Montana Chapter of the Wildlife Society! This year's theme is *Multiplying Human Impacts Bordering Open Space: Challenges for wildlife habitat and connectivity protection*. The idea for this conference theme was spun out of wanting to focus on multiple aspects of wildlife management and issues in the state. The first issue is the increased energy development that our state is proposing and acting upon and the effects to wildlife species living in areas of this development. Another issue that has current implications is rural residential development and the impacts on wildlife habitat and connectivity. Our chapter has an emerging working group called the Residential Development Working Group; and Montana Fish Wildlife and Parks is working on a draft for Subdivision Recommendations for wildlife considerations. Thirdly, I work with wildlife crossing structures and US Highway 93 North, so the majority of my work is thinking about habitats, connectivity, and barriers to wildlife movement. So to combine all of these topics into one conference I opted for *Multiplying Human Impacts* and put a special call out for papers and a plenary line up that would reflect these topics. I hope that you all come away with a feeling that these topics were covered.

An aspect I wanted to add to our 2011 conference was some wildlife artwork and a commemorative shirt so that people would have a memento of the conference. I am very fortunate to be related to one of the best wildlife/Native American themed water color artists I have ever seen. My sister, **Sashay Camel** is an amazing artist and does wondrous detail with watercolor paint and some tiny brushes! When I approached her to do some sort of artwork theme for this conference she said, "Tell me what you want and I'll paint it!" So I thought the shape of the state would be appropriate in making it represent our chapter. Then I started thinking about species to include. I wanted to have a geographically accurate representation of the state's species in the painting. I knew of some species that people are working with through reintroductions, so I also researched other threatened or endangered species from around that state to feature in the work. I gave her a list and locations and said, "Please add a little habitat too." When she returned with the painting I was blown away! Nothing I put together in my brain looked like the beautiful work of art that she presented to me. I am very proud to provide this artwork for our conference and hope you all purchase a shirt and enjoy it as well! Money we make from the shirts aids in helping to sponsor students to attend the annual state conference.

You may have noticed this year that we are only having a 4-day conference. It has been challenging fitting in all the events, meetings, and talks that we want to provide every year for you, our state members. Unfortunately when I researched the dates, I looked some where that listed President's Day as the week before. Obviously now, that was incorrect! I had wanted to minimize concurrent sessions so people didn't have to choose between attending and missing numerous talks, but with a great turn out of abstracts and a reduced time frame, we have at least two concurrent sessions at one time and in one short stint, three concurrent sessions. I know there are people who must travel back home on Friday and if you are traveling a greater distance I understand. With that said, humbly I encourage you to stay until the end of the sessions on Friday since we have numerous great talks lined up for that day! I will also have one final refreshment break on Friday at 3:30pm, after the last talks. Please stop there and grab something to fuel you for the trip home.

Thank you for your attendance and please feel free to talk with me about any suggestions you might have for conferences in the future! We plan to send out a survey after the conference, so please take some time and give us your valuable feedback!

Whisper Camel

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Vendors:

Montana Bird Conservation Partnership
Montana Loon Society

Acknowledgements:

In addition to all the sponsors listed above, we owe special thanks to several members of The Wildlife Society who went above the call of duty to help this conference be a success. A tremendous thank you to Mike McGrath, past treasurer, who has stepped up to help out with the 2011 Conference, in this recently vacated position. The previous experience that Mike has brought to the conference planning is invaluable and it would not have gone off as well without his help and suggestions! Our 2010 elected treasurer Lowell Whitney was selected for a new position in Massachusetts, where he and his family moved at the beginning of February. Lowell helped out as much as he could before his move and I think him for his efforts. Thank you to the executive board for all of your suggestions in the conference planning process. Thank you to all committee and working group chairs for your work and your timely responses to my many emails. Thanks also to all the student volunteers at the registration desk and to all those who stepped up as needed throughout the conference. Thank you to all speakers who took the time to prepare their presentations and share their results. Special thanks also to all the professionals who stood up to be student mentors, as well as paper and poster judges.

Thank you to our plenary panel for making the time to come in and talk with our group. Special thanks to the Montana Loon Working Group for arranging for Dr. Mark Pokras to attend the conference and speak about his specialty.

Thank you to the Confederated Salish and Kootenai Tribes for allowing me to do some conference planning on work time; as well as for supplies.

Tuesday Feb. 22

Working Group Meetings

- **Herps Working Group** (12-2pm) Bryce Maxell, bmaxell@mt.gov
- **Elk Habitat Working Group (USFWS & FWP)** (1-6pm) Julie Cunningham, juliecunningham@mt.gov
- **Bats Working Group** (2-6 PM) Kristi DuBois, kdubois@mt.gov
- **Montana Harlequin Duck Working Group** (6-8pm) Steve Gniadek, grayjaybro@yahoo.com
- **Residential Development Working Group** (3-5pm) *Proposed new working group meeting* Gael Bissel, gbissell@mt.gov

Workshop (1/2 day)

- **Web-based Crucial Areas Planning System (CAPS)**, a new FWP mapping service aimed at future planning for a variety of development and conservation purposes so fish, wildlife, and recreational resources can be considered earlier in planning processes. (8:00-12:00pm)

Wednesday Feb. 23

Working Group Meetings

- **Common Loon Working Group** (9am-12pm) Amy Jacobs, ajacobs@fs.fed.us
- **Grassland Bird Meeting** (8:30am-12pm) Shawn Cleveland, scleveland@tnc.org

Plenary Session Current Arranged speakers **(1pm-5:30pm)**

- Dr. Mark Pokras; Environmental Pathology (hosted by the Common Loon Working Group)
- Dr. Marcel Huijser; US Highway 93 Habitat Connectivity
- Dr. Ed Arnett; Bats and Wind Energy
- Rob Domenech; Eagles and Energy Development
- Amy Cilimburg; Birds and Energy Development

Student Professional Mixer **(6:00-10:00pm) Food and Beverages provided**

- **Student Professional Round Table Discussions**. Timed, themed discussions to break the ice between students and professionals

- **Quiz Bowl.** Teams consist of 2-3 students and 1 professional. Compete against other teams for fun and prizes!! Teams can be formed in advance or at the event. Kent Laudon will again officiate the game!

Thursday Feb. 24

Breakfast Business meeting

- We decided to try and have a breakfast business meeting this year in an attempt to get attendees back to the presentations with the least amount of talks missed! Breakfast will start at 7:00am cost is $10.00 per person for a plated breakfast. Join us and see committee reports and find out what types of business our chapter is conducting!

Professional and Student Presentations

- Please join us and share your research with other biologists, students and natural resource professionals!

Banquet

- Will include buffet style dinner, silent auction, and awards!

Friday Feb. 25

Presentations continued

- Please join us and share your research with other biologists, students and natural resource professionals!

Tuesday, February 22

TIME	**Jefferson/Gallatin**	**Montana Boardroom**	**Madison**
8:00 AM	Workshop~UM Journalism Building		
8:30 AM			
9:00 AM			
9:30 AM			
10:00 AM			
10:30 AM			
11:00 AM			
11:30 AM			
12:00 PM	Herp Working Group		
12:30 PM			
1:00 PM		Elk habitat USFS-FWP Working Group	
1:30 PM			
2:00 PM			
2:00 PM	Montana Bat Working Group		
2:30 PM			
3:00 PM			Residential Development Working Group
3:30 PM			
4:00 PM			
4:30 PM			
5:00 PM			
5:30 PM			
6:00 PM			
6:00 PM	Montana Harlequin Duck Working Group		Financial Management Committee Meeting
6:30 PM			
7:00 PM			
7:30 PM			
8:00 PM			

Wednesday, February 23

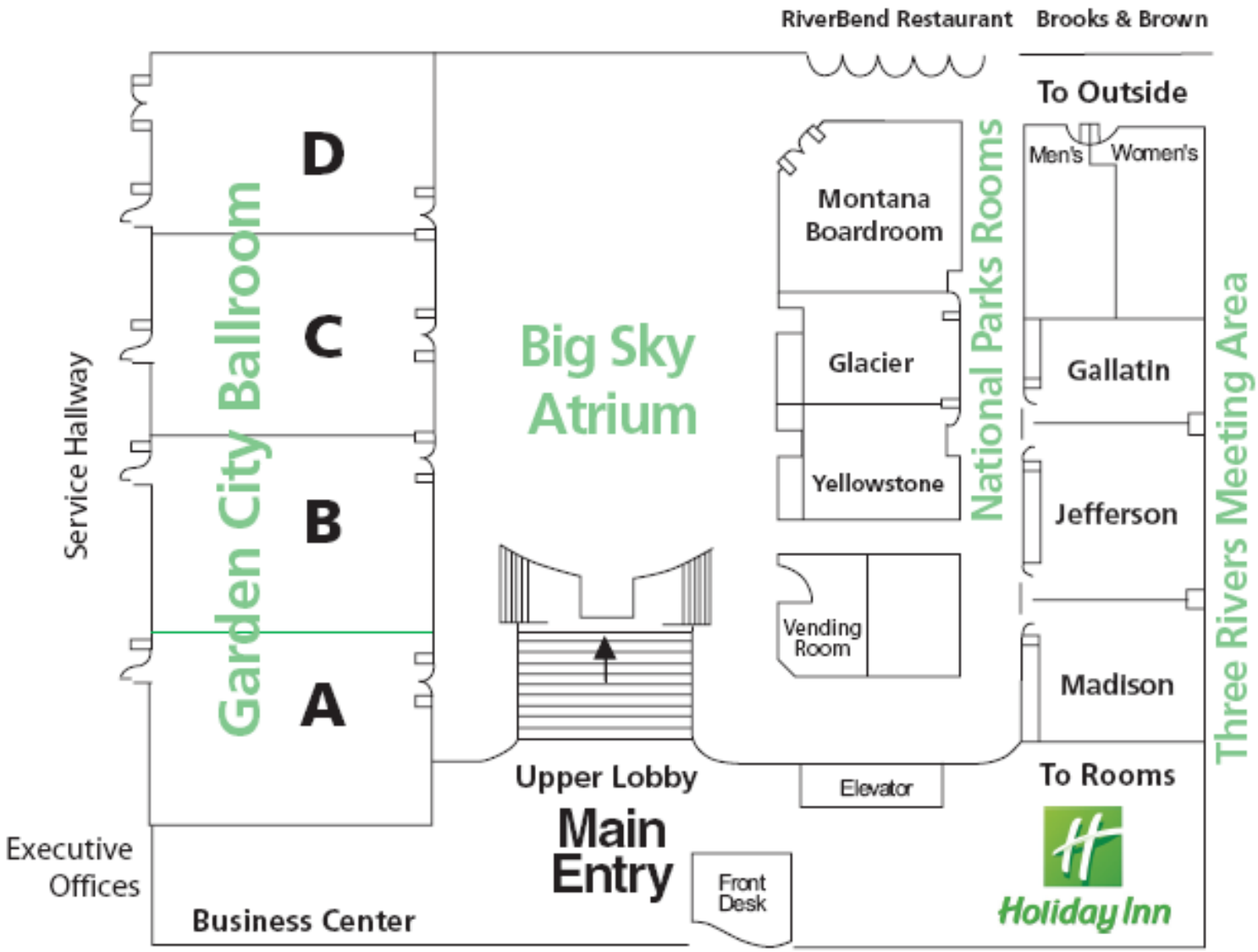
TIME	Parlor A, B, C	Big Sky Atrium	Parlor D	Madison/Jefferson/ Gallatin	Glacier/Yellowstone
8:30 AM				Grassland Bird Meeting	
9:00 AM					Common Loon Working Group
9:30 AM					
10:00 AM					
10:30 AM					
11:00 AM					
11:30 AM					
12:00 PM	**LUNCH ON YOUR OWN**				**LUNCH ON YOUR OWN**
12:30 PM					
1:00 PM	**Plenary Session**				
1:05 PM	Dr. Mark Pokras				
1:55 PM	Dr. Marcel Huijser				
2:45 PM	Dr. Ed Arnett				
3:35 PM	Rob Domenech				
4:25 PM	Amy Cilimburg				
5:00 PM					
5:30 PM				Montana Association of Fish & Wildlife Biologists Reception	
6:15 PM		**Student Pro Mixer** Food/Talking Session			
6:30 PM					
7:00 PM			**Quiz Bowl**		
7:30 PM					
8:00 PM					
9:00 PM					
10:00 PM					

Thursday, February 24

TIME	MT Boardroom	Parlor A	Big Sky Atrium	Madison/Jefferson/Gallatin
7:00 AM	MT TWS Breakfast Business Meeting			
8:00 AM				
8:30 AM		B. Kraft: Female moose in AK		B. Mosher: Avian Response to Mtn. Pine Beetle
9:00 AM		J. Polfus: Residential Development & Ungulates		K. Podruzny: Prairie Nesting Ducks
9:30 AM		N. DeCesare: Learning from cow/calf ratio		C. Hockenbary: Rec. Disturbance on Spotted Owls
10:00 AM	**BREAK**	**BREAK**		**BREAK**
10:30 AM		F. King: History of Wall Creek_Elk		D. Becker: Trumpeter Swans on FIR
11:00 AM		J. Shamhart: Grazing & Wintering Elk		M. Fylling & E. Greene: The Bird's Eye View Education Program
11:30 AM		V. Edwards: Managing elk, Wildland/urban interface		S. Harju: Landscape/Sage Grouse
12:00 PM		**LUNCH ON YOUR OWN**		**LUNCH ON YOUR OWN**
12:30 PM				
1:00 PM	R. Richardson: Pika Foraging Behavior	J. Brodie: Female Elk Survival		R. Hutto: Value of Landbird Monitoring Database
1:30 PM	J. Tucker: Fisher Decline DNA	J. Vore: Moose distribution in NW MT		W. Maples: 21 yrs Harlequin Ducks
2:00 PM	E. Beever: Landscape scale conservation	T. Smucker: Moose Management		A. Noson: Madison River Bird Distribution
2:30 PM	K. Pilgrim: Genetics of Sculpin in W. MT	R. Garrott: Mountain Ungulate Research Initiative		B. Bedrosian: Avian Scavengers & Lead Ammo
3:00 PM		B. Burkholder: Shiras Moose	**STUDENT POSTER SESSION**	K. Smucker: Bird Habitat Quality_Big Hole R. Valley
3:30 PM	**BREAK**	**BREAK**		**BREAK**
4:00 PM		T. Holland: The future of wildlife education		C. Wightman: Birds and Partnerships
4:30 PM		N. Borg: Genetic Distinctness & Big Horn Sheep		V. Slabe: Blood-lead levels of Golden Eagles
5:00 PM		P. Farnes: MT Electronic Precip Map		R. Taylor: Maximize sage grouse populations
6:30 PM	**Banquet: Awards, Silent Auction**			

Friday, February 25

TIME	Parlor A	Madison/Jefferson/Gallatin
8:00 AM		
8:30 AM	D. Ausband. How to Trick a Wolf	T. Allen: Wildlife Crossing Guards
9:00 AM	E. Bangs: Wolf Management in NW US	K. Michels: 1st Time Passage Analysis
9:30 AM	J. Derbridge: Summer wolf diet NW MT	R. Alter: Cameras to Monitor Wildlife
10:00 AM	**BREAK**	**BREAK**
10:30 AM	C. Sime: Wolf Adaptive Harvest	B. Jimenez: Black bears and roads
11:00 AM	J. Gude. Wolf-human caused mortality	J. Roscoe: Barrier Fences
11:30 AM	M. Mitchell: Hunter survey & wolf population	B. Hand: UNICOR
12:00 PM		**LUNCH ON YOUR OWN**
12:30 PM		
1:00 PM	K. Loveless: Quantifying Predator prey relationships	K. McKelvey: Climate Change and Wolverines
1:30 PM	W. Kasworm: Grizzly Population Augmentation	D. Newton: Genetics & Otters
2:00 PM	H. Robinson: Mountain Lions in Blackfoot Watershed	G. Stauffer: Weddell Seals
2:30 PM	M. Staats: Mercury magnification in Food Web	M. Young: Aquatic Vertebrate Populations
3:00 PM	J. Stetz: Black bear density in GNP	J. Vore: marmot, ptarmigan and pika
3:30 PM	**BREAK**	**BREAK**
4:00 PM		


RiverBend Restaurant
Brooks & Brown
To Outside
Men's
Women's
Montana Boardroom
Glacier
Yellowstone
National Parks Rooms
Gallatin
Jefferson
Madison
Three Rivers Meeting Area
Garden City Ballroom
D
C
B
A
Service Hallway
Big Sky Atrium
Vending Room
Upper Lobby
Main Entry
Elevator
To Rooms
Front Desk
Holiday Inn
Executive Offices
Business Center

2011 Plenary Speakers

Marcel Huijser, Road Ecologist, Western Transportation Institute, Montana State University. Marcel received his M.S. in population ecology (1992) and his Ph.D. in road ecology (2000) at Wageningen University in Wageningen, The Netherlands. He studied plant-herbivore interactions in wetlands for the Dutch Ministry of Transport, Public Works and Water Management (1992-1995), hedgehog traffic victims and mitigation strategies in an anthropogenic landscape for the Dutch Society for the Study and Conservation of Mammals (1995-1999), and multifunctional land use issues on agricultural lands for the Research Institute for Animal Husbandry at Wageningen University and Research Centre (1999-2002). Currently Marcel works on wildlife-transportation issues for the Western Transportation Institute at Montana State University (2002-present). He is a member of the Transportation Research Board (TRB) Committee on Ecology and Transportation and co-chaired the TRB Subcommittee on Animal-Vehicle Collisions (2002-2010).

Mark Pokras, DVM. Wildlife Clinic & Center for Conservation Medicine-Tufts University, Cummings School of Veterinary Medicine. Mark Pokras was born in 1949 in upstate NY. He attended elementary school in the US, then middle and high school in Mexico and Venezuela. He graduated from Cornell University in 1971 having specialized in ecology and systematics. Early career positions included research for an ecological consulting firm and teaching ornithology and marine biology at Richard Stockton State College in southern NJ. While at Stockton, he continued his ecological research to identify critical coastal habitats and to understand the ecological factors necessary to successful conservation of colonial waterbird populations. In 1980 he enrolled in Tufts School of Veterinary Medicine. After graduating in 1985 he worked for Massachusetts Audubon Society; followed by a residency in zoo and wildlife medicine at Tufts Veterinary School under Dr. Charles Sedgwick. He became a faculty member at Tufts Wildlife Clinic in 1988 and succeeded Dr. Sedgwick as Director of the Wildlife Clinic 1994. He is one of the co-founders of Tufts Center for Conservation Medicine and served as the Center's director for several years. Currently, Dr. Pokras teaches in Tufts programs in conservation medicine, public health and international veterinary medicine.

Dr. Pokras holds a seat on the Massachusetts Nongame and Endangered Species Advisory Committee and regularly consults for a variety of private, state and federal wildlife and environmental agencies. Special areas of interest include the medicine and surgery of native wildlife, aquatic birds as indicators of environmental health, allometric scaling, and conservation biology. He and his wife have 2 wonderful daughters in their 20's. Hobbies include playing several musical instruments, birding, kayaking and a variety of outdoors activities.

Edward B. Arnett, Ph.D. Conservation Scientist & Director of Programs Bats Conservation International. Dr. Arnett is a Conservation Scientist and Director of Programs at Bat Conservation International. He holds a Bachelor of Science in Biological Sciences/Fish and Wildlife Management from Montana State University, a Master of Science in Zoology and Physiology from the University of Wyoming, and Ph.D. in Forest Science from Oregon State University. He has studied bats for the past 15 years and during the past 6 years he has led research efforts on bats and wind energy that focuses on testing the effectiveness of turbine operational curtailment and deterrent devices to reduce bat fatality. His research also focuses on determining the effectiveness of pre-construction survey efforts for bats in predicting their risk at wind facilities. Ed served on the U.S. Department of Interior's Federal Advisory Committee for developing recommendations for the US Fish and Wildlife Service's guidelines for wind energy and wildlife, serves on the Association of Fish and Wildlife Agencies' Energy Committee and subcommittee on wind energy, and chaired The Wildlife Society's technical review committee on wind energy impacts on wildlife.

Dr. Arnett will present the current state of knowledge on impacts of wind energy on wildlife and discuss challenges and opportunities for developing solutions to reduce impacts on wildlife at wind facilities.

Amy Cilimburg. Director of Conservation and Climate Policy. Montana Audubon. As director of Conservation and Climate Policy for Montana Audubon, she coordinates science, education and outreach efforts to conserve Montana's native birds and their habitats. She spearheads Montana's Important Bird Areas (IBA) Program and collaborates with the Montana Bird Conservation Partnership and others to encourage citizen science projects and other efforts to protect key bird species and habitats from the most prominent threats of today. She also works to educate and inspire action and sound policy around issues related to global climate change and energy both here in Montana and nationally. Prior to coming to Montana Audubon, Amy was the Assistant Director of the University of Montana's Avian Science Center. She received a M.S. in Wildlife Biology from the University of Montana in 2001. Prior to this she spent 10 years teaching with the National Outdoor Leadership School both around the west and internationally. She lives in Missoula with her husband and daughter.

Rob Domenech, Raptor View Research Institute President. Rob graduated from the University of Montana in 2002 with a Wildlife Biology degree after eight years of attending classes in the spring and working on raptor migration studies in the fall. He worked throughout Western Montana for over ten years on various studies while scouting for suitable sites for the first fall migration ridgeline banding study in Montana. He founded Raptor View Research Institute (R.V.R.I.) in 2004 to continue his Raptor migration studies and its mission continues to evolve. Rob's enduring passion for raptors and his desire to work with at risk youth, has led R.V.R.I. to concentrate its outreach programs on educating the community by bringing small groups into the field for hands-on experience with raptors. Rob's future plans for R.V.R.I. are to expand on its early success with programs that include an Osprey monitoring project geared specifically toward at-risk youth and a Swainson's hawk nesting study, both of which are spring/summer projects.

Student Professional Mixer & Mentoring Session

Wednesday, February 23, 2011
6:15-10pm
Big Sky Atrium

6:15-6:45pm—Social
6:50-7:30pm—Mentoring Session
7:30-8pm—Social
8:00-10:00pm—Quiz bowl

Participants need for mentoring session! Session includes 1 hour guided discussion between students and professionals.

Professionals: WE NEED YOU to pass on your valuable knowledge of academics and the professional world to upcoming young professionals!

Students: WE NEED YOU to pick the brains of professionals with valuable experience…and possible jobs!

All are invited the watch the Quiz Bowl and cheer on your favorite teams. Teams consist of 2-3 students and 1 professional. Prize for top team!

Food and Drinks will be provided!

GENERAL ABSTRACTS

Alphabetical by First Author's Last Name (* denotes presenter)

EVALUATION OF WILDLIFE GUARDS AT ACCESS ROADS

Tiffany D.H. Allen*. Western Transportation Institute. Montana State University. PO Box 174250. Bozeman MT 59717.

Marcel P. Huijser. Western Transportation Institute. Montana State University. PO Box 174250. Bozeman MT 59717.

David W. Willey. Department of Ecology. Montana State University. 310 Lewis Hall. Bozeman MT 59717.

The reconstruction of 90.6 km of U.S. Highway 93 from Evaro to Polson, MT on the Flathead Indian Reservation includes 41 fish and wildlife crossing structures and 13.4 km of road with wildlife fencing. These measures are aimed at reducing wildlife–vehicle collisions, while allowing wildlife to cross the road. In fenced road sections, gaps for side roads are mitigated by wildlife guards (similar to cattle guards). We focused on a 1-km fenced section where animals can either cross the road using 5 crossing structures (4 culverts, 1 bridge), or they can access the road through two guards on the east side and cross using jump-outs (i.e. earthen ramps that allow animals in fenced areas to jump down to safety) on the west side. We monitored wildlife movements with cameras at the two guards and in one large crossing structure adjacent to a guard. We investigated how effective these guards are in keeping deer (*Odocoileus spp*.) from accessing the road. We also compared movements across a guard to those through a crossing structure. The guards were 85% or more effective in keeping deer from accessing the road, and 93.5% of deer used the crossing structure instead of an adjacent guard when crossing the road. Though the guards were not an absolute barrier to deer, the results indicate that deer were substantially discouraged from crossing the guards, and the vast majority crossed the road using the crossing structure rather than the guard, indicating that guards are an effective means of mitigation. ****Student Presentation****

USING CAMERAS EFFECTIVELY TO MONITOR WILDLIFE

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Tracy Holland, Alter Enterprise, LLC., PO Box 593, Lolo, MT 59847. 406-273-0223, tracy@alterenterprise.com

There are two important wildlife management issues that can be solved by using the appropriate wildlife camera. The first is human interference in wildlife behavior studies. As much as researchers try to do everything possible so animals won't notice their presence during a study, most wildlife have a keen senses that alert them to humans nearby and cause them to react differently to situations. Using motion-sensored cameras eliminates the human factor and allows wildlife to behave more naturally. Another important issue that wildlife conflict managers come across is not having enough time in the day. Our study used remote uploading, wireless wildlife cameras to help biologists involved in conflict management situations with

grizzly bears. The biologists were able to easily set up the cameras near residents who had complained of grizzly bears damaging property. Having the cameras automatically upload pictures allowed the biologist to observe the wildlife conflicts and the status of the deterrent measures from a remote location. The biologists could view the pictures almost immediately through their email and know what was occurring at the site. If there was a trap or deterrent set up, the biologist could see whether an animal was caught and needed to be removed, or could similarly observe that the trap was empty and would save themselves a trip to the site. This saved innumerable man hours of physically checking the traps and conflict sites and even saved the life of an owner's dog that had unknowingly been trapped in a leg snare.

HOW TO TRICK A WOLF: MANIPULATING PACK MOVEMENTS WITH BIOFENCING

David E. Ausband*, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812

Michael S. Mitchell, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812

Wolves (*Canis lupus*) have a relatively wide distribution in the northern Rockies and can conflict with livestock production in certain areas. Tools currently available to mitigate wolf/livestock conflict can be short-lived in their effectiveness or altogether ineffective. Wolves use scent-marking to establish territories and avoid intraspecific conflict. We hypothesized that human-deployed scent-marks could be used to manipulate wolf pack movements in Idaho. We deployed 64.7 km of biofence within 3 wolf pack territories during summer 2010. Location data from collared wolves showed little to no trespass of the biofence. Sign surveys at predicted rendezvous sites yielded little to no recent wolf use of exclusion areas. Lastly, a habitually depredating wolf pack was not implicated in any depredations. Our pilot test provides preliminary evidence that wolf movements can be manipulated using human-distributed scent-marks.

WOLF MANAGEMENT IN THE NORTHWESTERN UNITED STATES

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Mike Jimenez, USFWS, Jackson, WY

Carolyn Sime, Montana Fish, Wildlife and Parks, Helena, MT

Jon Rachael, Idaho Department of Fish and Game, Boise, ID

Curt Mack, Nez Perce Tribe, Lapwai, ID

Doug Smith, National Park Service, Yellowstone National Park, WY

Kenneth Mills, Wyoming Game and Fish Department, Pinedale, WY

Jeff Green, USDA APHIS, Wildlife Services, Denver, CO

Gray wolves (Canis lupus) were deliberately eliminated from the northern Rocky Mountains (NRM) by 1930. Restoration began in 1986. There are currently nearly 120 breeding pair and 1,800 wolves. Wolf restoration initially proceeded with more benefits and fewer problems than predicted. However, conflicts have steadily increased since 2002 when the population first met its minimum recovery goal. About $40 million has been spent since 1974 and the management program currently costs >$4 million/year. Wolves were delisted in 2008 and 2009 but relisted by federal court order in 2009 and 2010. While the NRM wolf population is biologically recovered, public opinion remains divisive and the legal, political, and policy decisions will continue to be litigated by a diversity of interests. Science is a poor tool to resolve the differing human values that continue to be debated with great passion through wolf symbolism.

CURRENT STATUS OF TRUMPETER SWAN REINTRODUCTION AT THE FLATHEAD INDIAN RESERVATION

Dale M. Becker*, Tribal Wildlife Management Program, Confederated Salish and Kootenai Tribes, P. O. Box 278, Pablo, MT 59855. daleb@cskt.org

Janene S. Lichtenberg, Tribal Wildlife Management Program, Confederated Salish and Kootenai Tribes, P. O. Box 278, Pablo, MT 59855. janenel@cskt.org

The Confederated Salish and Kootenai Tribes, in partnership with other agencies and non-governmental organizations, commenced a project to reintroduce trumpeter swans (Cygnus buccinator) at the Flathead Indian Reservation in 1996. Between 2002 to 2010, 191 swans were released on the Reservation. Released swans generally wintered locally in the lower Flathead River drainage and its tributaries, likely due to mild winter weather conditions, abundant open water and ample food resources. Wintering swans from the project were also observed in southwestern Montana, northeastern Colorado and eastern Idaho, but few of these known migrants survived. Collisions with overhead power lines accounted for the majority of documented mortalities. Cooperative efforts with the local electrical utility are underway to mark lines and the marking seems to have reduced the incidence of collision mortalities. The first wild-nesting trumpeter swans from the reintroduction project were observed in 2004, with continued successful nesting each subsequent year and a total production of 89 fledged cygnets. Future plans for the reintroduction project include additional releases of captive-reared swans, continued monitoring of released and wild hatched swans, wetland habitat restoration projects, and marking of additional power lines.

AVIAN SCAVENGERS AND LEAD RIFLE AMMUNITION: WHERE WE'RE AT, CHALLENGES, AND SOLUTIONS

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Birds have long been recognized at risk of lead poisoning from ammunition sources, but only in recent years has rifle ammunition been identified as a source of lead toxicity in raptors and other scavenging birds. Several studies have indicated increased lead exposure in eagles but the implications to population dynamics remain unclear. We have monitored blood lead levels of Common Ravens (Corvus corax), Bald Eagles (Haliaeetus luecocehpalus), and Golden Eagles (Aquila chrysaetos) in Jackson Hole, Wyoming, since 2004 to investigate effects of spent rifle ammunition on avian scavengers. Data from ravens and Bald Eagles indicated a strong relationship between big-game hunting seasons and elevated blood lead levels. In 2009, we initiated a voluntary non-lead ammunition program in collaboration with Grand Teton National Park and the National Elk Refuge. Free, non-lead ammunition was distributed to hunters in the area. Hunter surveys indicated that 24% of successful hunters on the Park and Refuge used non-lead ammunition and we detected a 28% drop in the mean lead levels of ravens monitored from previous years after the harvest totals were controlled for. We continued the voluntary program in 2010 by selling reduced-priced non-lead ammunition and there was greater participating in the voluntary non-lead program (33%). Further, we have outfitted 13 Bald Eagles with satellite transmitters to document the potential geographic impact our local hunting season has on the continental eagle population and found that 90% of eagles outfitted during the big-game hunting season breed/summer in central Canada.

LANDSCAPE-SCALE CONSERVATION AND MANAGEMENT OF MONTANE WILDLIFE: CONTEMPORARY CLIMATE MAY BE CHANGING THE RULES

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Montane ecosystems have been suggested by both paleontological and contemporary results to be systems of relatively rapid faunal change, compared to many valley-bottom counterparts. In addition to experiencing greater magnitudes of contemporary change in climatic parameters than species in other ecosystems, mountain-dwelling wildlife must also accommodate often-greater intra-annual swings in temperature and wind speeds, poorly developed soils, and generally harsher conditions. Research on a mountain-dwelling mammal species across 15 years of contemporary data and historical records from 1898-1956 suggest that pace of local extinctions and rate of upslope retraction have been markedly more rapid, and governed by markedly different dynamics, in the last decade than during the 20th century. This may mean that understanding past dynamics of species losses may not always help us predict the patterns of future loss. Given the importance of clinal variability and ecotypic variation, phenotypic plasticity, behavioral plasticity, and variation in climatic conditions, it is not uncommon for

widely-distributed species' geographic ranges to be determined by different factors in different portions of their range. Consequently, greatest progress in understanding distributional-change phenomena will occur with coordinated, landscape-scale research and monitoring. Landscape Conservation Cooperatives and Climate Science Centers are newly emerging efforts that may contribute greatly to such broad-scale investigations (e.g., climate-wildlife relationships). Based on our empirical findings and our review of related literature, we propose tenets that may serve as foundational starting points for mechanism-based research at broad scales to inform management and conservation of diverse montane wildlife and the ecosystem components with which they interact.****Student Presentation****

EVALUATING THE GENETIC DISTINCTIVENESS OF THE SALMON RIVER DRAINAGE BIGHORN SHEEP AND THEIR CONNECTIVITY TO NEIGHBORING POPULATIONS

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Rocky mountain bighorn sheep (Ovis canadensis canadensis) were historically abundant in Idaho but currently, population levels remain low. Bighorn Sheep (BHS) in the Salmon River drainage are considered one of Idaho's only remaining native sheep populations because they were never completely extirpated from their historic range. In addition, there has been little or no genetic influence via translocation of sheep from outside the drainage potentially making this BHS population genetically unique to Idaho. Contrastingly, surrounding populations to the west and east were extirpated or severely reduced and have subsequently been reintroduced or heavily augmented through use of translocations from Canada and several western states. There is presumed to be some degree of population connectivity between the Salmon River sheep and surrounding areas but to date, this has not been investigated using genetic data. To assess the genetic distinctiveness of Salmon River bighorns and their connectivity to other populations, we have collected genetic data from 15 nuclear DNA microsatellite loci for 256 BHS using blood and horn shaving samples across a 33,786km^2 study area in central Idaho. The number of BHS genetic groups will be determined using Bayesian clustering algorithms and the degree of connectivity between populations will be examined using Fst and assignment tests.

Future directions include comparing radio-location data and genetic information to investigate structure/connectivity and potential for disease transmission of SRD bighorns as well as examining relationship between lamb productivity/survival and genetic diversity/gene flow.
****Student Presentation****

A REGIONAL ANALYSIS OF FACTORS AFFECTING ADULT FEMALE ELK SURVIVAL

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The Western Elk Research Collaborative has pooled elk (*Cervus elaphus*) telemetry data from seven states, one Canadian province, and Yellowstone National Park. We have collected data from 3550 individual elk across 51 populations. The vast spatial scale of this analysis affords us an unprecedented opportunity to understand how natural ecological conditions and human changes to the environment influence survival of this critical segment of the population. We use proportional hazards models and information-theoretic approaches to assess how predator diversity, harvest by humans, habitat conditions, land use, climatic factors, and interactions between these factors affect adult female survival across the region. Most of our variables are uniform within a given population, but we also assess the effects of "age" at the individual level. Some variables such as land tenure, road density, and forest cover are considered temporally static for the purposes of this study, whereas others such as precipitation, climate, and density dependence could vary over time within each population. The survival estimates we generate will ultimately help inform decision-support tools that managers could use at statewide and regional scales to explore how harvestable numbers of elk are influenced by management of habitat and predation in the context of climatic and habitat changes.

WINTER ECOLOGY OF THE SHIRAS MOOSE ON THE MOUNT HAGGIN WILDLIFE MANAGEMENT AREA

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Moose populations across Montana have expanded in the last century, both in geographic range and in population size. This expansion has had a negative impact on moose winter range in some locations where moose have overutilized key browse species. Excessive and unsustainable browsing has the potential to reduce local biodiversity and carrying capacity of moose and other ungulates. The browse species of interest in this study were willow (*Salix* spp.), a highly palatable and abundant browse source for moose on many winter ranges, including our study area in southwestern Montana. The objectives of this study were to determine patterns of willow community use by selected female moose during winter and to quantify willow utilization across the study area to examine population scale habitat use through browse patterns. To accomplish these objectives we deployed GPS collars on 18 cow moose, 6 each in the winters of 2007, 2008, and 2009-2010. We also completed large scale, systematic browse surveys in the springs of 2008, 2009 and 2010. Results indicated cow moose spent the plurality of the winter within willow communities (48.4%, 48.2%, 51.8%, and 49.8% of locations in the winters of 2007, 2008, 2009, and 2010, respectively), but the estimated percentage of browsed willow twigs across the study area was low (11.5%, 8.0%, and 8.3% in 2008, 2009, and 2010, respectively). Our data suggest that while moose have the potential to significantly impact willow communities, this did not appear to be the case on the Mount Haggin WMA at current moose densities. ****Student Presentation****

WHAT CAN WE LEARN FROM CALF/COW RATIOS?

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Trends in population growth can be monitored with data for key vital rates without requiring knowledge of abundance. Adult female survival has the highest elasticity for ungulate population dynamics, but the more variable recruitment rates can be better predictors of local variation in growth rates. Recruitment is often monitored using young:adult age ratios, which are difficult to reliably interpret given the contribution of multiple vital rates to annual ratios. We show how concurrent monitoring of adult female survival and age ratios allows both retrospective estimation of empirical population growth rates and the decomposition of recruitment-specific vital rates. We demonstrate the estimation of recruitment and population growth rates for one woodland caribou population using these methods, including elasticity and life-stage simulation analysis of the relative contribution of adult female survival and recruitment rates to variation in population growth. We show, for this woodland caribou population, that adult survival and recruitment rates are nearly equivalent drivers of population growth rates. We recommend the concurrent monitoring of adult female survival to reliably interpret age ratios when managing caribou and other ungulates. ****Student Presentation****

STABLE ISOTOPE ANALYSIS OF SUMMER WOLF DIET IN NORTHWESTERN MONTANA

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When distinct $\delta^{13}C$ and $\delta^{15}N$ values of potential prey are known, stable isotope analysis (SIA) of wolf (*Canis lupus*) hair can be used to estimate diet variability at the individual, pack, and regional levels. Our objectives were to estimate intra-population diet variability, and determine proportions of prey consumed by wolves. We collected guard hairs of 45 wolves from 12 packs in northwestern Montana and temporally matched scats from 4 of the same

packs, summer 2008 and 2009. We used hierarchical Bayesian stable isotope mixing models to determine diet and scales of diet variation from $\delta^{13}C$ and $\delta^{15}N$ values of wolves, deer (*Odocoileus* spp.), elk (*Cervus canadensis*), moose (*Alces alces*), and other prey. We calculated percent biomass of prey consumed from scats, and used bootstrapped scat data, and Markov Chain Monte Carlo simulation data from stable isotopes to estimate confidence intervals of difference between results from each technique for the 4 packs with matched samples. Differences among packs explained most variability in diet based on stable isotopes, and moose was the most common prey item for 11 of 12 packs. From scat data, deer was the most common prey item for 3 of 4 packs, and estimates of moose consumed were significantly different from SIA estimates for the same 3 packs. The proportion of moose in wolf diet may have been overestimated by SIA because wolf-specific fractionation values were not available. Stable isotope analysis has the potential to efficiently provide useful management information, but experimentally derived fractionation values for wolves would likely improve the accuracy of estimates in future studies. ****Student Presentation****

THE STATUS OF GOLDEN EAGLES IN THE WEST: MIGRATION, BREEDING, AND ENERGY INFRASTRUCTURE

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Golden Eagles (*Aquila chrysaetos*), are widespread raptors, breeding predominately in western North America, from northern Alaska to central Mexico, occupying a wide range of habitats from arctic tundra to deserts. Several studies have recently indicated decreasing population estimates for migrant and wintering Golden Eagles in the western US. Long-term point count surveys of migrating raptors along the Rocky Mountain Front flyway have indicated approximately a 50% decline in total autumnal and vernal Golden Eagle migrants observed over the past 15 years and suggest the rate of decline has been increasing. Regionally, specific populations in the Lower 48 and parts of Alaska have been well studied on their breeding grounds. Some of these populations appear to be stable, while others show declines. Observed declines, appear to be associated with habitat alterations. Oil and gas resource extraction has increased noticeably across many areas of the West. The demand for resource extraction is growing and now includes renewable energy facilities such as wind farms. Due to the greater than ever human presence on the landscape and projected increases in development, it is critical to assess eagle response to these changes within their current and historic breeding, migration and winter ranges. Mapping current Golden Eagle habitat use, locally and at the landscape level to better understanding the relationships between human activities and eagle ecology, are the vital first steps to creating a balance between maintaining viable Golden Eagle populations and sustainable development. ****Plenary****

BLOOD-LEAD LEVELS OF FALL MIGRANT GOLDEN EAGLES IN WEST-CENTRAL MONTANA

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Lead has long been documented as a serious environmental hazard to eagles and other predatory, opportunistic and scavenging avian species. The use of lead shotgun pellets for waterfowl hunting on federal and state lands was banned in 1991 due to lead poisoning in Bald Eagles (*Haliaeetus leucocephalus*), Golden Eagles (*Aquila chrysaetos*) and numerous waterfowl species. At that time, this was thought to be the only major source of the lead exposure. More recently, lead poisoning from ingested lead-bullet fragments and shotgun pellets has been identified as the leading cause of death in California Condors (*Gymnogyps californianus*), leading to the recent ban of lead ammunition within the "California Condor Recovery Zone." Another on-going study on Common Ravens (*Corvus corax*) and Bald Eagles in Wyoming has shown a direct correlation between very high blood-lead levels and the on-set of rifle hunting season. Indeed, there is overwhelming evidence showing that lead toxicity is still prevalent in the environment and mounting data points to fragmented rifle bullets as the source. We sampled blood from 131 Golden Eagles captured on migration during the fall from 2006 and 2010 to quantify a suite of possible heavy metal contaminants, with an emphasis on lead.

THE DICHOTOMY OF CONSERVATION – MANAGING ELK IN THE WILDLAND/URBAN INTERFACE OF MISSOULA , MONTANA

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The Missoula Valley in western Montana is home to nearly 800 wintering elk, including the North Hills, Evaro, Jumbo, O'Brien Creek and Miller Creek herds. With the City of Missoula as the hub, the Valley has experienced substantial human population growth over the last 30-years. This increased growth and subsequent development has consumed and fragmented wildlife habitat and placed additional recreational demands on adjacent public lands. Wildlife biologists with Montana Fish, Wildlife and Parks have worked cooperatively with local governments, federal agencies, land trusts, other non-governmental organizations, and the general public to conserve and protect important elk winter range and habitat connectivity within the wildland/urban interface of the Missoula Valley. From a biological perspective, we have been extremely successful in managing for the persistence of elk populations. However, protecting winter range adjacent to and fragmented by human development has additional management challenges and costs. Since 1980, the North Hills elk herd has grown an average of 11% per year, with a 48% growth rate occurring between 2000 and 2007. Without an effective harvest, this population is expected to double in less than seven years. To protect elk winter range and to continue to keep elk wild, wildlife biologists have needed to become more creative with their management and conservation strategies. This presentation discusses those strategies, as well as the dichotomy of conserving elk winter range and managing elk on human developed landscapes.

MONTANA ELECTRONIC PRECIPITATION MAP

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A new average annual precipitation map (AAP) has been developed for Montana using GIS techniques including universal Kriging and elevation dependent linear regression. The map can be updated with new base periods or used for different parameters. The current map uses the 1981-2010 AAP base period and universal Kriging.

Results were compared to hand-drawn maps to assure appropriate location of isohyets. Stations adjacent to Montana in Idaho, Wyoming, North Dakota, South Dakota, Alberta, and British Columbia were used to assure compatibility along the border and provide the capability to develop a comparable map for drainages flowing into Montana.

Isohyetal lines were set at 2-inch increments under 20 inches AAP and 10 inch increments above 20 inches. Approximately 1400 stations were used for analysis of which about 1100 were in Montana and 300 in areas adjacent to Montana.

AAP was estimated at snow courses using correlation between April 1 snow water equivalent and AAP from SNOTEL stations in their area. NWS Climatological stations and NRCS SNOTEL stations provided majority of locations having current AAP. Data from an old NWS storage precipitation gage network, NRCS storage gages, and RAWS stations were also incorporated as well as a few stations from individuals, USGS, USFS, and others. To assure that precipitation at elevations above and below the data sites was applied correctly, synthetic points were developed using linear elevation-precipitation relationships from nearby measured sites. Maps will be available through Montana DEQ or Montana NRIS web sites electronically.

THE BIRD'S-EYE VIEW EDUCATION PROGRAM: USING BIRD RESEARCH TO EDUCATE THE PUBLIC ON THE IMPORTANCE OF HEALTHY RIPARIAN SYSTEMS

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The Upper Clark Fork River Basin (UCFRB) has been degraded by over 100 years of mining and smelting activities. The UCFRB is the largest contiguous complex of federal Superfund sites in the nation. Restoration and remediation efforts were initiated in the late 1980s and will continue, at a minimum, through 2030. Any restoration activity should include public education and outreach so that land-use decisions in the future do not compromise the integrity of the ecosystems that support the region. We have developed a program, the Bird's-eye View Education Program, which integrates public education and research on the ecological health of the UCFRB. Specifically we focus on birds, inviting the public to observe research at songbird banding stations and Osprey nests. Riparian-associated birds are likely to respond positively to riparian restoration activities and can be used as bio-indicators to measure success. In 2010 we operated three bird banding stations and monitored 19 Osprey nests. We captured 595 songbirds, collected 43 blood and feather samples from Osprey chicks, and served nearly 1000 participants. The program was an outstanding success and results from an assessment show that participants leave with a positive attitude toward the outdoor science experience and a general knowledge of Upper Clark Fork restoration, history, and its riparian ecosystems.

THE MOUNTAIN UNGULATE RESEARCH INITIATIVE: A COLLABORATIVE EFFORT TO ADVANCE UNDERSTANDING OF BIGHORN SHEEP AND MOUNTAIN GOAT ECOLOGY

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Bighorn sheep and mountain goats are important components of the faunal assemblage of Montana's mountainous ecosystems representing high-profile large mammals that garner substantial public interest. While population restoration, augmentation, and introductions have traditionally been the predominant conservation activities associated with these species in Montana, basic ecological research has been limited. A new research initiative has been developed and funded to study bighorn sheep and mountain goat spatial and population ecology in a number of ecological settings within the Greater Yellowstone Ecosystem. The aspiration of the collaborators is to develop a long-term research program that could expand to other populations of these species in Montana if we are successful. Primary objectives of the studies include 1) understanding the ecological interactions between sympatric populations, 2) developing and refining habitat suitability models, 3) documenting spatial dynamics within and among populations and identifying important movement corridors, 4) collecting vital rate data to better understand population dynamics, and 5) investigating potential responses of bighorn sheep and mountain goats to gradual changes in the regional climate. The presentation will describe the collaboration and ongoing efforts to consolidate all available data on bighorn sheep and mountain goats in the GYE. These data are used to describe mountain goat range expansion within the GYE over the past half century and to conduct initial habitat modeling efforts. We will also describe our plans for initiating field studies in the near future.

IMPORTANCE OF RECRUITMENT TO ACCURATELY PREDICT THE IMPACTS OF HUMAN-CAUSED MORTALITY ON WOLF POPULATIONS

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Reliable analyses can help wildlife managers make good decisions, which are particularly critical for controversial decisions such as wolf (*Canis lupus*) harvest. Creel and Rotella (2010) recently predicted substantial population declines in Montana wolf populations due to harvest, in contrast to predictions made by Montana Fish, Wildlife and Parks (MFWP). Here we replicate their analyses considering only those years in which field monitoring was consistent, and we consider the effect of annual variation in recruitment on wolf population growth. We also use model selection to evaluate models of recruitment and human-caused mortality rates in wolf populations in the Northern Rocky Mountains. Using data from 27 area-years of intensive wolf monitoring, we show that variation in both recruitment and human-caused mortality affect annual wolf population growth rates and that human-caused mortality rates have increased with the sizes of wolf populations. We also show that either recruitment rates have decreased with population sizes or that the ability of current field resources to document recruitment rates has recently become less successful as the number of wolves in the region has increased. Predictions of wolf population growth in Montana from our top models are consistent with field observations and estimates previously made by MFWP. Familiarity with limitations of raw data helps generate more reliable inferences and conclusions in analyses of publicly-available datasets. Additionally, development of efficient monitoring methods for wolves is a pressing need, so that analyses such as ours will be possible in future years when fewer resources will be available for monitoring.

UNICOR: A SPECIES CONNECTIVITY AND CORRIDOR NETWORK SIMULATOR

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Maintenance of species and landscape connectivity has emerged as an urgent need in the field of conservation biology. Current gaps include quantitative and spatially-explicit predictions of current and potential future patterns of fragmentation under a range of climate change scenarios. To address this need, we introduce UNIversal CORridor network simulator (UNICOR), a species connectivity and corridor identification tool. UNICOR applies Dijkstra's shortest path algorithm to individual-based simulations and outputs can be used to designate movement corridors, identify isolated populations, and characterize zones for species persistence. The program's key features include a driver-module framework, connectivity maps with thresholding and buffering, and graph theory metrics. Through parallel-processing computational efficiency is greatly improved, allowing for larger ranges (grid dimensions of thousands) and larger populations (individuals in the thousands), whereas previous approaches are limited by prolonged computational times and poor algorithmic efficiency; restricting problem-size (range and populations), and requiring artificially subsampling of target populations. ****Student Presentation****

FUNCTIONAL LANDSCAPE CONNECTIVITY OF GREATER SAGE-GROUSE HABITAT IN A MULTIPLE USE LANDSCAPE

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Maintaining connectivity of sage-grouse habitat is critical to managing sage-grouse populations in the presence of widespread human disturbance. We used an empirical approach to model connectivity of a landscape based on resource selection of free-ranging GPS-collared greater sage-grouse (*Centrocercus urophasianus*) in a natural gas field in central Wyoming. We analyzed resource selection during three movement states (encamped, traveling, and relocating) and incorporated turning angle to identify features that functioned as barriers or conduits to movement. To illustrate application of the results we used the resource selection model to create spatially-explicit predictive maps identifying areas that generally provided large amounts of high quality 'movement habitat'. We found that both males and females selected for vegetation variables at multiple spatial scales. When traveling or relocating, males

and females tended to avoid natural gas and oil wells and associated infrastructure and avoided areas with high topographic roughness within 800m. High topographic roughness was a barrier for traveling males. Relocating females were more likely to travel in a straight direction through areas of high road density and steep slopes. The predictive maps validated well using independent GPS location data. These results provide insight into habitat preferences of sage-grouse and can be used for both general and site-specific guidance on identifying habitats preferred or avoided during moderate and long distance movements of sage-grouse. When combined with critical seasonal use maps (e.g., nesting/brooding habitat and winter range), land managers could delineate areas of high value for connectivity of critical seasonal use areas.

EFFECTS OF RECREATIONAL DISTURBANCE ON MEXICAN SPOTTED OWLS ON THE COLORADO PLATEAU IN SOUTHERN UTAH

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The Mexican spotted owl (*Strix occidentalis lucida*) was listed as a "threatened" subspecies in 1993 by the U.S. Fish and Wildlife Service. In the Canyonlands of Southern Utah, the spotted owl is associated with fragmented habitats characterized by steep rocky canyons that attract high levels of human use for recreation, including climbing, hiking, hunting, and ORVs. Human-use levels have strongly increased in the canyonland region, e.g., permits for access to popular canyon hikes increased 1714% during 1998-2002 in Zion National Park. To assess owl population status and estimate effects of human-use on spotted owls, we conducted an occupancy-based research project during the 2008, 2009, and 2010 breeding seasons (defined as March-August). We designed our study to estimate occupancy rates and detection probability among owl territories in four areas: Zion and Capitol Reef National Parks, Grand Staircase-Escalante National Monument, and Cedar Mesa. A primary objective was to estimate the potential effects of human recreation on occupancy of the owl territories ("sites"). In addition to occupancy, we estimated reproductive status. Preliminary results from our data analysis showed varying occupancy rates, with 83% occupancy at mesic sites (Zion and Cedar Mesa), and 43% at xeric sites (Capitol Reef and GSENM). Detection probability was estimated to be 89%. Human use did not appear to reduce occupancy or detection. Reproduction varied by year, with 2009 showing the highest number of young, and several years with relatively low production of juveniles. Our results suggest that current management of human-use in our study areas is not adversely affecting occupancy and reproduction by Mexican spotted owls. ****Student Presentation****

THE FUTURE OF WILDLIFE EDUCATION

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Students today need to be motivated to learn using methods that stimulate their creativity and excite them to look deeper into a subject on their own. As wildlife specialists we can contribute a unique expertise that teachers love to share with their students. With distance learning you can provide a virtual field trip for students in 30 minutes or less. Share your knowledge and love of animals and nature with students all over the world using videoconferencing technology. Be a part of raising the future generation of conservationists. During this presentation, we will show you how both Alter Enterprise and California State Parks use technology to engage students from afar and how any biologist can do the same from their own conservation area. Not only is this form of educational outreach exploding throughout schools, museums and libraries all over the world, but it is also creating a new love and understanding of wildlife that will hopefully show an increase of park and refuge visits by students who have had their interest sparked.

UNLOCKING SOME OF THE UNTAPPED VALUE ASSOCIATED WITH OUR 20-YEAR LANDBIRD MONITORING DATABASE

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Twenty years ago, numerous partners initiated a region-wide landbird monitoring program. I will provide a brief history, will describe the data we now have in hand, and will present a few results that have important management implications. Finally, I will discuss the niche modeling potential buried in the data that we have amassed, and will propose that the strategic placement of additional monitoring points carries the greatest chance of yielding useful results for wildlife biologists who work for land management and conservation organizations. We hope to pilot the new approach within a 3-forest region associated with the Southern Crown's Collaborative Forest Landscape Restoration Partnership this year.

MULTI-SCALE EFFECTS OF FOREST ROADS ON BLACK BEARS

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The black bear (*Ursus americanus)* population within the Coeur d'Alene River watershed of northern Idaho is exposed to high hunting and recreational pressure facilitated by a dense network of forest roads. Bears are hunted using bait and dogs in spring and fall, with an additional non-lethal summer pursuit season. To understand the effects of these roads on black bear behavior we used data collected from 28 adult bears fitted with Global Positioning Systems (GPS) collars from June 1 2007 through the fall of 2008. We used locations acquired

at 20 minute intervals to assess habitat selection and activity patterns of males and females at home range (2nd order) and within home range (3rd order) scales, both annually and seasonally. We tested the hypotheses that black bears 1) will show no response to road density in 2nd order habitat selection in areas of relatively consistent road density, 2) will show a functional response to roads in 3rd order habitat selection, i.e. use of habitat near roads will be inversely proportional to traffic volume, 3) show seasonal shifts in activity patterns and movement rates in proximity to roads. Avoidance of areas containing primary food sources or increased activity and energy expenditure may have profound consequences for bears. Understanding how traffic volume and road density influences habitat selection and movement patterns can therefore play an important role in management of the species. ****Student Presentation****

GRIZZLY BEAR POPULATION AUGMENTATION IN THE CABINET MOUNTAINS OF NORTHWEST MONTANA

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The Cabinet Mountains grizzly bear population was estimated at 15 or fewer individuals in 1988 and believed to be declining toward extinction. In response to this decline, a test of population augmentation techniques was conducted during 1990-1994 when 4 subadult female grizzly bears were transplanted to the area. Two criteria were identified as measures of success: bears must remain in the target area for one year, and bears should ultimately breed with native male grizzly bears and reproduce. Reproductive success of any of the remaining individuals could not be established until 2006 when genetic analysis of hair snag samples collected from 2002-2005 indicated that one of the transplanted bears remained in the Cabinet Mountains and had reproduced. The detected bear was transplanted in 1993 as a 2-year-old and was identified by a hair snag within 5 miles of the original release site. Genetic analysis indicated she had produced at least 6 offspring, and 2 of her female offspring had also reproduced. This reproduction indicates that the original test of augmentation was successful with at least one of the transplanted individuals. Success of the grizzly bear augmentation test prompted continuation of this effort. The Northern Continental Divide Ecosystem area of north central Montana has been the source of 7 additional bears transplanted to the Cabinet Mountains during 2005-10. All were female bears except one: a young male was moved in 2010. Two female bears were killed and two female bears left the area. Fates and movements of these bears are discussed.

HISTORY OF THE WALL CREEK WILDLIFE MANAGEMENT AREA

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As the manager for the Wall Creek Wildlife Management Area for 34 years, I will provide an overview of the history of the FWP purchase of the Wall Creek WMA as well as an overview of the history of the grazing system and elk and livestock use of the game range.

ENERGETICS AND SPACE USE OF FEMALE MOOSE DURING WINTER IN ALASKA

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Space use and resource selection are a linked processes that are important determinants of individual and population fitness. Knowledge of those processes is important to understanding wildlife-habitat relationships. Knowledge of this information can improve the efficacy of wildlife management programs and provide baseline information in the face of changing environments. I present research findings investigating energetic and space use parameters of a population of female moose inhabiting two distinct, but adjacent, landscape types on the Kenai Peninsula, AK, USA. I also examine how the inferences we derive from estimated space use patterns are influenced by the metrics we use to model space use by evaluating four contemporary home range models (Brownian bridges, fixed kernels, minimum convex polygons, and local convex hulls). ****Student Presentation****

QUANTIFYING THE PREDATOR-PREY RELATIONSHIP: LESSONS LEARNED FROM A MULTIPLE-PREY, WOLF-HYBRID ZONE IN ALGONQUIN PARK, ONTARIO, CANADA

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We studied winter kill rates and prey selection in an eastern wolf/moose/white-tailed deer system in Algonquin Park, Ontario Canada. Eastern wolves (C. lycaon) are a distinct species, known to hybridize with both gray wolves and eastern coyotes, resulting in genetic variation within the study area. Deer in Algonquin are seasonally migratory, and accessibility of deer shifts significantly over winter. Some wolf packs migrate off territory to forage on deer, while others remain on territory, relying on moose. Our objectives were to 1) identify factors influencing variation in prey use, and 2) compare methodologies for quantifying prey use in a multiple prey system. We used fine scale GPS collar data to identify kill sites, and calculated relative use of moose and deer for each pack using several measures, including prey biomass/wolf/day, days/kill/pack and a newly developed method of time spent at kill sites from GPS data. We also conducted stable isotope analysis to compare with field collected prey-use

data. Variation in prey use among wolf packs was most influenced by accessibility to deer, vulnerability of moose, and genetic admixture, and mediated by winter progression. Methodological comparisons showed that prey biomass/wolf/day tended to overestimate large prey items, while days/kill/pack overestimated the importance of small prey. Stable isotope results were inconsistent, revealing some possible weaknesses of this approach. We found wide variation in kill rates and relative prey use with winter progression, and spatial variation in age-specific predation associated with differences in hunter harvest pressure.

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

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Harlequin duck surveys have been carried out continuously on the Rocky Mountain Ranger District (RMRD) for 22 years, beginning in 1990. Streams are surveyed on foot in spring to assess occupancy by breeding pairs, and in summer to count broods. Habitat and activity data have been collected for 247 separate observations (comprising over 600 individual ducks). We have summarized the habitats in which harlequins have been observed, including potential differences between pair and brood observations. Harlequins on the RMRD tend to be found in habitats similar to those described for other areas: in fast-moving segments of streams and in areas with shrub or tree overstory. Most observations are in areas accessible to, but not immediately adjacent to areas of human use. Most observations do not occur in proximity to within-stream woody debris, which may differ from findings elsewhere. We have not yet collected data with which to evaluate whether harlequin ducks actively select for any of these habitat characteristics. In 2007 three major fires burned on the RMRD, affecting several key harlequin breeding streams. We altered our survey areas to focus on the most historically productive stream system in the hopes of detecting any impacts of fire on harlequin occupancy or productivity. We have also begun to survey streams that have not been surveyed since the original 1990-1992 inventory. We provide possible explanations for the absence of harlequin ducks on several apparently suitable stream systems, and discuss the direction we hope to take with future surveys and analyses.

CLIMATE CHANGE PREDICTED TO SHIFT WOLVERINE DISTRIBUTIONS, CONNECTIVITY, AND DISPERSAL CORRIDORS

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Recent work has shown a link between wolverine habitat and persistent spring snow cover through May 15, the approximate end of the wolverine's reproductive denning period. We modeled the distribution of snow cover within the Columbia, Upper Missouri and Upper Colorado River Basins using a downscaled ensemble climate model. We bracketed our ensemble model predictions by analyzing warm (miroc 3.2) and cool (pcm1) downscaled GCMs. Based on the downscaled ensemble model, 67% of predicted spring snow cover will persist within the study area through 2030-2059, and 37% through 2070-2099. Contiguous areas of spring snow cover become smaller and more isolated over time, but large (>1,000 km^2) contiguous areas of wolverine habitat are predicted to persist within the study area throughout the 21st century for all projections. By the late 21st century, dispersal modeling indicates that habitat isolation at or above levels associated with genetic isolation of wolverine populations becomes widespread.

THE EFFECT OF FIX RATE AND FIX INTERVAL ON FIRST PASSAGE TIME ANALYSIS

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First passage time analysis is a method of analyzing changes in animal movement along paths through habitats. First passage time is defined as the time required to traverse a circular region of a specified radius. Plots of variance in logged first passage times versus spatial scale have been used to help identify the scale at which search is concentrated. Two critical assumptions made when calculating first passage time are that movement is linear and speed is constant within a given circle. We investigate the robustness of first passage time results relative to these 2 assumptions using movement data collected on 8 grizzly bears in the Greater Yellowstone Ecosystem. We find that the spatial scale identifying area restricted search is dependent on both fix interval and fix rate suggesting that how GPS collars are programmed influences first passage time results. ****Student Presentation****

AVIAN COMMUNITY RESPONSE TO A RECENT MOUNTAIN PINE BEETLE EPIDEMIC

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Recent epidemics of mountain pine beetles (*Dendroctonus ponderosae*) will fundamentally alter forests of the Intermountain West, impacting management decisions related to fire, logging, and wildlife habitat. We evaluated effects of a recent mountain pine beetle epidemic on site occupancy dynamics of > 60 avian species in 4 study units dominated by ponderosa pine (*Pinus ponderosa*) in the Helena National Forest. Point count data were collected during the avian breeding seasons (May-July) of 2003-06 (pre-epidemic) and again during 2009-10 (post-epidemic). We used a Bayesian hierarchical model that accounts for detection probability to obtain occupancy estimates for rare and elusive species as well as common ones. We estimated occupancy and detection for all species with respect to the occurrence of the beetle outbreak, live tree density at fine scale (1 ha), and live tree density at coarse (landscape) scale (100 ha). Preliminary analyses focus on trends in occupancy for species of interest, such as the American Three-toed Woodpecker (*Picoides tridactylus*), as well as patterns of occupancy for nesting and foraging guilds. Results indicated diverse responses among species, with occupancy rates increasing for some and declining for others. ****Student Presentation****

USING GENETICS TO STUDY OTTER CONNECTIVITY AND POPULATION SIZE IN NORTH WESTERN MONTANA

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River otters (*Lontra canadensis*) have begun to recover in the Upper Clark Fork River (UCFR) after decades of mining and smelting activity severely impacted the population. An initial project in 2009 showed otters occur throughout the UCFR, but at seemingly lower densities than other rivers in Montana. We are working to estimate otter population size in the UCFR and determine connectivity between other geographically close rivers. We are using 11 microsatellite loci amplified from tissue samples collected from trapped otters to look at connectivity between 5 rivers: the Bitterroot River, Blackfoot River, Clearwater River, UCFR, and Lower Clark Fork River. We are using heterozygosity and F_{st} values to indicate population substructuring, as well as using principle component analysis to visualize any differentiation. Additionally, we are using hair collected from hair snares to genetically estimate population size in the UCFR. Initial results from tissues indicate that otters in the 5

rivers are highly connected, and no one population is more connected to the UCFR than another. These results are based on a small samples size; additional samples currently being analyzed will enhance our ability to interpret this situation. Additional samples will be collected in 2011 to strengthen the population estimate. This is one of a few projects, and the first in Montana, to use genetics to look at population substructuring in otters. ****Student Presentation****

USING SPATIAL MODELS TO MAP BIRD DISTRIBUTIONS ALONG THE MADISON RIVER

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The Avian Science Center developed predictive maps of species distributions for the Madison River based on newly available riverine system data from the National Wetlands Inventory (NWI) and the Natural Heritage Program's Landscape Integrity Model. We used a maximum entropy model (MaxEnt) to predict species distributions using species occurrence locations collected from 2003-2010. Models performed well for 13 species, demonstrating that available environmental data layers, including NWI, can be used to successfully predict species distributions along the Madison River for a number of important riparian bird species. These models allow fine-scale mapping of habitat suitability for riparian birds, which fills gaps in current data on species distributions, and can be used to prioritize riparian conservation and restoration projects.

SOMETHING'S FISHY: A GENETIC INVESTIGATIONS OF SCULPIN SPECIES IN WESTERN MONTANA

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Sculpin (*Cottus* spp.) are small, cryptic, bottom-dwelling fish native to cool and coldwater systems throughout North America. Although three species of primarily stream-dwelling

sculpin are thought to occur in Montana (one of which is a species of concern), their taxonomy, distribution, and origin are not well understood. In western Montana, the present distribution of sculpin species may have been shaped by both historical events (e.g., the Columbian Ice Sheet) and contemporary landscape changes (passage barriers, climate change, pollution, etc.). To evaluate sculpin presence, and species diversity, we analyzed sculpins from river drainages throughout western Montana—the Clark Fork, Blackfoot, Flathead, Bitterroot, Kootenai, Gallatin, Madison, and Missouri—east and west of the Continental Divide. We analyzed 135 samples at the mitochondrial DNA COXI gene and at 11 microsatellite DNA loci. Preliminary results of genetic analysis suggest the presence of four distinct species with hybridization among three of the species in some locations. Hybridization led to uncertainty in species designations based on morphology, but even genetically pure fish were occasionally misidentified. One species may represent an undescribed taxon that is limited in its distribution to the St. Regis drainage, although its relation to sculpin in Idaho is unknown. A second species, previously thought to be Cottus bairdii, is distinct from that taxon and is distributed on both sides of the Continental Divide.

LONG-TERM EFFECTS OF PONDS, CLIMATE, AND UPLAND HABITATS ON PRAIRIE-NESTING DUCKS

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North American mid-continental breeding duck populations have historically demonstrated extreme annual variability, typically attributed to variation in annual spring pond numbers. However, strengths of these relationships have not remained constant over time or space for some species. Possible explanations for changes in duck/pond associations include reduced quality of wetlands and reduced quantity or quality of upland habitats. Therefore, I hypothesized that changes in the associations between ducks and ponds could be attributed to spring precipitation, temperature, and upland habitats.

I modeled observed duck numbers using random coefficient models structured to represent Gompertz population growth with environmental covariates. Varying modeled intercepts and slopes identified segment specific variation in carrying capacity and limiting environmental factors, respectively. I compared models of alternative a priori hypotheses describing duck abundances relative to various combinations of ponds, climate, and upland habitat using an information-theoretic approach.

Including additional climate and upland habitat covariates produced superior models to pond-only models when predicting duck abundances. Best models identified segment varying differences in the strengths of relationships between ducks and environmental covariates, implying spatial variability in factors limiting abundances. Top models were consistent with my hypothesis that climate and upland habitats provide additional information regarding duck population changes.

Knowledge of important environmental covariates that improve spatio-temporal models provides waterfowl managers with opportunities to target management programs in areas with the greatest benefits, or to protect specific habitat components where they are most limiting. Identifying areas with different levels of population response can potentially identify interesting new explanatory variables.
****Student Presentation****

LEAD, HEALTH & THE ENVIRONMENT: OLD PROBLEM & 21ST CENTURY CHALLENGE

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Conservation medicine examines the linkages among the health of people, animals and the environment. Few issues illustrate this approach better than an examination of lead (Pb) toxicity. Lead is cheap and there is a long tradition of its use. However the toxic effects of Pb have also been recognized for many years and our knowledge of the lethal and sublethal effects of Pb continues to grow dramatically. As a result, western societies have eliminated or greatly reduced many traditional uses of Pb, including many paints, gasoline and solders because of threats to the health of humans and the environment. Legislation in several countries has eliminated the use of lead shot for hunting waterfowl. Despite these advances, a great many Pb products continue to be readily available. Wildlife and environmental agencies recognize that angling and shooting sports deposit thousands of tons of Pb into the environment each year. Given what we are learning about the many toxic effects of this heavy metal, there is every reason to switch to non-toxic alternatives. To accomplish this, a broad, ecological vision is important. This presentation will briefly review the current state of knowledge on the toxicity of lead and its behavior in the environment, including the effects on wildlife, humans, and domestic animals. We will also discuss why wildlife professionals need to take a leadership role in bringing together all interest groups to find safe alternatives, to develop new educational and policy initiatives, to eliminate many current uses of Pb, and to clean up existing problems. ****Plenary****

LITERATURE REVIEW AND SYNTHESIS OF THE EFFECTS OF RESIDENTIAL DEVELOPMENT ON UNGULATE WINTER RANGE IN THE ROCKY MOUNTAIN WEST

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In the past 40 years human population and rural residential development at exurban densities have increased dramatically in the Rocky Mountain West resulting in increasing rates of conflict between high quality ungulate habitat and development. Roads and subdivisions near and in winter range affect ungulates in multiple ways and reduce management options. The literature review covered more than 100 articles on the effects of land use change, especially residential development at exurban densities, on five focal species; elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), white tailed deer (*Odocoileus virginianus*), American pronghorn (*Antilocapra antilocapra*) and bighorn sheep (*Ovis canadensis*). The direct and indirect effects of exurban development on ungulate winter range vary by region, species, specific habitat type, development type, and human wildlife perceptions. Topics of particular interest included zone of human influence, minimum habitat patch size requirements, habituation, thresholds between

functional and non-functional winter range, associated costs of exurban development, and cumulative effects. The literature sheds light on some of these issues, however, few studies addressed the impacts of land use change on population dynamics over the long term. For example, rigorous testing of the cumulative impact that multiple developments and development types (i.e., roads, housing, industrial development) have on seasonal habitat use and migratory behavior has been limited. Short-term and small-scale observational studies must be replaced by well designed experiments to help managers and planners make more credible recommendations to direct future exurban development. ****Student Presentation****

USING HUNTER SURVEY DATA TO ESTIMATE WOLF POPULATION SIZES IN MONTANA, 2007-2009

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Reliable knowledge of the status and trend of carnivore populations is critical to their conservation. In the Northern Rocky Mountains, wildlife managers need a time- and cost-efficient method for monitoring the large, growing population of gray wolves (*Canis lupus*) at a state-wide scale. We explored how hunter survey data could be incorporated into a multi-year patch occupancy model framework to estimate the abundance and distribution of wolf packs, wolves, and breeding pairs in Montana for 2007- 2009. We used hunter observations of wolves to estimate the probability that a given landscape patch was occupied by a wolf pack, and used additional data/models in combination with occupancy model output to provide estimates of total number of wolves and number of breeding pairs. Our modeling framework also allowed us to examine how geographic and ecological factors influenced occupancy and detection of wolf packs.. Our models provided estimates of number of packs, number of wolves, and number of breeding pairs that were within 20% of Montana Fish, Wildlife, and Parks minimum counts for 2007-2009. We found occupancy was positively related to forest cover, rural roads, and elevation and detection probability was positively related to hunter effort and forest cover. We believe that patch occupancy models based on hunter surveys offer promise as a method for accurately monitoring elusive carnivores at state-wide scales in a time- and cost-efficient manner. ****Student Presentation****

FACTORS INFLUENCING PIKA FORAGING BEHAVIOR IN THE NORTH CASCADES NATIONAL PARK SERVICE COMPLEX, WASHINGTON

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The American pika (*Ochotona princeps*) is a small lagomorph restricted to talus slopes at higher elevations or latitudes throughout mountainous regions in western North America. Pikas respond to seasonal fluctuations in food availability by haying (i.e., storing) vegetation for use during winter, and are considered a climate change indicator species because of their sensitivity to heat and restricted habitat requirements. Prior to 2009, no data existed on pika populations or foraging behavior in the North Cascades National Park Service Complex (NOCA) in Washington. To help address these data needs, we collected behavioral data on 95 foraging pikas throughout NOCA during summer 2009 and 2010 to better understand abiotic and biotic factors affecting foraging behavior and potential impacts of climate change on pikas. We calculated the proportion of time pikas spent grazing and haying, and developed competing hypotheses for each behavior expressed as logistic regression models consisting of climate, vegetation, elevation, date, and year covariates. We selected top models for both behaviors using information-theoretic techniques, and found that time spent grazing decreased while haying behavior increased through summer. Pikas spent more time haying as elevation increased while time spent grazing was negatively correlated with elevation, suggesting possible constraints in time available for foraging at higher elevations. Time spent grazing was also negatively correlated with temperature, a result likely in response to thermoregulation limitations of pikas. These results demonstrate how multiple factors may affect pika foraging behavior, thereby providing an opportunity to assist resource managers in future decisions regarding pika conservation. ****Student Presentation****

SURVIVAL AND MORTALITY OF MOUNTAIN LIONS IN THE BLACKFOOT WATERSHED, WEST-CENTRAL MONTANA

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We investigated population effects of harvest on mountain lions using a pseudo-experimental before-after-control-impact (BACI) design. We achieved this through 3 years of intensive harvest followed by a recovery period. In December 2000, after three years of hunting, approximately two-thirds of district 292 was closed to lion hunting which effectively created a refuge, representing approximately 12% (915 km^2) of the total Blackfoot watershed (7,908 km^2). Hunting continued in the remainder of the drainage, but harvest levels declined between 2001 and 2006 as quotas were reduced. From January 1998 and December 2006, a total of 121 individual mountain lions were captured, 152 times, including 82 kittens, and 39 juveniles and adults. Of these, 117 individuals were collared and monitored on average for 502 days (approximately 16 months) with males remaining on the air for shorter periods (=284 days) than females (=658 days). Hunting was the main cause of mortality for all age and sex classes across the study period, accounting for 36 of 63 mortalities documented. This was followed by illegal mortalities, natural, unknown, depredation, and vehicle collisions. Across the study period, any lion in the Blackfoot watershed had, on average, a 22% annual probability of dying due to hunting. We found human harvest to be an additive mortality

source (i.e. hunting mortality was not compensated for by increased survival of remaining individuals) that shapes the overall survival structure of mountain lion populations. As such, wildlife managers through the use of human harvest, have the capability to regulate mountain lion population growth.

MODIFYING BARRIER FENCES IN KEY WILDLIFE LINKAGES IN WESTERN MONTANA

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American Wildlands has identified landscape level wildlife linkages and corridors throughout western Montana and eastern Idaho. We are working cooperatively to implement on-the-ground projects to maintain or enhance this habitat connectivity. On a local scale, wildlife movement through these linkages is often impeded by livestock and property boundary fences. Fences with bottom wire spacing less than 16-18" above ground level and taller than 40-42" are usually barriers and entanglement hazards to deer, elk, bighorn sheep, and pronghorn, particularly for their young. BLM and Forest Service policy directs that public land fences will accommodate wildlife movement using wildlife-friendly fence specifications have been available for years, and some modification has been completed. But hundreds of miles of wildlife-unfriendly fences still exist throughout southwestern Montana on both private and public lands, and the miles are increasing. In 2008, American Wildlands initiated a fence modification program to cooperatively "fix" wildlife-unfriendly fences located in key wildlife linkages with emphasis on pronghorn movement. To date, nearly 50 miles of fence have been modified or reconstructed in the Centennial Valley, Grasshopper Valley, and East Pioneers, mostly on private lands and often using volunteer labor. Modification costs are minimal for simple wire adjustments or removal to achieve appropriate wire spacing, and represent little or no cost to the landowner. Although more expensive, modifying net wire fences can have dramatic benefits for wildlife movements.

EFFECTS OF A REST-ROTATION GRAZING SYSTEM ON WINTERING ELK DISTRIBUTIONS ON THE WALL CREEK, MONTANA WINTER RANGE

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Understanding livestock grazing effects on wildlife remains an important conservation issue. The purpose of this project was to evaluate the effects of a rest-rotation grazing system on elk resource selection within the Wall Creek winter range in southwest Montana. We collected bi-weekly observations of elk number and distributions across the winter range from 1988-2007. Using a matched-case control logistic regression model to estimate selection coefficients, we evaluated the effects of annual green-up conditions, winter conditions, landscape features, and grazing treatment on elk resource selection within the grazing system. We found that within the grazing system, elk preferentially selected for rested pastures over pastures that were

grazed the previous summer. The strength of selection against the pasture grazed during the growing season was strongest, and pastures grazed during the early and late summer were selected for over the pasture grazed during the growing season. The number of elk utilizing the grazing system increased in the 19 years following implementation of the grazing system; however, total elk herd size also increased during this time. We found no evidence that the proportion of the elk herd utilizing the grazing system changed following implementation of the rest-rotation grazing system. Our results provide support for the principals of rest-rotation grazing systems. Wintering elk preference for rested pastures suggests rested pastures play an important role in rotation grazing systems by conserving forage for wintering elk. We recommend wildlife managers maintain rested pastures within rotation grazing systems existing on ungulate winter range.

ADAPTIVE WOLF MANAGEMENT: THE REGULATED PUBLIC HARVEST COMPONENT

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Montana's wolf conservation and management plan is based on adaptive management principles and includes regulated public harvest as a population management tool. The need and opportunity to implement public harvest in 2008, 2009, and 2010 required Montana Fish, Wildlife & Parks (FWP) to develop a stepped down adaptive management framework specific to harvest. For 2008 and 2009, FWP set modest objectives: implement a harvest, maintain a recovered population, and begin the learning process to inform development of future hunting regulations and quotas. In 2010, FWP used a formal Structured Decision Making Process to more clearly define priorities and challenges of setting a wolf season, outline objectives of a successful season, and evaluate consequences and trade-offs between alternative management actions. For all years, FWP used a modeling process to simulate a wide range of harvest rates across three harvest units and to predict harvest effects on the minimum number of wolves, packs and breeding pairs. Model inputs were derived from minimum wolf numbers observed in the field. Modeling allowed consideration of a range of harvest quotas, predicted outcomes, and risk that harvest could drive the population below federally-required minimums. It also facilitated explicit consideration of how well a particular quota achieved objectives and how to adapt future regulations and quotas. Legal challenges to federal delisting restricted implementation of the first fair chase hunting season to 2009. Montana's wolf population is securely recovered, despite the dynamic political and legal environments. Regardless, FWP remains committed to a scientific, data-driven approach to adaptive management.

HABITAT QUALITY INFLUENCES BIRD COMMUNITY STRUCTURE IN THE BIG HOLE RIVER VALLEY

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Extensive restoration work along the Big Hole River aims at improving habitat conditions for the last remaining fluvial population of Arctic grayling in the U.S. Riparian-associated birds are also likely to respond positively to such restoration activities. From 2007 to 2009 we conducted surveys to document bird communities during the pre-restoration phase. We detected 111 species across the three survey years, representing 45% of bird species known to breed in Montana. We used a repeated measures design to control for potential variation in relative bird abundance among years and to test for differences among three treatment types: reference, control, and restoration. Both vegetation characteristics and bird communities differed significantly among treatments. Eight species selected a priori to be indicators of high quality riparian habitat were significantly more abundant at reference points than at control or restoration points. These species will be used as indicators to measure the success of restoration efforts in the future. The outstanding diversity of birds associated with the Big Hole watershed speaks to the conservation value of restoring this stretch for birds as well as fish.

SYNTHESIZING MOOSE MANAGEMENT, MONITORING, PAST RESEARCH, AND FUTURE RESEARCH NEEDS IN MONTANA

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Perceived declines in Shiras moose (*Alces alces Shirasi*) in many areas across Montana in recent years have elicited concern from biologists, managers, and members of the public. Interest in moose research in Montana has correspondingly been mounting, however little new research has occurred. For this reason we attempted to synthesize existing knowledge and management programs for moose in Montana to provide collective awareness of the issues and research needs for moose. We used structured interviews of wildlife biologists and managers that work with moose to document current moose management in Montana. Most biologists reported that moose were stable or decreasing in their areas of responsibility. Predation was the most common concern for factors limiting moose, followed by habitat succession, hunter harvest, disease and parasites, Native American harvest, and habitat loss, fragmentation and degradation. In addition to information from post-season surveys of moose permit holders, biologists assessed moose populations using information from a variety of sources including landowner reports, hunter reports collected at check stations, unadjusted trend counts, bull: cow ratios, recruitment ratios, sightability-corrected population estimates and habitat condition. Nearly all respondents felt that available information was inadequate in various ways for making moose management decisions. Clearly identified research needs include calibration of currently employed moose population indices to actual trends in moose populations, development of a survey program that will provide better and more moose survey data at the appropriate scale for management decisions, and research into how predation, habitat, disease, parasites, and climate affect moose survival and recruitment rates.

MERCURY MAGNIFICATION IN RIVERINE FOOD WEBS IN THE NORTHERN ROCKY MOUNTAINS: CLARK FORK RIVER BASIN, MONTANA, U.S.A.

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At a local scale, such as the Clark Fork River Basin (CFRB), historic gold mining contributes the majority of mercury (Hg) found in the environment. Mercury enters aquatic systems in inorganic forms and is transformed to methylmercury (MeHg) by bacteria. MeHg has the ability to bioaccumulate within higher trophic levels, causing severe neurotoxic diseases and mortality. Hg concentrations observed within an aquatic food web are controlled by two factors, a source of inorganic mercury and the potential for that Hg to become methylated

(methylation controlled by environmental conditions i.e.: water velocity, organic matter, etc.). A sufficient source of inorganic mercury and environmental conditions which promote Hg methylation can lead to maximum MeHg biomagnification.

This study presents a comprehensive look at food web Hg biomagnification within the CFRB. Hg concentrations are characterized through blood or tissue samples from osprey, fish, and aquatic macroinvertebrates. Additionally we look at controlling Hg biomagnification factors, Hg of fine-grained sediment, percentage of wetlands and riparian land cover, and mean monthly discharge, to access the biomagnification process within the watershed and thus the Hg levels observed throughout these three trophic levels. Preliminary results show Hg levels of aquatic invertebrates have been found to be heavily influenced by the source of Hg (fine-grained sediment), while upper trophic level species exhibit a strong correlation to environmental characteristics of the sample reach. ****Student Presentation****

TEMPORARY EMIGRATION OF FEMALE WEDDELL SEALS PRIOR TO FIRST REPRODUCTION

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Temporary emigration (TE) from a breeding site is common in some colonial-breeding species, but implications are poorly understood because TE is difficult to quantify. We used capture-mark-recapture models and a dataset of 5,450 female Weddell seals (*Leptonychotes weddellii*) born in Erebus Bay, Antarctica to investigate sources of variation in TE rates and evaluate possible implications for recruitment. Temporary emigration rates and recruitment rates were state- and age-dependent and annually variable. For seals that attended reproductive colonies the previous year, mean TE rates decreased from 0.98 (*sd* = 0.02) at age 1 to 0.15 (*sd* = 0.16) at age 8, whereas mean recruitment rates increased from 0.06 (*sd* = 0.03) at age 5 to 0.52 (*sd*= 0.16) at age 10. Seals that did not attend reproductive colonies the previous year had greater TE rates and lower recruitment rates than seals that did attend colonies, but the confidence interval for the effect of TE on recruitment included zero. Our results suggest that 1) motivation to emigrate varies temporally depending on environmental conditions, 2) as seals grow older they have increased motivation to attend reproductive colonies even before they are ready to recruit, and 3) some seals appear to always be more likely than others to emigrate. We suspect that TE may allow seals to buffer variability in survival rates. ****Student Presentation****

BLACK BEAR DENSITY IN GLACIER NATIONAL PARK, MONTANA

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No demographic information exists on the status of Glacier National Park's (GNP) black bear (*Ursus americanus*) population. In 2004, we sampled the black bear population within GNP plus a 10 km buffer using noninvasive hair collection methods as part of a 7.8 million–acre study of the regional grizzly bear (*U. arctos*) population. We collected 5,645 hair samples from 550 baited hair traps, and 3,807 samples from multiple visits to 1,542 natural bear rubs. Microsatellite analysis identified 601 (51% F) individuals from the 2,848 samples identified as black bears. Data from individual bears were used in closed population mark–recapture models to estimate black bear population abundance. We developed an information-theoretic approach to estimate the effectively sampled area from which we calculated density for the 6,600 km^2 greater GNP area. Preliminary results suggest that the density of GNP's black bear population was equal to or greater than other interior populations sympatric with grizzlies, despite the high density of grizzlies. This project represents the first estimate of black bear density for this area, and demonstrates the efficiency of multi–species projects to inform management.

MANAGING MULTIPLE VITAL RATES TO MAXIMIZE GREATER SAGE-GROUSE POPULATION GROWTH

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Despite decades of greater sage-grouse field research, the resulting range-wide demographic data has yet to be synthesized into sensitivity analyses to guide management actions. We summarized range-wide demographic rates from 71 studies from 1938—2008 to better understand greater sage-grouse population dynamics. We used data from 38 of these studies with suitable data to parameterize a two-stage, female-based population matrix model. We conducted analytical sensitivity, elasticity, and variance-stabilized sensitivity analyses to identify the contribution of each vital rate to population growth rate (λ) and life-stage simulation analysis (LSA) to determine the proportion of variation in λ accounted for by each vital rate. Greater sage-grouse showed marked annual and geographic variation in multiple vital rates. Sensitivity analyses suggest that, in contrast to most other North American galliforms, female survival is as important for population growth as chick survival and more important than nest success. In lieu of quantitative data on factors driving local populations, we recommend that management efforts for sage-grouse focus on increasing juvenile, yearling,

and adult female survival by restoring intact sagebrush landscapes, reducing persistent sources of mortality, and eliminating anthropogenic habitat features that subsidize predators. Our analysis also supports efforts to increase chick survival and nest success by managing shrub, forb, and grass cover and height to meet published brood-rearing and nesting habitat guidelines, but not at the expense of reducing shrub cover and height below that required for survival in fall and winter. ****Student Presentation****

THE DECLINE AND ISOLATION OF FISHER POPULATIONS PRIOR TO EUROPEAN SETTLEMENT: INSIGHTS FROM DNA ANALYSIS

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Historical and contemporary genetic information can provide insights into the nature of population expansions or contractions and temporal changes in abundance and connectivity. Fisher populations in California are thought to have declined precipitously over the last 150 years and currently only two populations remain in the state that are both geographically and genetically isolated from each other. In this study we looked at whether the isolation of these two populations is a result habitat alteration and trapping that accompanied European settlement in the mid-1800's or if it is the result of a more ancient demographic event.

We collected both historical and contemporary genetic samples from each of the two extant fisher populations. We were able to successfully obtain microsatellite genotypes at 10 loci for 21 museum specimens (dated 1882-1920) and 275 contemporary individuals (2006-2009). We found significant temporal shifts in allele frequencies between historical and contemporary samples between regions indicating large amounts of genetic drift likely due to isolation and small population size. We found a strong genetic signal for a 90% contraction in effective population size of fisher and estimated that this decline occurred over a thousand years ago. As a decline in abundance of this magnitude likely resulted in contraction of the geographic range, our analyses suggest that fisher populations in California became isolated from one another far prior to the European settlement of the state. ****Student Presentation****

HOARY MARMOT, WHITE-TAILED PTARMIGAN AND PIKA SURVEYS IN NORTHWEST MONTANA

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Montana Fish, Wildlife & Parks has long done survey and inventory of game species and largely within the past few decades has expanded the staff and program necessary to monitor non-game species, too. However, to date there has been little work done on three alpine species likely to be adversely impacted by climate change: the hoary marmot (*Marmota caligata*), white-tailed ptarmigan (*Lagopus leucurus*) and pika (*Ochotona princeps*). Prior to the 2010 field season, Montana Natural Heritage Program had only 31 hoary marmot, 8 white-tailed ptarmigan, and 62 pika observations for northwest Montana outside of Glacier National Park. We discuss the beginning of focused survey and inventory effort for these three species in northwest Montana that include searching historical narratives, reaching out to other agencies and backcountry users, developing a species identification guide and sighting log for free distribution, and on-the-ground surveys. On one 4-day backpacking trip we saw or saw sign of 17 marmots in 5 "colonies" or local areas, 20 pikas and 1 ptarmigan as well as several other species. In addition to the current survey and inventory work we are outlining future more in-depth work including structured systematic surveys, future monitoring, research on marmot genetics and colony relatedness across the species range in Montana, and potential partners. We also discuss some new and novel approaches such as winter helicopter surveys and fecal DNA analysis for ptarmigan.

MOOSE DISTRIBUTION AND AGE AND SEX RATIOS IN NORTHWEST MONTANA AS REPORTED BY HUNTERS AT CHECK STATIONS

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We sought to better document moose (*Alces alces*) distribution and age and sex ratios in northwest Montana by asking hunters. During the 2010 hunting season we asked all hunters stopping at six check stations if they had seen moose, and if so, where, how many, and if they saw bulls, cows or calves. During the 13 days that check stations were open 17,564 hunters reported 490 sightings totaling 749 moose (313 bulls, 320 cows, 95 calves and 21 unknown) for an average of 1.5 moose per sighting (range 1 – 5). Across all check stations there was an average of 2.8 sightings and 4.3 moose seen per 100 hunters, but this varied from 0.9 sightings and 1.2 moose per 100 hunters at the Swan Check Station to 6.9 sightings and 10.4 moose per 100 hunters at Canoe Gulch. The bulls per 100 cows ratio averaged 98:100 across all check stations but varied from 67:100 at Canoe Gulch to 225:100 at the Swan. Likewise, the calves per 100 cows ratio averaged 30:100 but varied from 8:100 at the Swan to 54:100 at Thompson Falls. Hunter-reported sex and age ratios at the North Fork Check Station agreed with those observed during a post-season helicopter survey in the same area (χ^2 $p = 0.83$), but hunter-

reported ratios at Olney were significantly higher than those observed by helicopter (χ^2 p = 0.01). We discuss the difficulty of monitoring moose populations and the pros and cons of helicopter surveys and hunter-reported moose sightings.

CONSERVING MONTANA'S BIRDS AND THEIR HABITATS THROUGH PARTNERSHIPS

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The Montana Bird Conservation Partnership is a consortium of representatives from state, tribal, and federal agencies, non-governmental organizations, and individuals who are dedicated to conserving birds and their habitats in Montana. Our goals are to work collaboratively to keep common birds common and to conserve, protect and restore sensitive species and habitats. We work to recognize the social and economic value of birds to the people of Montana. We also use the best available science to identify conservation opportunities. Over 300 species of birds regularly breed, winter, or migrate through Montana. Of these, 82 are considered to have sensitive or at-risk populations. Montana's birds are threatened by habitat loss stemming from changing land use practices and energy and subdivision development. Global climate change may exacerbate these threats. We will present current Montana Bird Conservation Partnership projects, our action plan, focal species initiatives, and examples of successful conservation-in-action projects. Find out how you and/or your organization can get involved at the local or state level. Learn more about the most exciting and forward-thinking bird partnership in the region!

BROAD-SCALE GENETIC AND COMPOSITIONAL MONITORING OF AQUATIC VERTEBRATE POPULATIONS: A PROOF OF CONCEPT IN THE INTERIOR COLUMBIA RIVER AND UPPER MISSOURI RIVER BASINS

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Monitoring fish and amphibian populations is essential for evaluating conservation efforts and the status and trends of individual species, but measuring abundance is time-consuming and problematic at large scales. Also, relations between fish populations and their surrogates, such as habitat characteristics, are often obscure. As an alternative, genetic assessment and monitoring offers promise as an indicator of population status and trends by providing information on genetic diversity, connectivity among populations, and the prevalence of hybridization with non-native species. We have undertaken intensive sampling of native and nonnative fishes and amphibians in streams monitored by the Pacfish/Infish Biological Opinion Monitoring Program, which includes a spatially comprehensive, random sample of subbasins in the interior Columbia River Basin and upper Missouri River Basin. We have also developed a panel of ~100 single nucleotide polymorphism markers for cutthroat trout, redband trout, and rainbow trout to describe patterns of hybridization and landscape genetic structure. If fully realized, analyses of tissues sampled from over 1500 streams in Montana, Idaho, eastern Oregon, and eastern Washington on federal lands should permit broad-scale evaluations of the status and distribution of much of the aquatic vertebrate fauna and enable detection of responses to climate change. Preliminary results of sampling at nearly 700 sites on almost 300 western Montana and northern Idaho streams indicate that westslope cutthroat trout occupy headwater sites in most of their historical range except in the Kootenai and Missouri River basins, brook trout are more widely distributed than previously recognized, and the taxonomic complexity of sculpins is underappreciated.

POSTER ABSTRACTS

Student

ADULT FEMALE SURVIVAL IN A PARTIALLY MIGRATORY ELK HERD

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Partial migration occurs when a portion of the population migrates, and results from density-dependence in the relative costs and benefits of migrating or remaining a resident. For elk (*Cervus elaphus*), partial migration is an adaptive strategy for maximizing optimum forage quality while reducing predation risk. I tested related hypotheses about the effects of migration status, season (summer, winter) and density on the winter range for adult female elk survival. I first tested whether migrants had higher survival, based on the hypothesized forage benefits of migration. Next, I tested the hypothesis that survival of adult female migrant and resident elk differs over time first, as a function of density and second, as a function of seasonal variation between summer and winter. I estimated survival for 204 radiocollared elk over 8 years using the non-parametric Kaplan Meier (KM) approach and regressed survival estimates against

population size. I tested my hypotheses regarding season, migratory status, and density using the semi-parametric Cox-Proportional Hazards (PH) Model. I found weak evidence supporting my hypothesis that adult female survival is higher for migrant elk compared to resident elk. Migrants had twice the variation in survival rates and a greater risk of death during summer compared to residents. I observed strong evidence of density dependence from the Cox PH model and my regression of KM survival estimates for residents showed adult female survival decreased with increasing elk density over time. My results show preliminary evidence for density dependence affecting resident, not migrant, adult female elk in this population.

UNICOR: A SPECIES CONNECTIVITY AND CORRIDOR NETWORK SIMULATOR

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See Abstract in previous section

THE INFLUENCE OF CONIFERS AND ABIOTIC FACTORS ON BIG SAGEBRUSH COVER

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Expansion of conifers into sagebrush is a concern since it reduces sagebrush cover for wildlife. The objective of this study was to model the relationship between the cover of Douglas-fir (*Pseudosuga menziesii*) and Rocky Mountain juniper (*Juniperus scopulorum*), and the cover of Wyoming big sagebrush (*Artemisia tridentate* spp. *Wyomingensis*) and mountain big sagebrush (*Artemisia tridentate* spp. *Vaseyana*). Two hundred forty 30x30 m plots were established at three locations in southwest Montana in 2009 to establish this relationship. The best-fit model using AIC criteria found ($\sqrt{sagebrush\ cover}$ = $Intercept_i$ - $0.401\sqrt{conifer\ cover}$; $R^2 = 0.61$) a negative relationship between conifer cover and sagebrush cover. No abiotic factors (elevation, slope, aspect, soil depth, soil texture and percent rock) significantly influenced sagebrush cover. Douglas-fir trees were found to have three-times the canopy area of similar

aged Rocky Mountain juniper trees. Conifer removal to increase sagebrush cover is not recommended, since the increase in sagebrush cover is small. If conifer control is deemed necessary, Douglas-fir should be removed before Rocky Mountain juniper, and begin at low levels of conifer cover.

THE SUITABILITY OF LARGE CULVERTS AS CROSSING STRUCTURES FOR DEER

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Most researchers that have investigated the use of wildlife crossing structures have done so through counting the number of animals present in the structures or the number of animals that crossed the road using the structures. However, we argue that crossing structure acceptance, as a percentage of all approaches, is a better measure of suitability. Once the acceptance of certain types and dimensions of crossing structures is known for different wildlife species, agencies can select crossing structures that meet certain goals. We used this method for one particular type of crossing structure; large diameter culverts. We placed wildlife cameras (Reconyx™) at the entrance of nine corrugated metal arched culverts located along US Highway 93 on the Flathead Indian Reservation, Montana; to capture approach behavior. We specifically examined the number of successful and aborted crossing attempts. White-tailed and mule deer were the most frequently observed species and had an acceptance rate of 84% (n=455) and 66% (n=56) respectively. Only 49% (n=426) of the groups that passed the structures successfully showed an alert posture versus 93% (n=98) for the groups that aborted the attempts. The two deer species showed slightly different levels of alertness with an alert posture for 55% of white-tailed deer events and 68% for mule deer events for all crossing attempts combined. The data show that wildlife acceptance rates and behavior at structures can vary between species and data on varying structure type and dimensions will add to our understanding of structure acceptability for various target species.

VARIATION IN WEDDELL SEAL PUP MASS: MATERNAL INVESTMENT IN OFFSPRING

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Life history theory predicts that individuals face physiological tradeoffs between current and future reproduction. These tradeoffs ultimately lead to reproductive costs which can affect survival, fecundity, condition of the female and offspring survival. Reproduction itself is costly and involves a number of sequential physiological processes that require different levels of energetic investment. In mammalian species gestation and lactation require the most energy and energy expenditure during these times is a characteristic of females and can vary among individuals. Mass measurements, used to quantify pre- and post-partum maternal investment, were collected from 887 Weddell seal (*Leptonychotes weddellii)* pups at parturition and throughout lactation in Erebus Bay, Antarctica during the 2002 through 2010 field seasons. Preliminary analysis demonstrated high individual variation in pup mass within a season and modest variation among seasons suggesting that pup mass may be affected more by individual animal attributes than annual variation in environmental conditions. This variation in maternal investment was investigated using maternal traits taken from the long term database. We found that maternal traits have different affects on pup mass at different stages of investment. Maternal age and birth date were found to be influential on pre- and post-partum investment along with age at first reproduction on pre-natal investment and breeding status the previous year on post-natal investment. The variation in the influence of maternal traits on maternal investment may be due to the increased energy requirement of lactation and reproductive costs that females accrue throughout their lifetime.

EVALUATING THE BARRIER EFFECT OF A MAJOR HIGHWAY ON MOVEMENT AND GENE FLOW OF THE NORTHERN FLYING SQUIRREL

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Robert Long. Road Ecology Program, Western Transportation Institute, Montana State University, Ellensburg, WA 98922

Roads are pervasive sources of habitat fragmentation around the world, affecting an estimated 19% of the land area of the coterminous United States (Forman 2000). The barrier effect of roads has been demonstrated for species from multiple taxa. Still, information regarding the response of the vast majority of species to roads is lacking. We examine the effects of a major roadway on the movement and population genetics of Northern flying squirrels (*Glaucomys sabrinus*) in the Cascade Mountains of Washington, USA. During 2009 and 2010, flying squirrels ($n = 16$) were trapped and radio-tracked to gather data on movement within their home ranges and to detect movement across the roadway. Additionally, DNA was extracted from cheek cells of 41 individuals and genotyped at 12 microsatellite loci to characterize patterns of population structure. 7 of 16 monitored squirrels crossed the highway at least once

during their nightly movements. Randomization tests of the movement data do not indicate significant avoidance of crossing the highway corridor. Movement does not necessarily equate to gene flow, however, and forthcoming analysis of microsatellite data will help elucidate whether current rates of movement are sufficient to maintain genetic connectivity across the highway.

Professional

50-Year Golden Eagle Nesting Trends in South-Central Montana

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Bryan Bedrosian, Craighead Beringia South, Kelly, WY, U.S.A.

Derek Craighead, Craighead Beringia South, Kelly, WY, U.S.A.

Golden Eagle (Aquila chrysaetos) migration counts in the western North America have shown a significant negative trend in recent years. However, the causes of these declines are unknown and it remains unclear if declining migration counts correlate to a declining population or changes in migratory behavior. Long-term research on nesting Golden Eagle populations is lacking and is needed to properly assess the current Golden Eagle population status in many areas. In 1962, intensive monitoring efforts were initiated in a roughly 1,200 mi2 study area in south-central Montana. The objectives were, among other things, to determine density and productivity of Golden Eagles. This area was re-surveyed in the mid 1990's to begin looking at long-term population trends. In 2009, we initiated a multi-year effort to investigate potential changes in the nesting trends in the same study area over a half a century. The data collected to date indicate an increase in the nesting density, similar nest success rates, and a decrease in productivity when compared with both the 1960's and 1990's studies. The longevity of data collected in this study area allows for one of the longest-term comparisons for Golden Eagle nesting density and success in the West and provides invaluable insights into the status of nesting Golden Eagles in this region.

Keeping Common Species Common: Inventory and Monitoring for a Diversity of Wildlife Species

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Many of the over 500 vertebrate species found in Montana lack formal status assessments. Few monitoring efforts exist for these species and very few are statewide to include public and private lands. In 2008, the Montana Natural Heritage Program and Montana Fish, Wildlife and Parks designed a protocol for simultaneous multi-species survey. We sampled quarter-

quadrangle grid cells selected at random over three years and covered the entire state. We surveyed all lentic sites for amphibians and all south-facing rocky slopes for reptiles within each cell. We also surveyed dominant habitats for bats using acoustic detectors and small-mammals using standard trap line techniques. The largest challenges included: securing private landowner contact information and permission, automating map creation for the hundreds of selected cells, the preservation of collected specimens, maintaining working acoustic equipment in inclement weather, housing and backing up huge amounts of data from remote locations, and analyzing large quantities of acoustic data. Small mammal and acoustic call identifications are ongoing. A preliminary summary of other data shows an investment of over 20,000 person hours for a total of: 211 grid cells surveyed, 40 small mammal species detected in 2,486 captures, 16 bat species detected through thousands of acoustic calls, 12 amphibian species and 8 reptile species detected, and 304 species detected as incidental observations. We intend to conduct occupancy modeling for many of the species detected using the grid cells as site. We discuss prospects for using this sampling scheme and methods for future monitoring.

USE OF WILDLIFE CROSSING STRUCTURES ON US HIGHWAY 93 ON THE FLATHEAD INDIAN RESERVATION

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Pat Basting, Montana Department of Transportation, 2100 W. Broadway Ave, Missoula, MT, (406)-523-5872, pbasting@mt.gov

In the 1990s, Montana Department of Transportation (MDT) proposed an expansion of U.S. Highway 93, in an area entirely within the Flathead Indian Reservation (FIR), home to the Confederated Salish and Kootenai Tribes (CSKT). In December 2000, the CSKT, MDT, and Federal Highway Administration (FHWA) signed a memorandum of agreement that enabled its expansion. It included wildlife mitigation measures to both mitigate impacts to wildlife and natural processes associated with the widening of US93 as well as to address the safety of the traveling public.

Mitigation measures include 41 fish and wildlife-crossing structures, including 40 underpasses and one overpass, wildlife fencing, jumpouts, and wildlife crossing guards across 56 miles of highway. Crossing structures were placed in areas that have a history of wildlife crossings and wildlife mortality, and/or locations where the surrounding landscape and land use was best suited for the crossing structures.

Research is underway to determine the effectiveness of the mitigation (see www.mdt.mt.gov/research/projects/env/wildlife_crossing.shtml). Between May 2008 and December 2009, eleven underpasses were monitored for wildlife use. Wildlife use of the structures was substantial with 3,000 deer crossings, 1,500 coyote crossings, 300 bobcat crossings, 200 raccoon crossings, and 200 black bear crossings. Other species that used the crossings include mountain lion, elk, grizzly bear, moose, badger, river otter, muskrat, beaver, skunk, rabbit, and various bird species. For the wildlife mitigation measures to be considered successful, goals have been set by the CSKT, MDT, and FHWA, and more data need to be collected and analyzed before the researchers can conclude whether the mitigation measures have indeed reached those goals.

SENTINEL PLANT SPECIES – LOOKOUTS FOR THE LAND

Robert M. Skinner, Charles M. Russell NWR, U.S. Fish & Wildlife Service, Box 110, 333 Airport Road, Lewistown, Montana 59457, (406) 538-8706, bob_skinner@fws.gov

Sentinel plant species are first to vanish with change to the evolutionary concert of ecological processes playing in a locale. The evolutionary concert of ecological processes is the combination of fire, hydrology, herbivory, and predation under which local flora and fauna first evolved. If first to vanish plant species populations are viable, other plant and animal species populations are likely to be viable also.
Sentinels are lookouts for the beginning unraveling of connectivity within landscapes. Large recovery of ecological systems is linked with small recuperations of sentinel well being. Restoration of sentinels may be accomplished by the return of an evolutionary course of management. Sentinel plant species monitoring and management is not based on vegetation classification systems such as the National Vegetation Classification System or Ecological Site Classification. Classifications often do not change with the disappearance of management sensitive uncommon species (sentinel plants). Major declines in sentinel plant species critical to specific wildlife species can occur before classification systems will notice. Monitoring consists of demographic measurements of sentinel species at randomly selected locations. Resource selection modeling of these 'used' and of "unused' locations may be accomplished with the demographic measurements and GIS layers such as soils, topography, and management history. The purpose of the modeling is to predict the presence and health of the species, as a function of management, using statistical methods like logistic regression.

DETERMINING SEX IN GOLDEN EAGLES USING FOOT DISPLACEMENT

Vincent Slabe,* Raptor View Research Institute, POB 4323, Missoula MT, 59806.

Rob Domenech, Raptor View Research Institute, POB 4323, Missoula MT, 59806.

David Ellis, PhD., Institute for Raptor Studies, Oracle AZ, 85623

The Golden Eagle (*Aquila Chysaetos*) is one of the most widespread raptors in the world. Attempts have been made in the past to determine sex in Golden Eagles (GOEA) through individual and combined morphometric measurements. Due to the gender overlap within these measurements, the GOEA is one of several diurnal raptor species in North America that cannot

be conclusively sexed in the hand. Sex in GOEAs is currently determined only through DNA analysis. Determining sex in the hand would increase the value of information collected by banders in the field, unable to devote time or resources to conduct blood or tissue assays. David Ellis, the author of the GOEA monograph, has developed an instrument under the assumption that foot volume could be definably different between male and female GOEA's. This method measures the volume of the eagle's foot, hallux claws, and lower part of the tarsus by the amount of water displaced in cubic centimeters (cc). The technique is in its infancy and will be refined as needed. Since 2008, Raptor View Research Institute (RVRI) has measured foot displacement on 36 GOEAs captured on migration in Montana. Our preliminary data shows a 3 cc separation in foot displacement between male and female GOEAs.

MONTANA'S COLONICAL NESTING WATERBIRD SURVEY

Catherine S. Wightman, Montana Fish, Wildlife and Parks, PO Box 200701, Helena, MT 59620

Janene Lichtenberg, Confederated Salish and Kootenai Tribes, Wildlife Management Program, PO Box 278, Pablo, MT 59855

Amy Cilimburg, Montana Audubon, 1601 Tamarack Street, Missoula, MT 59802

Wetlands are a dispersed but declining resource in Montana. They are considered a Tier 1 community (greatest conservation need) in Montana's Comprehensive Fish and Wildlife Conservation Strategy and are of critical importance to breeding waterbirds. Of the 17 colonially-nesting waterbirds in the state, 12 are Montana Species of Concern. Despite the conservation ranking of waterbirds and their habitats, information on the distribution and abundance of these wetland obligates is limited. The Montana Bird Conservation Partnership is participating in the U.S. Fish and Wildlife Service west-wide colonial nesting waterbird inventory to contribute to regional population estimates and meet state information needs. We are focusing on Species of Concern. We counted nests at 123 wetland sites across the state in 2009 and at 133 sites in 2010. Colony size ranged from 1 – 4833 pairs. Most colonies were relatively small (1 – 195 pairs), except Franklin's Gulls and American White Pelicans. High water levels likely affected reproductive success in spring 2010. Additional survey work will be conducted in 2011. In addition to calculating estimates of population size, we plan to use these data, in conjunction with other work, to link waterbird populations to wetland condition for use in future conservation decisions and planning. Our work has particular relevance to predicted changes in timing and amount of precipitation associated with climate change, which will likely change wetland condition and distribution throughout the state.

The Montana Chapter of The Wildlife Society is here to serve you as wildlife professionals. In order to be *effective* and to *influence circumstances* for Montana's wildlife resources, we must have an active and committed membership. Please consider volunteering and becoming an active member of any of the following committees or ad hoc committees. Your participation is always appreciated and needed!

Refer to Bylaws for duties and composition of standing committees (Article VIII).

Standing Committees

Nominating and Elections

A three-member Nominating and Elections Committee shall be selected by the President of the Montana Chapter not later than October 1 of each year and shall submit to the Secretary on or before October 15, the names of two candidates for each of the elective positions; namely the President-Elect, and every other year the Secretary or Treasurer, depending on the position coming open.

Current Committee Chair: Lorin Hicks~Lorin.Hicks@plumcreek.com

Membership

This committee shall encourage the maximum number of qualified persons working or residing within the Chapter's organizational area to become members of The Wildlife Society, the Northwest Section, and the Montana Chapter. The Committee shall also recommend Honorary Membership for deserving individuals in accordance with Article IV, Section 4.

Current Committee Chair: Adam Messer~amesser@mt.gov

Programs

This committee shall arrange programs of all regular and annual meetings and provide the President with a proposed agenda for the Annual Meeting at least two months prior to the meeting date. The President- Elect shall serve as Chair of the Program Committee. This is a need for members to assist with this committee. If you have previous experience putting together conferences or have an interest in our annual meetings.

Current Committee Chair: Whisper Camel~whisperc@cskt.org

Education and Information (Publicity)

This committee shall seek and employ methods of informing the public of basic wildlife management concepts and of Chapter and Wildlife Society activity and interests.

****There is currently no committee chair or member and we are very interested in people to volunteer on this committee****

Resolutions and Public Statements

This committee shall receive proposed resolutions or public statements from members at any time, and shall prepare, submit, and recommend action on such items to the Executive Board in accordance with Article VII, Section 5. Submit resolutions/statements to the Executive Board.

Current Committee Chair: Executive Board. Find email addresses for current officers at www.mttws.org

Scholarships

Each year the Chapter President will appoint a three-member selection committee to consist of one wildlife instructor from the University of Montana, one from Montana State University, and a member-at-large from the Chapter membership. The committee will select all scholarship recipients. The committee chairmanship will alternate every other year between the two universities.

Current Committee Co-Chairs: Bob Garrott (MSU) ~ rgarrott@montana.edu & Dan Pletscher (UM) ~ dan.pletscher@umontana.edu

Financial Management

This committee shall consist of a Chair and at least two other members, serving staggered three-year terms. The Financial Management Committee shall review the financial records and supporting documents of the Treasurer at least annually. The Committee also shall review these records and documents prior to any change in the office of the Treasurer. The Committee shall prepare an annual financial management plan for approval by the membership at the annual meeting.

Current Committee Chair: Frank Pickett~fjpickett@pplweb.com

Awards

This committee shall consist of three members, one from each geographic region of the Chapter. A fourth member of the committee will be appointed by the President for input on selection of recipients for the Bob Watts Wildlife Communications Award. This fourth member will be one of the Board Members of the Bohemian Corners Foundation, until such time as all original members of the Bohemian Corners Foundation, as published in the June 1990 Chapter Newsletter, are no longer members of the Montana Chapter.

Yearly Awards Nominations

The Chapter annually seeks nominations for four awards to be presented at the annual Conference.

1) The ***Distinguished Service Award*** is presented annually for cumulative, past, current, and/or continuing achievements in wildlife conservation.

2) The ***Biologist of the Year Award*** is presented annually for significant achievements in wildlife conservation anytime during the five years immediately preceding the award presentation.

3) The ***Bob Watts Communication Award*** is presented for significant communication in media such as
professional publications, popular wildlife articles, books, movies, or videos that have a relatively wide audience.

4) The ***Wildlife Conservation Award*** is given to an individual or non-governmental organization for past, present, or ongoing efforts that enhance wildlife conservation in Montana.

Current Committee Chair: JoAnn Dullum~joann_dullum@fws.org

Ad Hoc Committees

Legislative Affairs

This ad hoc committee monitors legislative and congressional issues pertinent to the Montana Chapter and makes recommendations to the Executive Board regarding reporting requirements and efforts at the legislature and during interim periods by lobbyist.

****There is currently no committee chair or member and we are very interested in people to volunteer on this committee****

Grants

This ad hoc committee shall receive and review applications for Montana Chapter Grants, and make recommendations to the Board. Grants may or may not be distributed annually depending on the financial status of the Chapter. See GRANTS page on website.

Current Committee Chair: Vanna Boccadori~vboccadori@mt.gov

Effects on Recreation

This ad hoc committee oversees distribution and updates of the Montana Chapter report entitled, Effects of Recreation on Rocky Mountain Wildlife – A Review for Montana. See

Recreation in Wildlife Habitat on www.mttws.org

****There is currently no committee chair or member and we are very interested in people to volunteer on this committee****

Species of Concern

This ad hoc committee oversees the review of the status of terrestrial animal species in Montana through;

1. Development of a status paper which summarizes all relevant information on the biology and status of the species in Montana, and

2. Completion of the NatureServe status model which evaluates population size, range extent or area of occupancy, short and long term population trends, intrinsic vulnerability, environmental specificity, and scope, severity, and immediacy of threats.

Status papers and status scores are reviewed, revised if necessary, and voted on by committee members. Approved status papers and status recommendations are forwarded to the joint Montana Natural Heritage Program and Montana Department of Fish, Wildlife, and Parks Species of Concern Committee. Portions of status papers are posted on the online Montana Animal Field Guide and status recommendations are used to update the Montana Animal Species of Concern Report. The Montana Animal Species of Concern Report provides a basis for resource managers and decision-makers to direct limited resources to priority data collection needs and address conservation needs proactively.

Current Committee Chair: Bryce Maxell~BMaxell@mt.gov

MT TWS Working Groups

Montana Harlequin Duck Working Group

The Montana Harlequin Duck Working Group is a team of biologists and volunteers from both government and non-government agencies, whose purposes are to foster communication, help coordinate monitoring and management, and promote research and education to sustain harlequin ducks in Montana.

Chair:
Steve Gniadek
grayjaybro@yahoo.com

Montana Bat Working Group

The Montana Bat Working Group is open to anyone interested in bats. Our group is loosely affiliated with the Western Bat Working Group. We meet one or more times per year to facilitate communication among interested parties in order to reduce risks of species decline and extinction, share current information on bat ecology, distribution, research techniques, and conservation issues, and develop a forum in which conservation strategies can be discussed, technical assistance provided, and education programs encouraged.

Co-chairs:

Kristi DuBois
kdubois@mt.gov
406-542-5551

Nate Schwab
nathanschwab@hotmail.com
406-360-8881

Montana Common Loon Working Group

The Montana Common Loon Working Group is a team of biologists and volunteers from both government and non-government agencies including Montana Department of Fish, Wildlife and Parks (FWP), Montana Department Of Natural Resources (DNRC), USDA Forest Service (USFS), Glacier National Park, Plum Creek Timber Company, Avista Corporation, Confederated Salish and Kootenai Tribes, the Montana Loon Society, U. S. Fish and Wildlife Service, the University of Montana, and lakeshore homeowner representatives. They usually meet twice a year and meetings are open to anyone interested in common loon management and conservation. The group helps coordinate annual common loon monitoring and management activities, maintains outreach and educational programs, secures funding for research and management programs such as the Loon Ranger Intern program, and compiles reports and summaries based on the review and analysis of annual surveys and productivity data.

Co-chairs:

Amy Jacobs
ajacobs@fs.fed.us
406-758-3544

Chris Hammond
chammond@mt.gov
406-751-4582

Montana Bird Conservation Partnership

The MBCP is a consortium of representatives from federal, state, tribal, educational, and non-governmental organizations working on bird conservation in Montana. We strive to keep common birds common and conserve at-risk species and habitats. All are welcome to participate in meetings and activities.
MBCP web site: http://avianscience.dbs.umt.edu/links/partners.php

Chair:
Catherine Wightman
cwightman@mt.gov
406-490-2329

Herp Working Group

The herp working group is a forum for discussion of issues related to the management and conservation of Montana's amphibian and reptile species.

Chair:
Bryce A. Maxell
bmaxell@mt.gov
406-444-3655

Membership in the Montana Chapter

Membership to the Montana Wildlife Society is open to all individuals interested in the perpetuation of Montana's wildlife resources. Voting membership in the Chapter is available to all paid regular, retired and student members. Governing board members must be current members of TWS. Membership activities continue to be a priority for our Chapter. In addition to increasing our own membership, we encourage our members to also become members of the National Wildlife Society.

Membership Benefits

Becoming a member of the Montana Chapter of The Wildlife Society has many benefits to offer both professionals and students including;

1. Close association with a group dedicated to wise use of our State's wildlife resources. Members come from universities, colleges, high schools, environmental consulting firms, state and federal agencies, private organizations, and business.

2. Participation in the Annual Conference, where timely resource topics are

explored.

3. Workshops, which permits exploration of selected wildlife topics and management activities.

4. The Newsletters, containing reports on items of interest to wildlife professionals in Montana.

5. The opportunity to influence state and federal policy through an organization capable of providing a unified professional opinion on Montana's wildlife issues.

Information Updates
Our chapter newsletter is distributed twice a year and provides information about upcoming events as well as opportunities to get involved with one of our working committees.

Peer Network
Increase your peer network by attending chapter meetings along with The Society's annual conference. These meetings and conferences allow you to interact with people who represent the diversity of the profession. Students can take advantage of the unique opportunity to meet and learn from seasoned professionals and potentially meet future employers.

Continuing Education
Gain in-depth exposures to timely wildlife management concerns by attending chapter meetings.

Professional Growth
Students can obtain leadership skills and enhance their professional growth by serving as an officer, on a committee, or giving a presentation at a chapter meeting.

We welcome you to join the Montana Chapter of The Wildlife Society. There is a role in the Chapter for the wildlife biologist, manager, technician, conservation officer, educator, naturalist, and any individual concerned about the welfare and future of Montana's wildlife resources

Montana Chapter Membership Fee Schedule

Regular State Membership Rate	$12
Retired/Student State Membership Rate	$7
Northwest Section Rate	$5

To become a member log on to www.mttws.org and select the **Membership** tab on the left side of the page. There you will find a downloadable form to mail in. Other options include paying at the annual conference registration table; or visiting the National TWS website at www.wildlife.org.

TWS~National Accepting Applications for 2011 Leadership Institute

The Wildlife Society (TWS) is currently accepting applications for its Leadership Institute. The goal of the Institute is to facilitate the development of new leaders within The Wildlife Society and the wildlife profession as a whole. The Institute will recruit 10-15 promising early-career professionals for a series of intensive activities and mentoring relationships. The focus will be on exposing the participants to the inner workings of TWS and increasing the ranks of active leaders in TWS and the wildlife profession.

From May until November 2011, participants will engage in a series of activities to develop and expand their leadership skills. Institute members will also attend the 2011 TWS Annual Conference in Hawaii in November and participate in various activities, including mentoring and leadership workshop sessions. There is no tuition cost for the program and participants receive free registration for the conference, as well as a travel grant to cover expenses.

Participation in the Institute is geared toward early-career professionals, those individuals who are 2 to 3 years out of school (either undergrad or graduate school) and currently working full-time in a professional position in wildlife management or conservation, who can show evidence of their leadership potential. A small number of slots may also be available for (1) more recent graduates who have shown strong evidence of their leadership potential or (2) those who are working while concurrently pursuing a graduate degree. All applicants must be members of The Wildlife Society and a Chapter or Section of The Wildlife Society. The selection committee will be seeking to create a diverse group, with participants of varying gender, ethnic, and regional diversity. Selection will be based upon:

- An excellent academic record
- Demonstrated leadership capability or potential
- Demonstrated level of excellence in current position
- Commitment to and involvement in TWS

Preference will be given to individuals who are certified as Associate Wildlife Biologists or Certified Wildlife Biologists, or who have submitted such an application to The Wildlife Society.

Applicants must submit the following materials:

- Application form (available at http://joomla.wildlife.org/leadershipinstitute/)
- Cover letter with evidence of leadership capacity or potential, such as previous leadership positions held in TWS Chapters or Student Chapters or in other organizations
- Résumé, which includes a list of publications, awards, etc.
- Academic transcript/s (scanned copy)
- 2 letters of recommendation from supervisors, academic advisors, professors, or others in leadership positions with whom you have worked and who are familiar with your leadership potential, commitment to TWS, and commitment to wildlife management and conservation (should be emailed directly to Laura Bies (laura@wildlife.org), subject line "Leadership Institute Recommendation for [applicant last name]")
- An essay (1000 word limit), which succinctly summarizes (1) your concept of leadership, (2) your aspiration for your role within TWS in 5 to 10 years, and (3) why you are an ideal candidate for the Institute

Application deadline is 18 March 2011. Email all materials (except the application form, which is submitted online) to Laura Bies (laura@wildlife.org). Visit www.wildlife.org for more information (click on 'Leadership Institute' on the left).

Friday, Feb. 25th @ 10:00AM and 12:00PM

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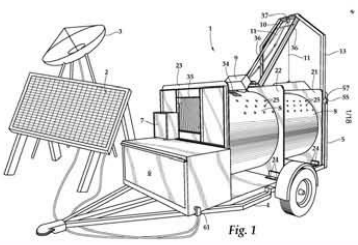

Fig. 1

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