Montana Chapter of The Wildlife Society

54th Annual Conference

Wildlife Restoration:

Celebrating Conservation Success and Facing Future Challenges

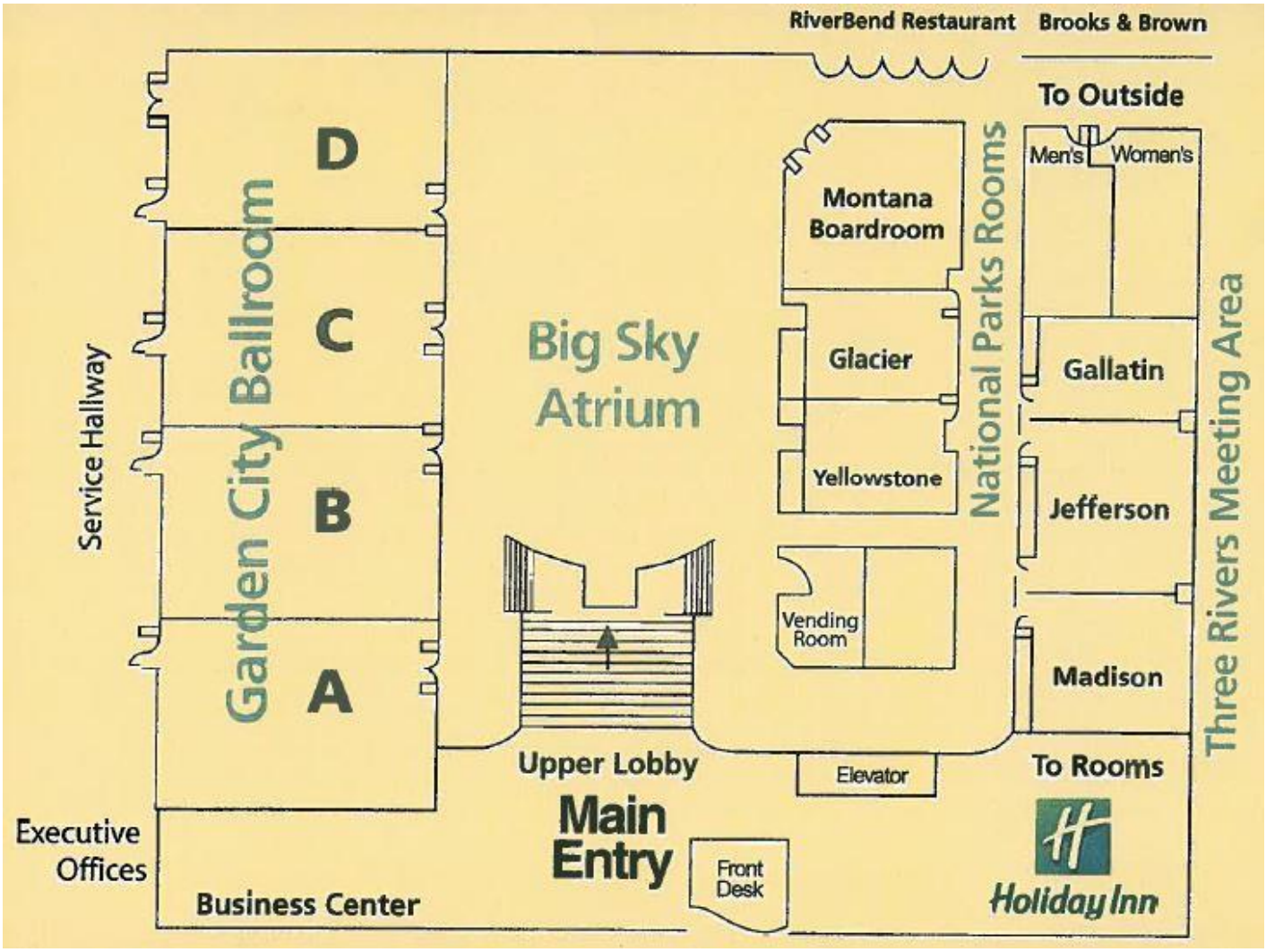
February 23–February 26, 2016

Missoula , Montana

Holliday Inn Downtown

2016 MT TWS Annual Conference Schedule

Time	Feb. 22 - Monday	Feb. 23 - Tuesday	Feb. 24- Wednesday	Feb. 25 - Thursday	Feb. 26- Friday
700				MT TWS Business Meeting 7-9am Breakfast provided Parlor B	
800			Common Loon Working Group 8am - 12pm Parlor A		Concurrent Sessions Begin at 8:20am Parlor B and C
900		REGISTRATION OPENS 9am		Concurrent Sessions Begin at 8:30am Parlor B and C	BREAK
1000		Collaborative Strategies Workshop Parlor A 9am -12 pm / Harlequin Duck Group Parlor B 10am-12pm	Partners of the America's Meeting 10am - 12pm Madison/Jefferson	BREAK Concurrent Sessions Parlor B and C	Parlor B and C
1100					
1200		LUNCH	LUNCH	CAC Meeting 12pm - 1pm Food provided - Parlor D	MEETING CONCLUDES
1300		Bat Working Group 1pm - 5pm Parlor B	PLENARY SESSION 1pm - 4pm Garden City Ballroom	Concurrent Sessions Parlor B and C	
1400					
1500			10-MINUTE BREAK	BREAK	
1600				Concurrent Sessions Parlor B and C	
1700			MT Assoc. FW Biologists Meeting 5pm-6pm Madison/Jefferson	Poster Session Big Sky Atrium	
1800		MT TWS Welcome Reception 6pm - 9pm Food provided Big Sky Atrium	Student/Professional Mixer Begin at 6pm Dinner provided Garden City Ballroom	Banquet Dinner Begin at 6pm Garden City Ballroom Silent Auction	
1900			Quiz Bowl Begin at 7:30pm Big Sky Atrium		
2000				Professional/Student Awards	
2100					


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

Daily Schedule

Tuesday - Feb. 24

Workshop

- **Collaborative and Innovative Strategies for Project Design and Accomplishing Work Goals** (9 am – 12 pm / Parlor A) Panel presentations focused on successful collaborations, recommendations for cooperation between partners, Creative avenues for partnership, identification of key elements to favor success in conservation, monitoring, or collaborator dynamics.

Working Groups

- **Harlequin Duck Working Group** (10am – 12pm / Parlor B)
- **Bat Working Group** (1– 5pm / Parlor B)

MT TWS Welcome Reception (6 – 9pm/Big Sky Atrium) Food provided (no host bar)

Wednesday - Feb. 25

Working Groups

- **Common Loon Working Group** (8 – 12pm / Parlor A)
- **Partners of the America's Meeting** (10am – 12pm / Madison/Jefferson)

LUNCH – provided by MT TWS (12:00pm – 1:00pm)

Plenary Session (1 – 4:00pm / Garden City Ballroom)

- **Welcome & State of the Chapter Address**
- **Speakers:**

  Dr. Jon Haufler and Carolyn Mehl (Ecosystem Management Research Institute): Restoring Wildlife Diversity at Landscape Scales

  Ed Bangs (USFWS-retired): Lessons from Wolf Restoration in the northwestern U.S.

  Keith Aune (Wildlife Conservation Society): Cultivating an ecological and cultural paradigm shift to restore bison on large prairie landscapes.

  Randy Matchett (USFWS): Black-footed ferret restoration; history, challenges and current status

MT Association of Fish & Wildlife Biologists Meeting (5 – 6pm / Madison/Jefferson)

Student Professional Mixer (6 – 9:30pm) Food provided (no host bar)

- **Student Professional Round Table Discussions** (6 – 7:30pm / Garden City Ballroom)
  Opportunity to meet professionals in different wildlife fields!
- **Quiz Bowl** (7:30 – 9:30pm / Big Sky Atrium)
  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.

Thursday - Feb. 26

Breakfast Business Meeting (7-9am / Parlor D) Food provided

- Join us and hear MT TWS chapter business updates, committee reports and keep up to date with the latest chapter activities.

Concurrent Sessions (Professional and Student Presentations) (8:30am – 5pm)

- Listen to and/or share your research with other biologists, students and natural resource professionals!
- **Session 1:** Parlor B
- **Session 2:** Parlor C

Conservation Affairs Committee with LUNCH – provided by MT TWS (12 – 1pm / Parlor D)

- The inaugural meeting of the Conservation Affairs Committee for those interested to establish committee leaders and policy priorities. Sign up to help, whether it be to volunteer your policy or biological expertise in current Montana affairs, your time to help coordinate activities, or your curious mind to gain policy experience. A table will be available throughout the conference for those who have questions or would like more information.

Poster Session (5-6pm / Big Sky Atrium)

- Visit with students and professionals about their poster presentations and research.

Silent Auction, Banquet Dinner & Awards (6 – 10pm / Garden City Ballroom)

- Will include a plated dinner, keynote speaker, silent auction fund raiser, and student/professional awards!

Friday - Feb. 26

Concurrent Sessions (Professional Presentations) (8:20am – 12pm)

- Listen to and/or share your research with other biologists, students and natural resource professionals.
- **Session 1:** Parlor B
- **Session 2:** Parlor C

CONCURRENT SESSIONS

****Indicates Student Presentation to be Judged**

THURS MORNING – FEBRUARY 25

	CONCURRENT SESSION 1 – Parlor B **Moderator – Erik Peterson**	**CONCURRENT SESSION 2 – Parlor C** **Moderator – Robert Garrott**
8:30	**C. Richardson – TRAPPING METHODS OF THE FERAL PIGEON IN THE CENTRAL BUSINESS DISTRICT OF BUTTE, MONTANA	**R. Herrygers – PREGNANCY RATES, METABOLITES, AND METABOLIC HORMONS IN BIGHORN SHEEP DURING AND AFTER THE BREEDING SEASON
8:50	**T. Ritter – HABITAT SELECTION, MOVMENTS, AN SURVIVAL OF DISPERSING JUVENILE BEAVERS IN SOUTHWESTERN MONTANA	**J. White – DEVELOPING PHYSIOLOGICAL PROFILES USING NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY TO INFORM BIGHORN SHEEP (*OVIS CANADENSIS*) MANAGEMENT
9:10	**A. Slominksi – LIFE HISTORY TRAITS AS MEDIATORS OF SOLITARY BEE RESPONSES TO CLIMATE-WARMING	**E. Flesch – AN INITIAL ASSESSMENT OF THE POTENTIAL OF GENOMIC ANALYSIS TO HELP INFORM BIGHORN SHEEP MANAGEMENT
9:30	N. Schwab – BAT ACTIVITY PATTERSN AND ROOST SELECTION IN MANAGED-FORESTS	**C. Butler – WHAT DOES IT ALL MEAN? INTERPETING RESPITORY PATHOGEN SURVEY RESULTS FOR BIGHORN SHEEP MANAGEMENT
9:50	**S. Cheyenne – BATS IN BUILDINGS: ASSESSING HUMAN STRUCTURES AS ROOST SITES IN GLACIER NATIONAL PARK	J. Cunningham – EVALUATING SUCCESS FOR A WITHIN RANGE TRANSPLANT OF BIGHORN SHEEP IN SOUTHWESTERN MONTANA
10:10	**BREAK** **Moderator – Lori Roberts**	**BREAK** **Moderator – Lauri Hanauska-Brown**
10:30	**T. Paterson – VARIATION IN BIRTH MASS GAIN DURING LACTATION FOR A LONG-LIVED MAMMAL: A CASE STUDY USING THE WEDDELL SEAL	**S. Sells – APPLICATION OF STRUCTURED DECISION MAKING WILDLIFE MANAGEMENT IN MONTANA
10:50	J. Coltrane – BROWN BEAR AND HUMAN RECREATIONAL USE OF TRAILS IN ACHORAGE, ALASKA	**B. Lowrey – SEASONAL RESOURCE SELECTION BY INTRODUCED MOUNTAIN GOATS IN THE SOUTHWEST GREATER YELLOWSTONE AREA
11:10	**L. Stutzman – INFLUENCE OF INFANTICIDE RISK ON BROWN BEAR DEN-SITE SELECTION	**W. Sarmento – REDISTRIBUTION, HUMAN SHIELDS, AND LOSS OF MIGRATORY BEHAVIOR IN THE CROWN OF THE CONTINENT
11:30	**W. Deacy – KODIAK BROWN BEARS SURF THE SALMON RED WAVE: DIRECT EVIDENCE FROM GPS COLLARED INDIVIDUALS	**B. Turnock - SEEKING OUT THE HOARY MARMOT: HABITAT CHARACTERISTICS OF AN ALPINE OBLIGATE
11:50	**LUNCH (PROVIDED)**	**LUNCH (PROVIDED)**

THURS AFTERNOON – FEBRUARY 25

	CONCURRENT SESSION 1 – Parlor B Moderator – Jodie Canfield	CONCURRENT SESSION 2 – Parlor C Moderator – Bryce Maxell
1:00	N. Mikle –EVALUATING REPRODUCTIVE SUCCESS AND CHANGES IN GENETIC DIVERSITY OF GRIZZLY BEARS IN NORTHWESTERN MONTANA	**W. Janousek – AN ASSESSMENT OF CURRENT STATEWIDE AVIAN MONITORING PROGRAMS
1:20	J. Teisberg – DIET COMPOSITION AND BODY CONDITION IN NORTHERN CONTINENTAL DIVIDE GRIZZLY BEARS, MONTANA	**C. Deane – HARVEST AND NON-HARVEST MORTALITY RELATIONSHIPS FOR LESSER SCAUP BREEDING IN SOUTHWESTERN MONTANA
1:40	L. Roberts – FORTY-FIVE YEARS OF GRIZZLY BEAR MORTALITY IN THE NORTHERN CONTINTAL DIVIDE ECOSYSTEM	**D. Fagre – INVESTIGATING THE EFFECTS OF BISON GRAZING ON GRASSLAND SONGBIRDS
2:00	C. Costello – ESTIMATION OF SUSTAINABLE MORTALITY THRESHOLDS OF GRIZZLY BEARS IN THE NORTHERN CONTINENTAL DIVDE ECOSYSTEM	**S. SCHROFF – FINE SCALE NEST SITE SELECTION OF GREATER-SAGE GROUSE (CENTOCERCUS UROPHASIANUS) IN THE CENTENNIAL VALLEY, MONTANA
2:20	**B. Regan – GRIZZLY BEAR SCAVENGING OF CARRION ON THE NORTHERN YELLOWSTONE RANGE (1997-2012)	**J. Thornburg – MEXICAN SPOTTED OWL SITE OCCUPANCY TREANDS AND SMALL MAMMAL ABUNANCE IN THE CANYONLANDS OF UTAH
2:40	W. Kasworm – AMERICAN BLACK BEAR POPULATION FRAGMENTATION DETERMINED THROUGH PEDIGREES IN THE TRANSBORDER CANADA-UNITED STATES REGION	**D. Landry – RECREATIONAL AVIATION AND WILDLIFE: THE PHYSIOLOGICAL STRESS RESPONSE IN DEER AND ASSOCIATED USER PERCEPTIONS
3:00	**BREAK** **Moderator – Kenneth Plourde**	**BREAK** **Moderator – Julie Cunningham**
3:20	** S. Bassing – WOLF PACK DISTRIBUTION IN RELATION TO HEAVY HARVEST IN SOUTHWEST ALBERTA	J. Newby – ASSESSING AGE STRUCTURE, WINTER TICKS, AND NUTRITIONAL CONDITION AS POTENTIAL DRIVERS OF FECUNDITY IN MONTANA MOOSE
3:40	**M. PARKS – PARTICIPANT PERCEPTIONS OF RANGE RIDER PROGRAMS OPERATING TO MITIGATE WOLF-LIVESTOCK CONFLICTS IN THE WESTERN UNITED STATES	K. Proffitt – LINKING LANDSCAPE-SCALE DIFFERENCE IN FORAGE TO UNGULATE NUTRITIONAL ECOLOGY
4:00	L. Bradley – EFFECTS OF WOLF REMOVAL ON LIVESTOCK DEPREDATION RECURRENCE AND WOLF RECOVERY IN MONTANA, IDAHO AND WYOMING	S. Thompson – EFFECTS OF HUNTER ACCESS ON HUNTING SEASON ELK DISTRIBUTION IN THE MISSOURI RIVER BREAKS
4:20	N. DeCesare – WOLF-LIVESTOCK CONFLICT IN MONTANA: SPATIAL AND TEMPORAL FACTORS INFLUENCING LIVESTOCK LOSS	D. Ranglack – EVALUATING ELK SUMMER RESOURCE SELECTIONS AND APPLICATION TO SUMMER RANGE HABITAT MANAGEMENT
4:40	J. Nowak – POPR: SOFTWARE FOR WILDLIFE MANAGERS	A. Jakes – FACTORS INFLUENCING SEASONAL MIGRATIONS OF PROGHORN ACROSS THE NORTHERN SAGEBRUSH STEPPE

FRIDAY MORNING – FEBRUARY 26

	CONCURRENT SESSION 1 – Parlor B **Moderator – Chris Hammond**	**CONCURRENT SESSION 2 – Parlor C** **Moderator – Kaitlin MacDonald**
8:20	J. Canfield – 25 YEARS OF ASPEN HABITAT RESTORATION ON THE BEARTOOTH RANGER DISTRICT, CUSTER GALLATIN NATIONAL FOREST	E. Almberg – SPATIAL AND TEMPORAL PATTERNS OF TRICHINELLA IN MONTANA'S BLACK BEARS 2004-2014
8:40	A. Soukkala – CURRENT STATUS OF EFFORTS TO RESTORE NORTHERN LEOPARD FROGS TO THE FLATHEAD RESERVATIONS IN NORTHWESTERN MONTANA	K. Carson – 2015 WILDLIFE DISEASE RETROSPECTIVE
9:00	K. DuBois – EFFECTIVENESS OF TRAIL CAMERAS AND SCAT GENETICS FOR DETECTING NORTHERN BOG LEMMINGS IN WESTERN MONTANA	K. Linnell – SPION KOP WIND FARM: MONTANA, FISH, WILDLIFE AND PARKS' NEW ROLE IN WIND ENERGY
9:20	C. Sime – MONTANA'S GREATER SAGE GROUSE CONSERVATION STRATEGY: ALL HANDS ACROSS ALL LANDS	R. Domenech – WING_TAGGED ENCOUNTERS OF GOLDEN EAGLES CAPTURED IN MONTANA
9:40	**BREAK** **Moderator – Chris Forristal**	**BREAK** **Moderator – Beau Larkin**
10:00	S. Hilty- MONTANA'S BAT ACOUSTIC SURVEILLANCE EFFORTS: AN UPDATE	A. Anderson & K. Farrar – A COMPARISON OF OCCUPIED AND UNOCCUPIED SHARP-TAILED GROUSE HABITAT IN MONTANA
10:20	P. Farnes – IS FALL GREEN-UP SIGNIFICANT?	J. Holbrook – OCCUPANCY AND ABUNDANCE OF AMERICAN BADGERS AND PIUTE GROUND SQUIRRELS IN THE SAGEBRUSH-STEPPE: IMPLICATIONS OF THE FIRE-CHEATGRASS CYCLE
10:40	M. Restani – CITIZEN SCIENTIST MONITORING OF OSPREY DISTRIBUTION AND REPORDUCTIVE SUCCESS ALONG THE YELLOWSTONE RIVER, MONTANA	Q. Latif – AVIAN RELATIONSHIPS WITH WILDFIRE AT TWO DRY FOREST LOCATIONS WITH DIFFERENT HISTORICAL FIRE REGIMES
11:00	K. Stone – COMMON POORWILL HABITAT USE AND BREEDING ECOLOGY IN WESTERN MONTANA	J. Golding – ASSESSING GRAZING AS A CONSERVATION TOOL IN SAGEBRUSH AND GRASSLAND ECOSYSTEMS
11:20	B. Maxell – ACCESSING INFORMATION ON MONTANA'S ANIMALS, PLANTS, AND BIOLOGICAL COMMUNITIES THROUGH THE MONTANA NATURAL HERITAGE PROGRAM'S WEB APPLICATIONS: RECENT UPDATES	R. Crandall – ESTIMATING SURVIVAL AND DETERMING CAUSES OF MORTALITY OF GOLDEN EAGLES IN SOUTH-CENTRAL MONTANA
11:40		A. Shreading – GOLDEN EAGLE MIGRATION CORRIDORS ALONG THE ROCKY MOUNTAIN FRONT AND INTERMOUNTAIN FLYWAYS
12:00	**END 2015 MT TWS CONFERENCE - THANKS FOR ATTENDING!**	**END 2015 MT TWS CONFERENCE - THANKS FOR ATTENDING!**

ABSTRACTS

ALPHABETICAL BY PRESENTER'S NAME
***indicates Presenter**
****indicates student presentation**
(poster's indicated in parentheses)

SPATIAL AND TEMPORAL PATTERNS OF TRICHINELLA IN MONTANA'S BLACK BEARS, 2004-2014

Emily Almberg*, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman
Lynnzie Tompkins, Department of Biotechnology, Montana State University, Bozeman
Floyd Seesee, Department of Veterinary Science, Montana State University, Bozeman
Jennifer Ramsey, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman
Keri Carson, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman
Neil Anderson, Montana Fish, Wildlife, and Parks, Kalispell

Trichinella nematodes are a globally distributed, zoonotic parasite transmitted through the consumption of infected animal tissue. Humans are at risk of contracting Trichinella by consuming undercooked bear or mountain lion meat, and thus historically, Montana Fish, Wildlife, and Parks subsidized Trichinella-testing of hunter-harvested black bears and mountain lions. Here, we summarize 11 years of data (2004-2014) on the spatial and temporal distribution of Trichinella in Montana's black bears. Risk of infection was spatially variable, highest in northwest Regions 1 and 4, and was positively associated with black bear and grizzly bear densities. Prevalence has been significantly declining across the state over time from a state-wide prevalence of 0.05 in 2004 to 0.02 in 2014. Potential causes and consequences are discussed. Montana Fish, Wildlife, and Parks stopped subsidizing Trichinella testing in 2015; hunters are asked to thoroughly cook their meat to an internal temperature of 165° F, which inactivates Trichinella species and most other parasites.

A COMPARISON OF OCCUPIED AND UNOCCUPIED SHARP-TAILED GROUSE HABITAT IN MONTANA.

Alissa A. Anderson*, Wildlife Division, Montana Fish, Wildlife and Parks, Kalispell
Kaitlyn E. Farrar*, Wildlife Division, Montana Fish, Wildlife and Parks, Kalispell

The sharp-tailed grouse (*Tympanuchus phasianellus*) was once present throughout the state of Montana. The species was extirpated in Montana west of the Continental Divide by the late 2000's, while healthy populations still exist east of the Continental Divide. We compared key habitat components important to sharp-tailed grouse survival in occupied areas east of the Divide to unoccupied areas west of the Divide. We measured vegetative variables related to nesting, brood-rearing, and wintering habitat requirements in 3 occupied study areas and 4 unoccupied study areas during the spring of 2015. Habitat Suitability Index scores were calculated for nesting and brood-rearing. Habitat Suitability Index averages show habitat in the Blackfoot valley to be most suitable for sustaining a sharp-tailed grouse population, habitat in the Bitterroot valley to be potentially suitable, and habitat in Drummond and in the Mission

Valley to be unsuitable at this time. These results suggest that the Blackfoot and Bitterroot valleys may contain suitable habitat for a potential sharp-tailed grouse reintroduction.

****WOLF PACK DISTRIBUTION IN RELATION TO HEAVY HARVEST IN SOUTHWEST ALBERTA**

Sarah B. Bassing*, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula
Michael S. Mitchell, U.S. Geological Survey, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula
Paul M. Lukacs, Wildlife Biology Program, University of Montana, Missoula
Dave E. Ausband, Idaho Department of Fish & Game, Coeur d'Alene
Lisette P. Waits, Department of Fish & Wildlife Sciences, University of Idaho, Moscow
Greg Hale, Fish & Wildlife, Alberta Environmental & Sustainable Resource Development, Blairmore

Gray wolf (*Canis lupus*) populations are difficult to monitor because wolves can be elusive and occur in low densities. Harvest can further complicate wolf monitoring by affecting wolf behavior, altering pack structure, and potentially reducing probability of detection. Currently, Montana and Idaho use patch occupancy models to monitor wolves at state-wide scales. These models were originally developed prior to the initiation of wolf harvest and there is growing concern that current occupancy estimates are becoming less reliable as harvest continues. Our objectives were to determine whether we could estimate wolf distribution for a heavily harvested wolf population and assess how harvest may be affecting that distribution. We surveyed potential rendezvous sites and collected DNA samples from wolf scats for genetic analysis and surveyed hunters for wolf sightings in southwestern Alberta from 2012 to 2014. We used a Bayesian approach to fit dynamic occupancy models to the encounter histories while accounting for false-positive detections using JAGS and Program R. We found both habitat and anthropogenic factors influenced wolf occupancy parameters in southwestern Alberta and detection probability varied by survey method. Our preliminary results suggest wolf pack distribution is fairly consistent but that source-sink dynamics may be occurring in certain regions of the study area. Despite heavy harvest pressure, southwestern Alberta appears to maintain a stable wolf population, although this is possibly due to immigration from nearby regions.

EFFECTS OF WOLF REMOVAL ON LIVESTOCK DEPREDATION RECURRENCE AND WOLF RECOVERY IN MONTANA, IDAHO AND WYOMING

Elizabeth H. Bradley,* Montana Fish, Wildlife and Parks, Missoula
Hugh S. Robinson, University of Montana, Missoula
Edward E. Bangs, U.S. Fish and Wildlife Service, Helena, MT
Kyran Kunkel, University of Montana, Missoula
Michael D. Jimenez, U.S. Fish and Wildlife Service, Jackson, WY
Justin A. Gude, Montana Fish, Wildlife and Parks, Helena
Todd Grimm, U.S. Department of Agriculture Wildlife Services, Boise, ID

Wolf predation on livestock and management methods used to mitigate conflicts are highly controversial and scrutinized especially where wolf populations are recovering. Wolves are commonly removed from a local area in attempts to reduce further depredations, but the effectiveness of such management actions is poorly understood. We compared the effects of 3 management responses to livestock depredation by wolf packs in Montana, Idaho, and Wyoming: no removal, partial pack removal, and full pack removal. From 1989 to 2008, we documented 967 depredations by 156 packs: 228 on sheep and 739 on cattle and other stock. Median time between recurrent depredations was 19 days following no removal (n = 593), 64 days following partial pack removal (n = 326), and 730 days following full pack removal (n = 48). Partial pack removal was most effective if conducted within the first 7 days following depredation, after which there was only a marginally significant difference between partial pack removal and no action (HR = 0.86, P = 0.07), and no difference after 14 days (HR = 0.99, P = 0.93). Ultimately, pack size was the best predictor of a recurrent depredation event; the probability of a depredation event recurring within 5 years increased by 7% for each animal left in the pack after the management response. However, the greater the number of wolves left in a pack, the higher the likelihood the pack met federal criteria to count as a breeding pair the following year toward population recovery goals.

****WHAT DOES IT ALL MEAN? INTERPRETING RESPIRATORY PATHOGEN SURVEY RESULTS FOR BIGHORN SHEEP MANAGEMENT**

Carson J. Butler *, Ecology Department, Montana State University, Bozeman
Robert A. Garrott, Ecology Department, Montana State University, Bozeman

Respiratory disease has been a major challenge for bighorn sheep conservation and is a dominant factor influencing management decisions of bighorn sheep, however; much about the disease process remains unknown. Decades of research have compiled considerable evidence that domestic sheep and goats can transmit the disease to bighorn sheep as well as strong evidence for several bacterial organisms as causative agents for the disease. However, there are examples of bighorn populations hosting the agents linked to respiratory disease with little demographic side-effects. Further, the immediate cause of disease events often remains undetermined. Two general hypotheses exist to explain observed disease events in wildlife populations: 1) A disease event is caused by introduction of a novel pathogen from neighboring or sympatric host populations or; 2) A disease event is caused by certain conditions triggering endemic pathogens to become virulent to the host. While the extent to which these competing hypotheses explain observed respiratory disease events in bighorn sheep is unknown, the appropriate management actions to address disease due to these different processes are very different. Effectively addressing these hypotheses and better understanding the major causes of observed respiratory disease events is a challenge and requires rigorous and repeated pathogen sampling in bighorn populations both affected and seemingly unaffected by respiratory disease. This presentation provides a brief background of bighorn respiratory disease, highlights the challenges of interpreting respiratory pathogen survey results to inform management as well as recent advances in respiratory pathogen research that have promise to help further inform management decisions.

25 YEARS OF ASPEN WILDLIFE HABITAT RESTORATION ON THE BEARTOOTH RANGER DISTRICT, CUSTER GALLATIN NATIONAL FOREST

Jodie E. Canfield*, Custer Gallatin National Forest, Bozeman, MT
Shawn Stewart, Montana Fish Wildlife and Parks, Red Lodge

Aspen is one of the most biologically diverse ecosystems in the Intermountain West. Aspen is an important wildlife habitat, providing forage, cover, shade, and nesting for birds, small mammals, big game, and forest carnivores. Upland game birds, particularly ruffed grouse, are associated with aspen. Ruffed grouse are a habitat indicator species for aspen communities in the Custer National Forest Plan. Montana's Comprehensive Fish and Wildlife Conservation Strategy (2005) identified aspen as a community type of greatest conservation need due to altered natural fire regimes. Although aspen is a rare vegetation component on the Custer Gallatin National Forest, the Beartooth Ranger District supports relatively large expanses of aspen along the Beartooth Mountain Face. Many of these aspen communities had converted to conifers, or were declining in health. In recognition of this opportunity to restore wildlife habitat, a management plan was developed in 1990, featuring ruffed grouse. Since 1990, crews have treated about 141 aspen stands on about 400 acres. Methods included prescribed burning and using chainsaws and other hand tools, resulting in the creation of a mosaic of aspen size and age classes and drumming logs that fulfill the yearlong habitat needs of ruffed grouse. Funding for these treatments came largely from a partnership between the Beartooth Ranger District and Montana's Upland Bird Program. Wildlife observed using treated aspen stands included a diverse array of cavity and non-cavity nesting birds, including ruffed grouse; small mammals; and big game, especially moose.

2015 WILDLIFE DISEASE RETROSPECTIVE

Keri Carson*, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman
Jennifer Ramsey, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman
Emily Almberg, Wildlife Health Laboratory, Montana Fish, Wildlife, and Parks, Bozeman

Montana Fish, Wildlife and Parks is developing a Wildlife Health Program. One of the functions of the program is to integrate disease surveillance, population health monitoring, and wildlife health diagnostic services to provide information to the public and wildlife professionals on the dynamics, risk, and impacts of disease in Montana's wildlife. The knowledge gained from this program is aimed at improving conservation efforts and the safety of both humans and domestic animals. The Wildlife Health Laboratory is a statewide lab that receives hundreds to thousands of biological samples each year for disease surveillance projects, epidemiologic and morbidity investigations, and forensics. An overview of notable zoonotic and non-zoonotic diseases detected from 2015 laboratory submissions will be discussed, providing relevance, repercussions and general background or recent history of the disease in Montana.

BROWN BEAR AND HUMAN RECREATIONAL USE OF TRAILS IN ANCHORAGE, ALASKA

Jessica A. Coltrane*, Montana Fish Wildlife & Parks, Kalispell
Rick Sinnott, retired, Alaska Department of Fish and Game, Anchorage

The Municipality of Anchorage, Alaska, has 301,000 human residents and hundreds of thousands of visitors each year. Anchorage also supports a viable population of brown bears. As a result, human-bear encounters are common. We monitored recreational trails near salmon spawning streams at 3 study sites with camera traps during the summers of 2009 – 2012 to better understand daily and seasonal activity patterns of bears and humans on these trails. We found that the more remote study sites had the least human activity and the most bear activity, and human-bear encounters were most likely to occur from July through early September due to a higher degree of overlap between human and bear activity during this timeframe. Most brown bears at our study sites appeared to have adopted a crepuscular and nocturnal activity pattern, which was more pronounced at the site with the most human use. More people used trails Friday through Sunday, while there was no difference in bear activity among days of week. Recreational activities and user groups differed among sites. Based on our data, areas should be assessed individually to mitigate adverse human-bear encounters. However, one potential solution for avoiding dangerous bear encounters at all study sites is to restrict human access or types of recreational activity. When human access is controlled in important bear habitat, distribution of visitors becomes spatially and temporally more predictable, allowing bears an opportunity to adjust activity patterns to avoid people while still using the resource.

ESTIMATION OF SUSTAINABLE MORTALITY THRESHOLDS FOR GRIZZLY BEARS IN THE NORTHERN CONTINENTAL DIVIDE ECOSYSTEM

Cecily M. Costello*, Montana Fish, Wildlife, and Parks, Kalispell
Richard D. Mace, Montana Fish, Wildlife, and Parks, Kalispell
Lori Roberts, Montana Fish, Wildlife, and Parks, Kalispell
Daniel Carney, Blackfeet Fish and Wildlife Department, Browning, MT
Stacy Courville, Confederated Salish and Kootenai Tribe, East Polson, MT
James Jonkel, Montana Fish, Wildlife and Parks, Missoula
Michael Madel, Montana Fish, Wildlife and Parks, Choteau
Tim Manley, Montana Fish, Wildlife and Parks, Kalispell
John Waller, National Park Service, Glacier National Park, West Glacier, MT
Erik Wenum, Montana Fish, Wildlife and Parks, Kalispell

Habitat management and limits on mortality have led to population growth and sizable range expansion for the federally-listed grizzly bear population in the Northern Continental Divide Ecosystem (NCDE), Montana. Human-caused mortality has coincidentally increased, but it is not clear what level of human-caused mortality would cause the population to decline. A record of annual documented mortalities of independent (≥2 years old) bears is maintained for the NCDE, from which an estimate of the total number of mortalities is generated. Our goal was to estimate sustainable survival rates for independent bears and to develop realistic thresholds for sustainable mortality, which could be applied to these annual estimates. We estimated survival and recruitment rates using 662 bear-years of telemetry data, performed stochastic modeling, and estimated the annual growth rate as 1.023 and annual population size as 765–960 during 2004–2014. We then evaluated minimum independent survival rates consistent with a stable to increasing trend, and integrated these sustainable rates with model-estimated population size and mean estimates of total annual independent bear mortality to establish mortality thresholds.

During 2004–2014, estimates of total annual mortality were highly variable, but averaged 13.8 for females and 16.4 for males. For females and males, respectively, these estimates accounted for only 69% (range 28–168%) and 62% (28–121%) of sustainable mortality thresholds, indicating that approximately 6 and 10 additional annual mortalities could have been sustained without the population declining. Application and periodic reevaluation of mortality thresholds will help managers reach or maintain a target population size for grizzly bears in the NCDE.

ESTIMATING SURVIVAL AND DETERMINING CAUSES OF MORTALITY OF GOLDEN EAGLES IN SOUTH-CENTRAL MONTANA

Ross Crandall*, Craighead Beringia South, Kelly, Wyoming
Derek Craighead, Craighead Beringia South, Kelly, Wyoming
Bryan Bedrosian, Teton Raptor Center, Jackson, Wyoming

There is concern for Golden Eagles in the West as a result of contradictory population trend estimates and a likely increase in threats including but not limited to expanded wind energy development. Estimating survival of Golden Eagles and identifying causes of mortality can be used to assess the viability of nesting Golden Eagle populations and to direct mitigation efforts if necessary. To date, little information exists on Golden Eagle survival in western North America. In addition, identified causes of Golden Eagle mortality are often associated with an opportunity to find dead birds, creating a potential bias that may be minimized with the use of satellite telemetry. We outfitted 17 adult and 13 nestling Golden Eagles with satellite transmitters during the 2011-2014 nesting seasons near Livingston, Montana to estimate survival and determine causes of mortality. We used multi-state models to estimate survival over discrete-time periods for both adults and nestlings. Preliminary results showed our survival estimates were consistent with similar long-lived, slow reproducing raptors. Golden Eagle mortalities in our study were a result of poisoning, intraspecific interaction and poaching. Our survival estimates are consistent with the stable density of breeding Golden Eagles in our study area and the primary causes of mortality differed from repository-based studies.

EVALUATING SUCCESS FOR A WITHIN-MOUNTAIN RANGE TRANSPLANT OF BIGHORN SHEEP IN SOUTHWESTERN MONTANA

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Montana Fish, Wildlife and Parks (MFWP) performed a bighorn sheep transplant within the Madison Mountains of southwest Montana February 2015. Once with 5 distinct wintering ranges, the herd since endured, and recovered from, several all-age die-offs. As of 2013, one historic wintering area was overpopulated (>250 bighorn), one sparsely populated (~30 bighorn), and three historic wintering areas were left unoccupied: Indian Creek, Wolf Creek, and the Henry's Mountains. MFWP evaluated habitat and proposed to reintroduce bighorn from the overpopulated wintering range to either Wolf Creek or Indian Creek. After the EA and public process concluded, Wolf Creek was the selected release site. MFWP captured 52 bighorn from the overpopulated winter range using a drop-net, and moved them via trailer to the release site. Ten of the released bighorns were fitted with LOTEK Lifecycle GPS collars, providing satellite location data once daily for up to 4 years. Transplant success was mixed, with three collared bighorns immediately returning to their former range, three collared bighorns wintering at the sparsely populated intermediate range, and four collared bighorns remaining through winter and into summer at the reintroduction site. One bighorn died shortly after release. The four collared bighorns remaining at the release site explored Indian Creek through summer, then in July, 3 returned to their original range and 1 remained in the transplant area. Of the 52 bighorns transplanted, approximately 10-15 remain in the Wolf Creek transplant range. Subsequent transplants are planned to enhance the restoration of bighorn sheep in the Madison Range.

****KODIAK BROWN BEARS SURF THE SALMON RED WAVE: DIRECT EVIDENCE FROM GPS COLLARED INDIVIDUALS**

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One of the goals of Ecosystems Base Fisheries Management (EBFM) is recognizing and mitigating indirect effects of fisheries on trophic interactions. Most research on indirect effects has considered how the abundance of managed fishes influences trophic interactions with other species. However, recent work has shown that attributes besides abundance, such as life history variation, can strongly mediate species interactions. For example, phenological variation within prey species may enhance foraging opportunities for mobile predators by increasing the duration over which predators can target vulnerable life stages of prey. Here, we present direct evidence of individual brown bears exploiting variation in sockeye salmon spawning phenology by tracking salmon runs across a 2,800 km^2 region of Kodiak Island. Data from 40 GPS collared brown bears show bears visited multiple spawning sites in synchrony with the order of spawning phenology. The average time spent feeding on salmon was 67 days, while the average duration of spawning for one population was only 40 days. The number of sites used was correlated with the number of days a bear exploited salmon, suggesting phenological variation in the study area influenced bear access to salmon, a resource which strongly influences bear fitness. These results suggest fisheries managers attempting to maximize harvest while minimizing impacts on brown bears should strive to protect the population diversity that underlies the phenological variation used by wildlife consumers.

These results underscore the need to understand how fisheries affect life history diversity in addition to abundance in order to minimize negative effects of fisheries management on non-target species, a goal of EBFM.

****HARVEST AND NON-HARVEST MORTALITY RELATIONSHIPS FOR LESSER SCAUP BREEDING IN SOUTHWESTERN MONTANA**

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Since the mid-to-late 1990s, lesser scaup (*Aythya affinis*) populations have remained more than 20% below the population goal set forth in the North American Waterfowl Management Plan. Accordingly, considerable attention has been directed towards understanding what factors may be limiting their population, including the role of harvest. Red Rock Lakes National Wildlife Refuge (RRL) in southwestern Montana is the site of a long-term study of lesser scaup ecology and demography. Preliminary harvest estimates indicate that this population is harvested at rates similar to the continental population with juveniles experiencing an annual average harvest rate of 9.1% (95% CI = 7.7 - 10.7%) and adults an average annual harvest rate of 3.6% (95% CI = 2.2 - 6.1%). Since 2005, ~1,300 female have been banded on the study site and an additional ~1,000 females have been nasal-marked. In addition, ~1,400 resightings have been collected for nasal-marked hens on the study site and ~340 dead recoveries from our study population have been reported from Canada to Mexico. With results obtained from multistrata models that utilize these multiple encounter types, I will present (1) estimates of harvest and natural mortality rates for female lesser scaup banded and nasal-marked at RRL from 2005-2016; (2) how non-harvest mortality varies in relation to harvest mortality over the same period; (3) an assessment of how these rates respond to changes in hunting regulations. These results will be used to help inform lesser scaup harvest demography, a key structural uncertainty in current harvest models identified in the draft Scaup Conservation Action Plan.

WOLF-LIVESTOCK CONFLICT IN MONTANA: SPATIAL AND TEMPORAL FACTORS INFLUENCING LIVESTOCK LOSS

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Successful wolf recovery in Montana has brought with it some negative impacts on livestock producers in certain areas and time periods. We assessed the spatial and temporal patterns of wolf depredations on livestock in Montana at a broad, statewide scale during the past decade (2005–2014). These analyses highlighted areas of concentrated and consistent wolf-livestock conflicts, such that, for example, 50% of the statewide conflicts occur in 5% of the state. We then used generalized linear mixed-models to test covariates potentially predictive of both conflict presence (zero vs. non-zero depredation events) and conflict severity (number of events given at least 1), including the assessment of lethal controls and hunter harvest as tools to reduce conflicts. Using administrative hunting districts (HDs) as the unit of analysis, we found that conflict presence increased for HD-years with wolves present (P<0.001), higher wolf pack densities (P=0.006), higher livestock densities (P<0.001), and intermediate proportionate areas of agricultural land (P<0.001). HDs with depredations the previous year were more likely to continue having them (P<0.001), though lethal removal of wolves significantly reduced this effect (P=0.038). Direct effects of wolf hunter harvest were shown to marginally (P=0.152) reduce year-to-year conflicts, but indirect effects of harvest would also be expected given its role in determining wolf numbers, a primary driver of conflicts. Minimizing livestock losses is a top priority for successful wolf management, and these results shed light on the broad-scale patterns behind chronic problems and the tools used to address them.

WING-TAGGED ENCOUNTERS OF GOLDEN EAGLES CAPTURED IN MONTANA

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Recently, there has been an increase in concern for Golden Eagle (*Aquila chrysaetos*) populations in the western U.S. The concern stems from a marked decrease in the number of migrants and future threats from a variety of anthropogenic factors including industrial energy development. Thus, there is a need for more information on Golden Eagles including: where they winter, longevity, causes of mortality and critical habitat needs. Standard banding offers low encounter rates (ca. 7%) and satellite telemetry is cost prohibitive for large sample sizes. We began auxiliary marking Golden Eagles with vinyl wing-tag markers as a cost effective means to gather information on the species. Since 2004, we have wing-tagged 260 eagles, and re-encountered 59 individuals, giving us a 23% encounter rate. This technique is proving considerably more effective than banding alone as a means of identifying individuals and receiving re-encounter information. We attribute this success, in part, to internet information sharing and the increasing use of remote cameras set up on carcasses to view scavenger activity. Given our observed encounter rates, we suggest utilizing wing-tags as a form of auxiliary marking to augment studies where standard banding is the lone marking method.

EFFECTIVENESS OF TRAIL CAMERAS AND SCAT GENETICS FOR DETECTING NORTHERN BOG LEMMINGS IN WESTERN MONTANA

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The northern bog lemming (*Synaptomys borealis*) is a boreal species that extends south into Washington, Idaho, and Montana in the west. Little is known about this rare species in Montana, in part due to the difficulty of catching it using standard small mammal trapping methods. Prior surveys with Sherman live traps resulted in low trapping success and high mortality rates for northern bog lemmings. This species is currently being evaluated for ESA listing, so better methods for detecting them are needed. We tested scat boards and Bushnell NatureView trail cameras with close-up lenses to determine their effectiveness for detecting northern bog lemmings. Cameras were pointed at scat boards baited with muskrat lure. In 2015 we surveyed seven wetland sites, five of which were known northern bog lemming sites, for 3-8 nights each with 5-10 cameras per site. Camera-nights at each site ranged from 15 to 38, and totaled 188 camera-nights overall. We obtained definitive and probable detections of northern bog lemmings (n=8) at three sites for a detection rate of 4.25 detections per 100 camera-nights. Twenty scat samples collected from scat boards, runways, and latrine sites were submitted to the National Genomics Laboratory for Wildlife and Fish Conservation at the Rocky Mountain Research Station in Missoula. Genetic testing is in progress to determine species identification (results will be presented, if available). Trail cameras are easy to deploy and less labor-intensive than live trapping for detecting small mammal species that can be identified from photographs. Efficiency may be improved by finding better lures, but overall, species identification through genetic analysis of scat would be the most cost effective way to survey northern bog lemmings, if it is proven to work.

****INVESTIGATING THE EFFECTS OF BISON GRAZING ON GRASSLAND SONGBIRDS**

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The National Bison Range (NBR) in the Mission Valley of Montana manages a herd of 325-350 bison (*Bison bison*). Bison are rotated through eight grazing pastures, which consist mostly of intermountain grassland. This creates different grazing intensities, based on length of time grazed, season grazed, and density of bison. Grazing is considered to be an important source of disturbance in grassland systems. However, different grazing intensities may create more or less favorable conditions for grassland breeding songbirds, a suite of birds that has declined drastically over the last few decades. This research investigates the interaction between bison grazing and songbird abundance. We used double-dependent observer transects to record grassland songbird observations during the pilot season of 2015. We present preliminary results from the pilot season of grassland songbird abundance and density. The outcomes will culminate into a concrete, local monitoring program for the NBR to support conservation of grassland songbirds, and will allow them to adjust management activities to maintain suitable grassland songbird habitat. Furthermore, the research will illuminate the relationship between a native grazer and grassland birds. While domestic livestock have largely replaced native grazers on grasslands, numerous reintroduction efforts of bison have been proposed. This study will help inform the expected outcomes and management objectives of those reintroduction efforts.

IS FALL GREEN-UP SIGNIFICANT?

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Fall green-up does not occur every year. Methods have been developed to determine whether or not fall green-up occurs at each SNOTEL and Climatological site in the Greater Yellowstone area. It is based on climatic conditions after the first killing frost (daily Tmin of 22 ^{0} F or less) and growing degree days and precipitation that occur after that point. Green-up vegetation may be available into January or February if snow covers the vegetation before another Tmin of 22 ^{0} F or lower occurs. Crude protein of cured grasses is about 3 to 7 percent. Ungulates need crude protein of about 6-8 percent in order to maintain fat reserves. Green vegetation has a crude protein of about 10 to 13 percent. Years with no fall green-up can make winter survival difficult for males, especially bull elk trying to recover from the rut. Winters that are more severe can further affect survival. Predators may capitalize on animals in poorer physical condition. Methods and procedures used to determine which years fall green-up occurs will be presented and possible impacts of fall green-up will be discussed.

****AN INITIAL ASSESSMENT OF THE POTENTIAL OF GENOMIC ANALYSIS TO HELP INFORM BIGHORN SHEEP MANAGEMENT**

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Genetic research may be a useful approach for understanding factors that could impact productivity and restoration of bighorn sheep herds. For example, genetic consequences of inbreeding in small populations can impact recruitment and local adaptations can influence translocation success. This modest pilot study quantified genetic attributes of bighorn sheep populations with a range of different herd histories in Montana and Wyoming to investigate genetic similarity and differences, genetic heterogeneity, and genetic distance. Employing an Ovine array containing about 700,000 single nucleotide polymorphisms (SNPs) with approximately 24,000 markers that are informative for Rocky Mountain bighorn sheep, we used whole genome genotyping to analyze genetic material. This technique represents a significant advancement in genetic analysis of bighorn sheep, as most previous studies have used microsatellites and less than 200 genetic markers. We analyzed approximately fifteen individuals from each of four different populations that we predicted would differ in genetic characteristics, due to population dissimilarities that potentially impacted their genetics, including origin (native/reintroduced), population size, bottleneck history, degree of connectivity, and augmentation history. We selected four populations that provided a spectrum of these herd attributes, including the Tendoys, Stillwater, and Glacier National Park in Montana and the northeastern Greater Yellowstone Area in Wyoming. We present the results of this effort and examine expected and observed heterogeneity and genetic distance estimates to evaluate the potential for links between genetics and herd demography. We

discuss the utility of genetic analyses in improving knowledge of bighorn sheep populations and potential implications for bighorn sheep management.

ASSESSING GRAZING AS A CONSERVATION TOOL IN SAGEBRUSH AND GRASSLAND ECOSYSTEMS

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Grazing is a powerful tool to address wildlife declines associated with land use conversion in the western United States. Grazing systems can be manipulated to achieve desired vegetation outcomes, preserve native habitat and economically benefit multiple stakeholders. As a result, systems designed to benefit native ecosystems are being widely implemented. However, the benefits of these grazing systems on many wildlife communities remain relatively unexplored. Songbirds provide an ideal study system to test these benefits because they continue to use landscapes that are currently grazed. We compared songbird communities between two grazing systems in eastern Montana: rest-rotation systems and season-long systems. Our results suggest grassland and sagebrush associated species, many of which are of conservation concern, exhibit a mixed response to these two grazing types. Grassland associated species are more abundant in season-long grazing systems than rest-rotation grazing systems. In contrast, sagebrush associated species show no difference in abundance between the two grazing systems. These results suggest that grazing management may have the largest impact on grassland associated species. In contrast to the idea that different grazing management can have effects on a wide variety species with similar life history traits, such as birds, we found that differences in grazing management only affected a small subset of species. Our findings provide essential information for assessing the suitability of grazing as a conservation tool.

****OPTIMIZING WILDLIFE MONITOIRNG STRATEGIES IN A DYNAMIC SETTING (POSTER)**

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Long term, broadly distributed datasets are ideal for effective wildlife management. However, collecting and utilizing these data present a variety of challenges to management agencies. Idaho Department of Fish and Game is currently trying to optimize their use of monitoring resources for mule deer (*Odocoileus hemionus*) throughout Idaho. Three areas are being investigated for their potential to accomplish this goal: cost effectiveness, data utilization, and efficiency in data collection. An analysis of the cost effectiveness of monitoring methods is currently being conducted. This analysis varies the amount of each type of data available to the population model used to estimate abundance. The precision, credible interval width (CRI), associated with the estimate is used as the measure of effectiveness, mean 95% CRIs range from 9278 - 9804. This measure of precision is then combined with the cost of the collection technique to compare the cost effectiveness of different monitoring methods. Further research will focus on a weighting scheme that weights data types by both sampling precision and

reliability. Thereby allowing managers to fully utilize all available data sources based on relative quality within the framework of the population model. A third line of research focuses on increasing the efficiency of monitoring effort through an alternative sampling design derived from seasonal nutrition. The previous lines of research will then be combined to solve a dynamic programming problem to determine the optimal methods for monitoring population abundance while accounting for changes in the availability of monitoring resources over space and time.

****PREGNANCY RATES, METABOLITES AND METABOLIC HORMONES IN BIGHORN SHEEP DURING AND AFTER THE BREEDING SEASON**

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Wildlife managers routinely draw blood and harvest serum when bighorn sheep and other ungulates are captured for management and research purposes. Serum samples are routinely submitted to state livestock labs that perform a panel of assays to access exposure to a variety of important pathogens that cause disease, providing managers important insights. Wildlife managers would also benefit from similar procedures that could provide assessments of reproduction, nutrition, and physiological status. The objectives of this preliminary study were to evaluate pregnancy rates , energy-related metabolites and hormones among herds of Montana and Wyoming bighorn sheep during and after the breeding season in order to assess the general 'health' of herds. Metabolites and metabolic hormones are frequently used in domestic animals to evaluate nutrition, reproduction and energy balance, and potentially may provide the same insights in wildlife for managers. A total of 240 bighorn ewes were sampled from 13 herds between December 2014 and March 2015. Samples were assayed for progesterone (P4) and pregnancy specific protein B (PSPBs) to assess reproductive cycling and pregnancy. Assays were also performed for non-esterified fatty acid, insulin, triiodothyronine and thyroxine which are metabolites and metabolic hormones that indicate nutritional and energy states of animals. We will be presenting the results of this preliminary study and discussing the relationship between pregnancy rates, energy-related metabolites and hormones and how they might be used to inform wildlife management.

MONTANA'S BAT ACOUSTIC SURVEILLANCE EFFORTS: AN UPDATE

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Montana's bat species face a wide array of conservation issues that threaten their long-term viability. A collaborative effort was initiated in 2011 to document year-round activity patterns of Montana's bats prior to the arrival of White-nose Syndrome as mortality has exceeded 95% for some bat populations effected by this disease in eastern North America. In the last 5 years, we have deployed a network of over 76 Song Meter ultrasonic acoustic detector/recorder stations programmed to record bat passes from sunset to sunrise year-round. Through late December 2015, these recording stations have resulted in more than 7.2 million full spectrum sound files containing nearly 13 terabytes of information. Processing and automated analyses have been completed for all sound files and over 43,000 bat passes have been reviewed by hand using an updated Montana bat call characteristics key to definitively confirm the presence of species during each month of the year, identify the lowest temperatures at which individual bat species are active, and track overall bat activity, regardless of species, at each station. Highlights to-date include: 2,104 new records of monthly species presence in various landscapes across the region, numerous first records of species' activity during the fall, winter, and spring months, numerous first records of species in regions with previously limited survey effort, documentation of nightly activity patterns throughout the year, regular winter activity for a few resident species, the year-round presence of species previously considered migratory, and exciting patterns of activity relative to temperature, wind speed, barometric pressure, and moonlight.

OCCUPANCY AND ABUNDANCE OF AMERICAN BADGERS AND PIUTE GROUND SQUIRRELS IN THE SAGEBRUSH-STEPPE: IMPLICATIONS OF THE FIRE-CHEATGRASS CYCLE

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Sagebrush-steppe is experiencing vast changes due to biological invasions and changing fire characteristics. Understanding how these changes influence functionally important animals is essential for ecosystem management. American Badgers (*Taxidea taxus*) are an apex predator and ecosystem engineer within sagebrush ecosystems. Piute Ground Squirrels (*Urocitellus mollis*) are also an ecosystem engineer as well as an essential prey source for many predators.

Our objective was to evaluate the relative importance of large-scale changes, abiotic processes, and biotic processes on badgers and ground squirrels. We samples 163 1-ha plots across a gradient of burn histories within a 1,962 km^2 area in Southern Idaho, USA. At each plot, we characterized ground squirrel and badger occupancy, ground squirrel relative abundance, and many environmental variables. We used information-theoretic approaches to evaluate competing hypotheses concerning occupancy of ground squirrels and badgers, and ground squirrel relative abundance. Results suggest that ground squirrel occupancy was positively associated with abiotic characteristics (e.g., higher precipitation and finer textured soil). Badger occupancy was positively associated with ground squirrel occupancy and agriculture. Relative abundance of ground squirrels was positively associated with finer textured soils, but negatively associated with cheatgrass (*Bromus tectorum*), fire frequency, agriculture, and shrubs. Managers can focus restoration efforts on areas with high cheatgrass and shrub cover, if ground squirrels are a management objective. These results support previous hypotheses suggesting abiotic processes are important for herbivore occupancy. However, we provide support that a combination of abiotic, biotic, and disturbance processes are important for mesocarnivore occupancy and herbivore abundance.

FACTORS INFLUENCING SEASONAL MIGRATIONS OF PRONGHORN ACROSS THE NORTHERN SAGEBRUSH STEPPE

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Globally, grassland systems have received the highest impacts from human activities, and therefore management of these systems is important for ungulate conservation. Pronghorn (*Antilocapra americana*) undertake seasonal migrations to satisfy annual life history requirements. The effects from environmental gradients and anthropogenic factors on pronghorn migrations are not well understood. My objectives were to: 1) Classify and determine metrics for various movement behaviors and states across individuals; 2) Predict multi-scale seasonal pronghorn migration pathways across the Northern Sagebrush Steppe (NSS) and integrate scales into one spatial prediction and; 3) Create pronghorn connectivity network maps across the NSS. Based on 170 animal years from collared females, 55% of individuals undertook seasonal migrations. Using between-class analysis of metrics, three distinct movement groupings were identified. Next, I modelled multi-scale migratory pathway selection in response to anthropogenic and environmental parameters. Generally, migratory pronghorn selected grasslands, intermediate slopes and south-facing aspects and avoided increased well and road densities. Pronghorn selected stopover sites with higher forage productivity values and lower well densities versus migratory pathways. I then used a scale-integrated mapping approach and found that these spatial predictions performed as well or better than single order scales to predict migration pathways. Finally, using a suite of novel approaches, I created seasonal pronghorn connectivity networks across the NSS. I concluded that multi-scale migration followed hierarchically nested theory where finer scale decisions are conditional on broader scales that can be assessed sequentially. I suggest that the pronghorn is a broad-scale focal species useful for conservation planning across the NSS.

****AN ASSESSMENT OF CURRENT STATEWIDE AVIAN MONITORING PROGRAMS IN MONTANA**

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Birds are a highly diverse group consisting of species that use a wide-range of available resources. Therefore bird communities are thought to represent the natural complexity of ecosystems. In recent years, groups of birds and individual species have been recognized as indicators of environmental change. Even with all the potential benefits of conserving bird populations, considerable declines of avian populations in the US have been well documented. These losses highlight the need for continued large-scale monitoring programs. The North American Breeding Bird Survey (BBS) and the Integrated Monitoring in Bird Conservation Regions (IMBCR) are independent large-scale programs conducted within the US to monitor populations of birds. Each of these programs is uniquely designed to provide different types of information to resource managers within the state of Montana. We examined the current products available from BBS and IMBCR programs and the methodology employed. We also compared how each monitoring program assesses population change at the Montana state level across a variety of species to investigate potential program inconsistencies. If programs work equivalently we would expect abundance trend estimates to be in the same direction (positive or negative) and of similar magnitudes. Preliminary results suggest 94% (104/111) of species analyzed exhibited some difference in their abundance trend estimates between monitoring programs. Inconsistencies found within our species comparisons reflect inherent differences in the programs. Our results reiterate the importance for users to carefully consider the unique design, intention, and sources of bias ascribed to each program before applying monitoring data to ecological questions.

****EFFECTS OF ELECTRIC FENCE PERMEABILIY ON GRIZZLY AND BLACK BEARS IN THE BLACKFOOT VALLEY OF MONTANA (POSTER)**

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Increasing agriculture-bear conflicts on private lands require innovative approaches to conserve wildlife while also conserving the economic viability of Montana farmers and ranchers. Electric fencing has been an effective tool for deterring bears from calving areas and bee yards. Recent advances in electric fencing materials, as well as automated deployment devices, have reduced costs and increased interest in using electric fencing to deter bears from larger areas, like crop fields. Scientific evaluations of the efficacy of temporary electric fencing at deterring grizzly and black bears are lacking. Additionally, large-scale installations of electric fencing may impact bear movements and habitat use. In 2015, we began a multi-faceted study in the Blackfoot Valley to evaluate A) the efficacy of various rapid-deployment electric fencing designs in deterring bears from agricultural lands, and B) landscape level space use and permeability of agricultural lands relative to electric fences. Baited enclosures of 2-3 fencing configurations were established in the valley during the spring of 2015. Each enclosure is systematically

energized and unenergized for 3-day periods throughout the spring and summer; passage into the enclosure is monitored with motion-activated trail cameras to provide information on configuration effectiveness and permeability. In addition, we established 60 randomly selected camera trap stations throughout the valley to evaluate landscape-level habitat use relative to landscape metrics and electric fences. Daily movement locations provided by 5 grizzly bears fitted with GPS collars will provide individual-level information on seasonal movements and habitat selection relative to habitat conditions and electric fences.

****RECREATIONAL AVIATION AND WILDLIFE: THE PHYSIOLOGICAL STRESS RESPONSE IN DEER AND ASSOCIATED USER PERCEPTIONS**

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Backcountry aviation is a popular form of recreation throughout the northern Rocky Mountains; however, it is unclear whether this seasonal disturbance has adverse effects on wildlife. Using stress physiology techniques provides a mechanistic understanding of the effects of disturbance on free-living populations. The analysis of fecal glucocorticoid metabolites (FGM) is an increasingly useful tool in conservation biology as it provides a non-invasive measurement of circulating stress hormones (e.g., cortisol) deposited into the feces. We quantified aircraft activity and human presence in concert with collecting white-tailed deer and mule deer fecal samples from six backcountry airstrips and six non-airstrip recreational sites (n=12) located on public land throughout western Montana and north-central Idaho. By modeling deer FGM levels at these sites, we can evaluate the impacts of backcountry aviation on wildlife stress responses within the greater context of recreation on public lands. We also surveyed recreational pilots who frequent backcountry airstrips in the study area. The main objectives of this human dimensions analysis are to 1) measure attitudes of pilots toward seeing various wildlife species at backcountry airstrips and 2) evaluate scenarios under which pilots might alter their recreational behavior in order to mitigate potential wildlife impacts. This research represents the first attempt to model the endocrine profile of wildlife populations exposed to recreational, backcountry aviation while also providing data on current stakeholder attitudes regarding this topic. In doing so, we can gain an integrated understanding of the factors surrounding recreational aviation and wildlife bat backcountry airstrips.

AVIAN RELATIONSHIPS WITH WILDFIRE AT TWO DRY FOREST LOCATIONS WITH DIFFERENT HISTORICAL FIRE REGIMES

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Wildfire is a key factor influencing bird communities in western North American forests. We need to understand species and community responses to wildfire and how responses vary

regionally to effectively manage for biodiversity in dry conifer forests. We compared avian relationships with wildfire burn severity between two locations of Arizona and Idaho. We predicted different responses to wildfire corresponding with regional differences in historical fire regime. We conducted point-count surveys for 3 years following wildfire (Arizona: 1997–1999; Idaho: 2008–2010) and used multispecies hierarchical models to analyze relationships of bird occupancy with burn severity. Consistent with our prediction for mixed-severity fire regimes characterizing the Idaho location, we observed proportionately more positive species occupancy relationships and, consequently, a positive species richness relationship with burn severity in Idaho. We also observed the opposite pattern in Arizona, which was congruent with our prediction for the low-severity fire regime characterizing that location. Cavity nesters and aerial insectivores occupied more severely burned sites following wildfire, corresponding with predicted increases in nesting substrate and foraging opportunities for these species. In contrast, canopy-nesting foliage gleaners and pine-seed consumers exhibited negative relationships with burn severity. Congruence with species life histories and with patterns reported in the literature suggests generality of observed patterns. We therefore suggest that optimal management strategies for maintaining avian diversity could differ regionally. Specifically, intensive fuels management may be ecologically less appropriate for promoting biodiversity in areas such as the Idaho location where mixed-severity wildfires and dense forest stands were historically more common.

USE OF HIGH-RESOLUTION AERIAL IMAGERY TO IMPROVE A GIS HABITAT MODEL (POSTER)

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For many species, land cover is the most important input variable for a GIS habitat model. Yet, coarse-resolution satellite imagery provides the foundation of many available land cover datasets. With low-resolution imagery, habitats such as shrublands and narrow or small riparian elements typically remain invisible to digital image analysis software and to the naked eye. Habitat misclassification often occurs and land cover accuracy rates may range from only 60% to 80%. We ran a Sharp-tailed Grouse habitat model, originally developed by Montana FWP, using a current land cover layer based on 30-meter resolution satellite imagery. From the results, we chose a subset of areas with high potential to contain the most suitable habitat. We then updated each area's land cover by "ground-truthing" it against high resolution imagery (NAIP, 1 meter and Esri, 6 inch). We corrected misclassified habitats of interest and then reran the model. Although time consuming, we believe this manual "ground-truthing" process greatly improved the accuracy of the model and made the on-ground habitat surveys more efficient. We also believe this approach would improve habitat modeling efforts for other species.

SPION KOP WIND FARM: MONTANA FISH, WILDLIFE AND PARKS NEW ROLE IN WIND ENERGY

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Montana Fish, Wildlife and Parks (FWP) has acquired a new role in working with NorthWestern Energy to plan and implement the post construction monitoring (PCM) at Spion Kop Wind Farm,

located on the southern slopes of the Highwood Mountains near Geyser, Montana. The objectives of this project are not only to assess the bird and bat fatalities and impacts of habitat loss as a result of construction and operation, but to work together to make a standard for wind energy monitoring in Montana, implementing any further mitigation measures and research as determined by the outcome of the PCM, and eventually making all findings available to the public for reference. Using the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines and Eagle Conservation Plan Guidance, FWP will estimate bird and bat fatalities through conducting formal fatality searches, assess the risk to eagles through standard eagle point counts, monitor all eagle nests within the project area, search for new nests through flight surveys, and monitor species of concern including bat activity, nesting of non-eagle raptors, and sharp-tailed grouse leks. Through early PCM work, an active Golden Eagle nest was discovered just .70 miles away from the nearest wind turbine. This, as well as the challenges realized through pilot fatality searches, has made FWP have to adapt the PCM plan accordingly. Where the project is currently as well as the future goals and objectives are addressed.

****SEASONAL RESOURCE SELECTION BY INTRODUCED MOUNTAIN GOATS IN THE SOUTHWEST GREATER YELLOWSTONE AREA**

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Mountain ungulates, although regarded as iconic and charismatic wildlife species, are the least studied and understood large mammals in the Greater Yellowstone Area (GYA). Mountain goats (*Oreamnos americanus*) are considered non-native in the GYA according to reviews of archeological, paleontological, and historical records, and have been steadily expanding their range since their initial introduction in the 1940s. Because of the general propensity of mountain goats to inhabit high elevation, mountainous terrain, there is significant potential for range overlap with native bighorn sheep (*Ovis canadensis*) and the possibility that competition and disease transfer will be detrimental to sympatric bighorn populations. I will broadly discuss mountain goat seasonal resource selection modeled from 15 (11 females and 4 males) allopatric mountain goats representing the sole established population in the southwest GYA. These efforts produce the first spatial predictions of seasonal habitat use by mountain goats in the GYA using GPS data, and provide regional managers with important insights regarding the current and future distribution of mountain goats. Of particular interest are areas where mountain goats are in the early stages of colonization, such as Grand Teton National Park. Building seasonal resource selection models for mountain goats in the GYA is the first step needed to better understand their biological needs, ecological role, and potential to negatively impact native communities and species.

ACCESSING INFORMATION ON MONTANA'S ANIMALS, PLANTS, AND BIOLOGICAL COMMUNITIES THROUGH THE MONTANA NATURAL HERITAGE PROGRAM'S WEB APPLICATIONS: RECENT UPDATES

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The Montana Natural Heritage Program (MTNHP) was established by the Montana State Legislature in 1983 and charged with statutory responsibility for acquisition, storage, and retrieval of information documenting Montana's flora, fauna and biological communities (Montana Code Annotated 90-15). Information managed by MTNHP includes taxonomy, biology, ecology, and conservation status information for nearly 8,000 plant and animal species and nearly 150 terrestrial and aquatic communities, nearly 1.7 million animal observation records, over 182,000 locations where a formal structured animal survey protocol has been followed, predictive distribution models for animal and plant species, species occurrence and wetland and riparian mapping polygons that are used in environmental reviews, land cover mapping, and land management information. We deliver this information via staff facilitated requests and web applications that include the Montana Animal and Plant Species of Concern reports, the Montana Field Guide, the Natural Heritage MapViewer, and the Species Snapshot. In this presentation, we will provide a brief overview of how biologists and natural resource managers can access information via our websites. We will focus on recent updates to our Species Snapshot and Montana Field Guide applications that allow users to create custom species summaries and field guides using spatial, taxonomy, and conservation status filters and our vision for the development of an environmental review tool that can be used by agency resource managers, planners, and consultants to speed environmental reviews.

**AGE DETERMINATION OF LIVE-CAPTURED BEAVERS BY WEIGHT IN SOUTHWEST MONTANA (POSTER)

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Studies evaluating demography and age-specific space use of beavers require accurate methods for aging live-captured individuals in the field. Unfortunately, techniques for aging live-captured beavers in the field are often unreliable and can require previous experience in handling beavers. Previous age-weight relationships developed in other regions (e.g., Midwest) may not be suitable, because differences in diets, seasonal behavior, and selection for

life-history traits likely results in significant regional variation in age-weight relationships. Thus, regional assessments of age-weight relationships are necessary for accurate inference. In the fall of 2015, we began a two-year study with the goal of developing accurate growth curves for beavers occurring in southwestern Montana. We are collecting beaver carcasses from local trappers and animal control experts. Carcasses are weighed and the molar teeth extracted for laboratory analysis of cementum annuli which provide an accurate age for each beaver. Regression analysis will be used to model age-weight relationships for beavers, and model predictions will be tested using a hold-out dataset and cross-validation. We expect our results to provide useful information for researchers in forested headwater habitats of Montana, and provide baseline data for calibrations for broader-scale assessments in the region. Please contact us if you can provide whole beaver carcasses.

EVALUATING REPRODUCTIVE SUCCESS AND CHANGES IN GENETIC DIVERSITY OF GRIZZLY BEARS IN NORTHWESTERN MONTANA

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Current range expansions of large terrestrial carnivores are occurring following anthropogenically-induced range contraction. Contractions are often incomplete, leaving small remnant groups in refugia throughout the former range. We know little about underlying eco-evolutionary processes that influence how remnant groups are affected during range expansion. We used data from a spatially-explicit, long-term genetic sampling effort of grizzly bears (*Ursus arctos*) in the Northern Continental Divide Ecosystem (NCDE) to identify the processes underlying spatial patterns of genetic diversity. We conducted parentage analysis to evaluate how reproductive success and migration contribute to spatio-temporal patterns of genetic diversity in remnant groups of grizzly bears existing in the southwestern (SW), southeastern (SE), and east-central (EC) regions of the NCDE. Highly skewed reproductive success and local inbreeding caused distinct signatures in remnants that eroded rapidly (~1 generation) during population expansion and migration into the regions. Our results highlight that individual-level genetic and reproductive dynamics play critical roles during genetic assimilation, and show that patterns of genetic distinctiveness on the leading edge of an expansion may result from historical demographic patterns that are highly ephemeral.

ASSESSING AGE STRUCTURE, WINTER TICKS, AND NUTRITIONAL CONDITION AS POTENTIAL DRIVERS OF FECUNDITY IN MONTANA MOOSE

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Fecundity in ungulates is an important component of population dynamics, and itself can be driven by differences in the age and nutritional condition of females. As one element of a larger research project focused on moose population dynamics and ecology, we examined nutritional condition, pregnancy rates, and litter sizes for moose in three Montana moose populations. During the winters of 2013–2015 we captured 100 female moose ≥ 1 year old and assessed pregnancy status using assays of both serum (pregnancy specific protein B [PSPB]) and feces (fecal progesterone). After calibrating the relationship between these two assays, we subsequently monitored pregnancy with feces alone for additional winters following capture. Coincident with captures, animals were aged using tooth extraction and cementum analysis, nutritional condition was assessed using ultrasonography of rump fat thickness, and winter tick loads were estimated by counting ticks along transects of the rump and shoulder. Additionally, the concentrations of nitrogen and neutral detergent fiber of winter pellets were measured during each winter as indices of dietary quality. Here, we assess the importance of environmental and demographic factors in limiting moose productivity in Montana by examining the interdependence of forage, parasites, nutritional condition, age structure, and ultimately fecundity for female moose. We then place these findings in context of fecundity rates observed for moose elsewhere within neighboring US Rocky Mountain populations and across North America.

POPR: SOFTWARE FOR WILDLIFE MANAGERS

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It is widely recognized that modern computer software makes wildlife management and research easier and allows increasingly complex tasks to become routine. Unfortunately, data storage and reporting rarely keep pace with the rapid expansion of data analysis software. Such disconnects in workflow can lead to missed opportunities where data are not used to their fullest extent and results are slow to emerge. Here we present a server-based software system, PopR (https://popr.cfc.umt.edu), which merges wildlife management agency databases with state-of-the-art statistical software for real-time wildlife data analysis, population modeling and reporting. The interface to PopR is a secure website allowing access from any location with internet access and from any platform (personal computer, smartphone, tablet, etc.). PopR connects to remote data sources through an application program interface (API). PopR implements Bayesian integrated population models (IPM) combining multiple data sources. The IPM's efficiently deal with limited data, overcome missing data and facilitate prediction with error. PopR also implements individual data source analyses such as survival, sightability and herd composition, among others. PopR modules are in development or in use in the states of Idaho, Montana and South Dakota where the software is used for a variety of species

including deer, elk and mountain lions. Finally, add-on applications include tools for defining biological populations, checking data integrity and eliciting expert opinion. The PopR workflow management system promises to streamline data collection, automate routine analyses and generally save managers time while increasing inference from limited data.

****PARTICIPANT PERCEPTIONS OF RANGE RIDER PROGRAMS OPERATING TO MITIGATE WOLF-LIVESTOCK CONFLICTS IN THE WESTERN UNITED STATES**

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As gray wolf (*Canis lupus*) populations have expanded in the western United States, wolf depredations on domestic livestock have increased. Concomitantly, wildlife managers are seeking management tools that could mitigate wolf-livestock conflicts and enhance stakeholder support for conservation efforts. Range Rider Programs (RRPs) have emerged as a non-lethal management strategy that advocates the use of increased human surveillance of livestock herds in area occupied by wolves to reduce wolf-livestock conflicts. However, little information is available about the scope of contemporary NRM RRPs or participant perceptions about the potential for the programs to mitigate these conflicts. We conducted semi-structured phone and personal interviews with 51 participants from 17 Range Rider Programs (RRPs) in Montana, Oregon, and Washington to develop a typology of NRM RRPs and assess participant perceptions of current programs. Although the RRPs we studied varied in context, program focus, and scale, they shared similar organizational components that included: a sponsor, collaboration among several organizations, a funding mechanism, a structure that included a supervisor, the landowner(s), and the range rider(s), and a mechanism for stakeholder feedback. We identified three unique RRP versions based on the primary focus of the programs: 1) livestock monitoring, 2) wolf surveillance, and 3) livestock herding. While participants identified a number of benefits (e.g. increased information on wolf activity, extra herd supervision, rapid carcass identification), they also identified challenges which affected program sustainability. Challenges pertaining to trust and open communication were inherent in several programs, however the lack of stable funding was viewed as a major threat to program sustainability. The final challenge to RRPs sustainability was the largely unproven success of this strategy.

****VARIATION IN BIRTH MASS AND MASS GAIN DURING LACTATION FOR A LONG-LIVED MAMMAL: A CASE STUDY USING THE WEDDELL SEAL**

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Reproduction in mammals is costly, with implications for trade-offs between current reproduction and survival. Life history theory suggests the amount of energy allocated to reproduction should change as a function of increasing maternal age, and empirical work supports both within-individual decreases (consistent with senescence) and increases (consistent with constraint and restraint). The Weddell seal (*Leptonychotes weddellii*) is an ideal organism with which to study patterns of maternal energy allocation due to the life history. Here, we used

a long-term mark-recapture database of individually marked mothers and pups in Erebus Bay, Antarctica, to develop a stratified sample of masses from pups and known-age females across maternal ages in 11 different years. Hierarchical modeling of potential sources of variation in: 1) pup masses at parturition, 2) pup mass gains from parturition to mid-lactation (~20 days), and 3) pup mass gains from mid-lactation to late-lactation (~20-days to ~35-days) was used to 1) evaluate the relative support for increases/decreases in reproductive allocation as a function of maternal age, 2) assess how patterns of reproductive allocation may reflect pre-parturition resource acquisition and/or post-parturition resource allocation, and 3) estimate the magnitude of individual heterogeneity in maternal effects after accounting for maternal and offspring characteristics. Our results provide strong evidence that reproductive investment at parturition and pup mass gains from parturition through late-lactation vary with maternal age and breeding history and result in important differences in late-lactation pup masses. Such variation may have consequences for the early-life success of offspring, and thus implications at the population level.

INFLUENCE OF BOULDER SIZE ON OCCUPANCY AND DETECTION OF HOARY MARMOTS (POSTER)

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Hoary marmots *(Marmota caligata)* can be found in boulder fields throughout alpine areas of western Montana, but we know little about their specific habitat requirements. We sought to determine the influence of boulder size on occupancy and detection probability of the hoary marmot during occupancy surveys. We conducted 532 visual occupancy surveys of 147 sites between June and September 2015. We estimated variation in occupancy and detection probability based on four size categories of boulders. We did not detect differences in occupancy of marmots as the size composition of boulders changed. Detection probability was most influenced by medium and large boulders. Probability of detecting a marmot was 38% (95% CI=0.24–0.53) when medium boulders were absent, but decreased to 3% as the proportion of medium boulders increased to 60% (95% CI=0–0.15). Probability of detecting a marmot was 16% when large boulders were absent (95% CI=0.1–0.24) but increased to 92% when just 5% of the site consisted of large boulders (95% CI=0.61–0.99). Accounting for this variation in detection probability with changes in boulder size will be important for designing a long-term monitoring protocol that can produce accurate estimates of occupancy for hoary marmots. A monitoring protocol incorporating key habitat requirements would be valuable for the future management and conservation of a species living in harsh alpine environments where climate change is predicted to occur rapidly.

AMERICAN BLACK BEAR POPULATION FRAGMENTATION DETERMINED THROUGH PEDIGREES IN THE TRANS-BORDER CANADA-UNITED STATES REGION

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Fragmentation of species with large numbers of individuals in adjacent areas can be challenging to detect using genetic tools as there often is no differentiation because genetic drift occurs very slowly. We used a genetic-based pedigree analysis to detect fragmentation in the American black bear across 2 highways with large adjacent populations. We used 20 locus microsatellite genotypes to detect parent-offspring and full sibling pairs within a sample of 388 black bears. We used the spatial patterns of capture locations of these first order relatives relative to US Highway 2 in northwest Montana and Highway 3 in southeast British Columbia to estimate the number of close relatives sampled across the highways (migrants/km of highway length) as an index of fragmentation. We compared these values to an expected migrant/km rate derived from the mean values of simulated fractures in the Highway 2 and Highway 3 region. We found evidence that these highway corridors were fragmenting black bear populations, but not completely. The observed migrant/km rate for Highway 2 was 0.05, while the expected rate was 0.21 migrants/km. Highway 3 had an observed migrant/km rate of 0.09 compared to the expected rate of 0.26. None of the 16 bears carrying GPS radio collars for 1 year crossed Highway 2, yet 6 of 18 crossed Highway 3. Pedigree and telemetry results were more closely aligned in the Highway 2 system evidencing more intense fragmentation than we found along Highway 3. Our results demonstrate that pedigree analysis may be a useful tool for investigating population fragmentation in situations where genetic signals of differentiation are too weak to determine migration rates using individual-based methods, such as population assignment.

LINKING LANDSCAPE-SCALE DIFFERENCES IN FORAGE TO UNGULATE NUTRITIONAL ECOLOGY

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Understanding how habitat and nutritional condition affect ungulate populations is necessary for informing management, particularly in areas experiencing carnivore recovery and declining ungulate population trends. Variations in forage species availability, plant phenological stage, and the abundance of forage make it challenging to understand landscape-level effects of nutrition on ungulates. We developed an integrated spatial modeling approach to estimate

landscape-level elk (*Cervus elaphus*) forage quality in two adjacent study areas that differed in coarse measures of habitat quality and related the consequences of differences in forage quality to elk body condition and pregnancy rates. We found no support for differences in dry matter digestibility between plant samples or in phenological stage based on ground sampling plots in the two study areas. Forage quality, measured as digestible forage biomass, varied among landcover types and between study areas. We found that altered plant composition following fires was the biggest driver of forage quality differences, suggesting that maintaining a mosaic of fire history and distribution will likely benefit ungulate populations. Study area, lactation status and year affected fall body fat of adult female elk. Elk in the study area exposed to lower quality summer range forage had lower nutritional condition entering winter. These differences in nutritional condition resulted in differences in pregnancy rate, with average pregnancy rates of 89% for elk exposed to higher quality forage and 72% for elk exposed to lower quality forage. Summer range forage quality has the potential to limit elk pregnancy rate and calf production, and these nutritional limitations may predispose elk to be more sensitive to the effects of harvest or predation. Wildlife managers should identify ungulate populations that are nutritionally limited and recognize that these populations may be more impacted by recovering carnivores or harvest than populations inhabiting more productive summer habitats.

EVALUATING ELK SUMMER RESOURCE SELECTION AND APPLICATIONS TO SUMMER RANGE HABITAT MANAGEMENT

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In much of the west, National Forest lands are managed in part to provide and protect elk (*Cervus elaphus*) habitat needs, and summer elk habitat is managed with consideration to motorized routes. We evaluated the relative importance of nutritional resources, access routes and other landscape attributes on elk summer resource selection at multiple spatial scales. Resource selection models for 9 different western Montana elk populations, as well are regional models using data from all 9 herds, were compared to determine the applicability of resource selection models for informing habitat management recommendations. We found that in all populations nutritional resources, best represented using NDVI metrics, were the most important factors associated with elk summer resource selection. Access route disturbances, best represented by the density of all routes (i.e., routes open and closed to motorized use), affected resource selection in all populations, however, the influence of access routes was relatively small as compared to nutritional resources. Regional models of resource selection predicted resource selection across populations better than population-specific models, thus we recommend these types of models be used to inform regional habitat management. Our results suggest that managers should expand the current management paradigm for elk summer habitat to also consider nutritional resources as an important

component of elk summer habitat. Time-integrated NDVI, an easily accessible and free data source, may be useful as an assessment tool to identify areas of optimal elk nutrition.

****GRIZZLY BEAR SCAVENGING OF CARRION ON THE NORTHERN YELLOWSTONE WINTER RANGE (1997-2012)**

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The Northern Yellowstone Winter Range (NYWR) in northwestern Wyoming and southwestern Montana is an important winter migratory destination for ungulates. The NYWR is within the Greater Yellowstone Ecosystem (GYE), a landscape characterized by a complex ecological system of predators, scavengers, and ungulates. Grizzly bears (*Ursus arctos*) are dominant members of the scavenging community throughout the spring. However, little is known about factors associated with grizzly bear use of carcasses. Of particular interest to managers is how habitat and anthropogenic factors are associated with carcass use. Such information, for example, may be useful to manage spring recreation in important bear foraging areas to reduce conflict and support conservation efforts. We used logistic regression to analyze spring survey data from 23 transects located in Yellowstone National Park and the Gallatin National Forest during 1997–2012, to identify factors associated with grizzly bear scavenging of winter- or predator-killed ungulates. Multi-model inference was used to evaluate relative support for a set of *a priori* candidate models containing environmental and temporal correlates. Our preliminary findings showed support for models with distance to forest edge, road density, and elevation. Results indicated negative relationships between these factors and probability of carcass use. Our results suggest that spatial heterogeneity in landscape-level habitat characteristics and human activity affect grizzly bear use of a valuable spring food source.

CITIZEN SCIENTIST MONITORING OF OSPREY DISTRIBUTION AND REPRODUCTIVE SUCCESS ALONG THE YELLOWSTONE RIVER, MONTANA

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Deb Regele, Yellowstone Valley Audubon Society, Billings, MT
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The Yellowstone Valley Audubon Society monitors ospreys (*Pandion haliaetus*) nesting along the Yellowstone River 1) to increase science literacy by engaging volunteers and undergraduate interns in conservation, 2) to reduce conflicts between utility companies and ospreys nesting on

power poles, and 3) to rescue nestlings entangled in baling twine used in nest construction. Trained volunteers surveyed the study area and determined reproductive success for occupied nests from April through August 2012-2015. All nests were located on anthropogenic substrates: platforms on poles, bridge spans, power poles, and cell towers. Mean (SE) number of young fledged per occupied nest was above that needed to sustain the local population: 1.87 (0.22) in 2012 (*n* = 30 nests), 1.35 (0.18) in 2013 (*n* = 48 nests), 1.51 (0.16) in 2014 (*n* = 55 nests), and 1.48 (0.17) in 2015 (*n* = 62 nests). Although some nest sites consistently produced more fledglings than others, reproductive success was unrelated to distance to nearest neighbor, density of breeding pairs within 5 km, and location along the river. From 2012-2015, 11 nestlings and one adult became entangled in baling twine: three died, one was euthanized, and eight nestlings fledged normally after being freed. A disease of unknown etiology appeared to affect nearly 50% of nestlings in 2015. Carcasses tested by the National Wildlife Health Center were negative for Avian Influenza, West Nile Virus, and Newcastle Disease. The discovery of new nests annually, robust reproductive success, and relatively low density suggested the population was in the growth phase.

****TRAPPING METHODS OF THE FERAL PIGEON IN THE CENTRAL BUSINESS DISTRICT OF BUTTE MONTANA.**

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Dr. Stella Capoccia, Montana Tech, Butte
Dr. Julie Hart, Montana Tech, Butte

The purpose of this study is to illustrate innovative trapping methods for the successful capture of feral pigeons (*Columba livia*). Our results highlight unique characteristics of the pigeon's behavior that, when harnessed, increase success in trapping frequency and bird numbers and underscore the importance of understanding a species behavior when conducting biological research. Our results came about when conducting a population study of pigeons throughout the central business district (CBD) of Uptown Butte, MT. Through a succession of trial-and-error trapping efforts, we identified two aspects of trapping our target species: 1) minimal information exists on effective trapping protocol for pigeons, and 2) effective trapping protocol was closely tied to specific adjustments that prove effective in a number of different pigeon colonies. While pigeons differ from truly wild animals, insofar as they are a Eurasian species and feral, free-roaming colonies of pigeons offer excellent ecological models for studies that include population models, behavioral studies, handling protocol, and, of course, trapping. Our methods address conventional trapping and tagging techniques as well as innovative procedures and traditional urban point-count surveys. These innovative procedures would help with re-sighting tagged birds within the survey routes. All these methods will collectively provide insight into dispersal, recruitment, foraging, and abundance of pigeons.

****HABITAT SELECTION, MOVEMENTS, AND SURVIVAL OF DISPERSING JUVENILE BEAVERS IN SOUTHWESTERN MONTANA (ORAL AND POSTER)**

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The natural activities of beavers effectively create or expand, and maintain, healthy riparian and wetland areas. Therefore, interest has increased among land and wildlife managers in the reintroduction of beavers into degraded riparian habitats as a proactive management option for natural restoration of these areas. However, there is a need for information regarding habitat selection by beavers in novel habitats to increase the likelihood that reintroduced beavers will colonize the area targeted for restoration. We are using cable snares to capture and radio tag dispersal age beavers in headwater streams of the Madison and Gallatin River drainages. We will relocate tagged beavers via handheld telemetry to obtain movement data from the moment the beavers leave their natal colony in the spring until they settle in a new location in the late summer and fall. Habitat characteristics representing vegetation, hydrology, and geomorphology will be assessed at settlement locations as well as locations encountered but not settled to make inference on habitat conditions most important to dispersing beavers in selecting settlement sites. Eighteen beavers were radio tagged in the fall of 2015 representing 6 different streams in the study area. The 18 tagged beavers will be tracked through the spring and summer of 2016 and habitat conditions will be assessed based on their movements before another season of beaver trapping in the fall of 2016. Our analysis of habitat selection by juvenile beavers will guide future beaver restoration projects in this region by identifying release sites with the highest probability of success.

FORTY-FIVE YEARS OF GRIZZLY BEAR MORTALITY IN THE NORTHERN CONTINENTAL DIVIDE ECOSYSTEM

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Within the last 10 years, the grizzly bear (Ursus arctos) population in the Northern Continental Divide Ecosystem (NCDE) has increased in size and doubled its range. Understanding the changes in mortalities is important to guide management of the population. Montana Department of Fish, Wildlife and Parks has maintained a record of documented grizzly bear mortalities since 1971. During this time there were a total of 650 human-caused, independent-aged (≥2 years old) bear mortalities recorded. We reviewed the last 45 years of human-caused grizzly bear mortalities in the NCDE, to determine any changes in mortality demographics, mortality causes, and spatial distribution. During 1975–1992, a quota of 25 human-caused mortalities was in effect and a slight temporal decline in total mortality was observed. Since 1992, the trend in total mortalities has been increasing at approximately 3%/year. Agency removals comprised 24% of human-caused mortalities. Previously, removals were largely associated with anthropogenic foods, but livestock depredations have been the primary cause for removals during the last two decades. Among public-caused mortalities (76%), legal hunting (during 1971–1991) and poaching/malicious kill have been the most dominant causes of death. Defense of life kills and automobile and train collision deaths have increased over time. During the last decade, there was an increase in the number of females with young present that were killed by the public. Whereas most mortalities occurred inside the Recovery Zone during the 1970s and 1980s, >50% now occur outside of it. Wildlife managers can use this information for

developing strategies for managing grizzly bear mortality and improving bear-human coexistence.

****REDISTRIBUTION, HUMAN SHIELDS, AND LOSS OF MIGRATORY BEHAVIOR IN THE CROWN OF THE CONTINENT**

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Redistribution of wildlife resulting from human alteration of environments is of growing management concern in North America. Habituation, which can coincide with redistribution, seems to be particularity prevalent in national park systems because millions of visitors interact with wildlife. For example, Glacier National Park in northwestern Montana, USA, receives approximately 2.2 million visitors over the months of June, July, and August each year—with the majority of their activity concentrated along the Going-to-Sun Road. The Going-to-Sun Road corridor is well-known for its habituated mountain goats (*Oreamnos americanus*). Habituation, however, was identified as a priority management concern in Glacier National Park. Successful management actions require a clear understanding of the causes and consequences of complex ecological issues such as habituation. Through experimental and observation effort this project has identified human-created predation refugia, or human shields, where mountain goats are escaping predation through interaction with people. Reductions in predation risk have resulted in mountain goat redistribution and changes in behavior. We found mountain goats using sites with human shields were less vigilant and were found in smaller groups. Furthermore, goats in areas with human-mediated predation refuge had reduced use cliff security terrain. Additionally, mountain goats that exploited people as shields from predators showed a weakened response to an experimentally presented predator model. Reductions in predator risk appear to be the primary driver of mountain goat redistribution, and the use of humans as buffers from predation has led to close contact between people and wildlife, resulting in compromised safety and altered ecological interactions.

****FINE SCALE NEST SITE SELECTION OF GREATER SAGE-GROUSE (*CENTROCERCUS UROPHASIANUS*) IN THE CENTENNIAL VALLEY, MONTANA**

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The purpose of this study was to determine fine scale nest site selection of greater sage-grouse (*Centrocercus urophasianus*) in the Centennial Valley, MT. A total of ninety nests were found during 2014-2015 using radio-collared sage-grouse. Vegetation surveys were conducted at nests and random sites that measured the nest shrub and the cover available within 3m of the nest. Length of the branch over the nest (Lgth.LB), average axis width of the nest shrub

(AvgAxis), lateral cover of the nest shrub (LCShrub), aerial cover of the nest shrub (ACShrub), and height of the lower branch over the nest (Ht.LB) were the habitat variables that received the most support. All habitat variables that were included in the top model were nest shrub morphological characteristics and cover provided by the nest shrub. Therefore, there is strong support that sage-grouse in the Centennial Valley are selecting nest sites based on the morphology of the nest shrub and the cover provided by that nest shrub. None of the habitat variables associated with herbaceous cover received much support for inclusion in our models. On average, residual cover (i.e. grass from previous year) provided concealment for only 4% of the nest bowl. The relative probability of a shrub being selected for a nest site is maximized when Lgth.LB >75cm long, AvgAxis >130cm wide, LCShrub >80%, and ACShrub > 70%. Managers should focus on conserving mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) and three-tip sagebrush (*Artemisia tripartita*) habitats because they were more likely to meet those shrub characteristics.

BAT ACTIVITY PATTERNS AND ROOST SELECTION IN MANAGED FORESTS

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The recent introduction and subsequent westward spread of white-nose syndrome (WNS) has decimated hibernating bat populations in eastern North America and created an urgent need for scientists to understand basic information about bat ecology, especially during the winter season. White-nose syndrome has killed between 5 and 7 million bats and continues to spread westward from the eastern U.S. and southern Canada, primarily affecting bats during hibernation. Acoustic monitoring has been suggested as a potential surveillance tool for detecting WNS; however, baseline information must first be collected to test this technique. Recent interests in habitat for resident bats has focused on managed forests, particularly in western Montana, where caves used as communal winter hibernacula are not abundant. We initiated a pilot project in June 2014 deploying 2 remote acoustic monitoring stations on Plum Creek property in Flathead County and adding an additional 2 stations in forests owned by Stoltze Land and Lumber and Stimson Lumber Company in May 2015 to collect baseline acoustic information. We also conducted radio telemetry to determine characteristics of roosts used by bats during the fall season in 2014 and 2015. Thus far we have acoustically detected 11 of Montana's 15 bat species, observed extremely high activity levels during the summer, and detected bat activity during every month of the year. We radio-tagged 14 bats of 4 different species (California myotis, Western small-footed myotis, Silver-haired bat, Little brown bat) and tracked them in late October and early November. Identifying the characteristics of roost sites used during the pre-hibernation period, and the annual activity patterns determined from acoustic monitoring, begin to form the foundation for understanding basic aspects of bat ecology during the season when Montana bats will be most susceptible to WNS.

****APPLICATION OF STRUCTURED DECISION MAKING TO WILDLIFE MANAGEMENT IN MONTANA**

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Good decision-making is essential to conserving wildlife populations. Whereas there may be multiple ways to address a problem, perfect solutions rarely exist. Managers are therefore tasked with identifying optimal decisions that will best achieve desired outcomes. Structured decision making (SDM) is a method of decision analysis used to identify the most effective, efficient, and realistic optimal decisions while accounting for values and priorities of the decision maker. The stepwise process includes identifying the management problem, defining objectives for solving the problem, developing alternative approaches to achieve the objectives, and formally evaluating which alternative is most likely to accomplish the objectives. The SDM process can be more effective than informal decision-making because it provides a transparent way to quantitatively evaluate decisions for addressing multiple management objectives while incorporating science, uncertainty, and risk tolerance. We illustrate the application of this process to management needs, including an SDM-based decision tool developed to identify optimal decisions for proactively managing risk of pneumonia epizootics in bighorn sheep (*Ovis canadensis*). Pneumonia epizootics are a major challenge for managers, including in terms of knowing how or when to manage risk. The decision tool facilitates analysis of alternative decisions for how to manage herds based on predictions from a risk model, herd-specific objectives, and predicted costs and benefits of each alternative. Managers can be confident resulting decisions are most effective, efficient, and realistic because they explicitly account for important considerations managers implicitly weigh when making decisions, including competing management objectives, uncertainty in potential outcomes, and risk tolerance.

GOLDEN EAGLE MIGRATION CORRIDORS ALONG THE ROCKY MOUNTAIN FRONT AND INTERMOUNTAIN FLYWAYS

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Golden Eagles (*Aquila chrysaetos*) have been receiving increased attention in the western United States due to an increase in anthropogenic population threats, including wind and other industrial energy developments. Conservation of migratory Golden Eagles hinges on knowledge of threats within breeding ranges, migratory corridors, and over-wintering areas. Often, understanding threats along migration corridors can be difficult due to the short temporal use of migration paths and because pathways can often be dispersed across the landscape. We

used satellite tracking data from three Golden Eagle studies across Montana to estimate key migration routes and bottlenecks for migratory Golden Eagles wintering or passing through Montana, with an emphasis on the Rocky Mountain Front. We gathered data from 35 individuals, including from 21 adult and 14 sub-adult Golden Eagles. We created individual dynamic Brownian Bridge Movement Models (dBBMM) for each migration event to estimate migratory pathways of individuals. We also created a population level migratory pathway estimate to determine key migration corridors and bottlenecks by summing the individual dBBMMs after accounting for age and study location. These models can be used for future risk assessments for developments and conservation measures for Golden Eagle migration routes.

MONTANA'S GREATER SAGE GROUSE CONSERVATION STRATEGY: ALL HANDS ACROSS ALL LANDS

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The greater sage grouse was once a candidate for listing under the federal Endangered Species Act across its range. Unprecedented efforts by states, federal agencies, private organizations, and private landowners led to adoption of conservation strategies to address threats caused by habitat fragmentation, development, and loss of sagebrush. Montana's Conservation Strategy is based on the collaborative work of a governor-appointed advisory council, the Montana Sage Grouse Stewardship Act passed during the 2015 Legislative Session, and Executive Orders 12-2015 and 21-2015. Montana's Strategy has three parts. First, Executive Orders 12-2015 and 21-2015 establish regulatory mechanisms to guide development in designated habitats. The Orders require consultation to assess potential impacts caused by activities requiring a state permit, involving state grant funds or technical assistance, or resulting from the state's own work. Federal agencies will align project review with the Orders. Specific parameters and disturbance thresholds apply, particularly for human activities near leks. Second, the Stewardship Grant Fund serves to maintain, enhance, restore, expand or benefit sage grouse. The Fund facilitates free-market mechanisms for voluntary, conservation on private lands by funding projects that produce credits. Credits can then be purchased by developers in a habitat exchange. Third, the habitat exchange establishes a compensatory mitigation framework to address impacts which cannot avoided, minimized, or restored and replacement is required. Montana's goal is to maintain viable sage grouse populations and conserve habitat and maintain Montana's flexibility to manage its own lands, wildlife, and economy. Success requires collaboration across all landownerships to address all threats.

****LIFE HISTORY TRAITS AS MEDIATORS OF SOLITARY BEE RESPONSES TO CLIMATE-WARMING**

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Climate-warming is uncoupling plant-pollinator interactions by causing species-specific shifts in seasonal flowering periods and pollinator activity times (i.e. phenologies). The mechanisms mediating pollinator responses to warming are poorly understood, preventing conservation professionals from identifying the most at-risk species and limiting our understanding of the potential effects of climate warming on plant-pollinator communities. The goal of this study

was to experimentally investigate whether solitary bee overwintering life stages influence phenological responses to climate-warming. Climate-controlled growth chambers where used to manipulate the temperature bees experienced while developing and overwintering. Results suggest that different physiological constraints associated with overwintering in the prepupal life stage compared to the adult life stage may influence how solitary bees respond to climate-warming in predictable ways. Bees that overwinter as adults may be more prone to phenological mismatches in the spring, while bees that overwinter as prepupae may be more prone to phenological mismatches in mid summer. In addition, the phenologies of bees that overwinter as adults may be converging with the phenologies of bees that overwinter as prepupae, causing reduced pollinator abundance during late summer and altering competition among bees for nectar and pollen during early summer. This work demonstrates that life history traits of bees may mediate their responses to climate-warming. These findings contribute to a better understanding of the effects of climate warming on pollinator species, with implications for preserving pollination services in Montana, as well as informing future studies investigating the effects of climate warming on plants and pollinators.

CURRENT STATUS OF EFFORTS TO RESTORE NORTHERN LEOPARD FROGS TO THE FLATHEAD RESERVATION IN NORTHWEST MONTANA

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One long term goal of the Confederated Salish and Kootenai Tribes Wildlife Management Program is to restore populations of native wildlife species on the Flathead Indian Reservation. In 2003 we embarked on a project to restore populations of northern leopard frogs, a species not documented on the Reservation since 1980. Over the next 4 years, 26 egg masses were translocated from populations in eastern Montana to a release site on the Reservation. Although tadpoles developed and metamorphosed successfully, we could not document significant overwintering survival. In 2006 a second release site was chosen in a newly restored wetland along the Little Bitterroot River. A total of 128 egg masses have been translocated to this and surrounding wetlands since 2006. Overwintering survival was suspected in 2007 and confirmed in 2008. Adult leopard frogs were first heard calling at this release site in 2010. A significant milestone in the project was achieved when egg masses were documented in 2013. This represented the first documented breeding of Northern Leopard Frogs on the Flathead Reservation in over 30 years. Since 2013, the number of egg masses documented at our release wetland has increased giving us guarded optimism. Future plans include continuing to translocate egg masses into the Little Bitterroot River release wetland and additional nearby wetlands in an attempt to diversify breeding sites within the localized population. Pilot releases will be made in other areas in an attempt to reach our ultimate goal of 5 breeding populations on the Flathead Indian Reservation.

****BATS IN BUILDINGS: ASSESSING HUMAN STRUCTURES AS ROOST SITES IN GLACIER NATIONAL PARK**

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Many bat populations are declining due to factors such as spread of white-nose syndrome (WNS) and changes in land use, increasing the need for information to prevent further declines. The Little Brown Bat is a species of concern in Montana, is susceptible to WNS, is the most common bat in Glacier National Park (GNP), and is frequently found roosting in buildings. We sought to document the locations and types of bat roosts in human structures throughout GNP. We conducted daytime inspections of 579 of the >900 buildings in GNP during summer 2015. When we detected a roost, we determined whether it was a day or night roost and recorded characteristics of the building and roost. In total we found 451 roost sites; most were night roosts. Buildings with tin siding were less likely to be used as night roosts, whereas buildings with masonry were more likely to be used as night roosts. Buildings with a bat house were more likely to be used as day roosts. We also found some evidence that bats preferred to day roost in buildings with tin roofs or logs. These baseline data on locations and numbers of bat roosts will allow biologists to better assess potential impacts of WNS should it arrive in Montana. These data also will provide GNP staff with the necessary information to develop mitigation measures to protect bats.

COMMON POORWILL HABITAT USE AND BREEDING ECOLOGY IN WESTERN MONTANA

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We know relatively little about Common Poorwill (*Phalaenoptilus nuttallii*) natural history or habitat needs in Montana. Most published range maps do not show them occurring west of the Continental Divide in Montana. However, surveys targeting other birds led to numerous incidental detections of Common Poorwills on the MPG Ranch, a private conservation property in the Sapphire Mountains just south of Missoula. In 2015 we started a pilot project on the MPG Ranch to more closely examine poorwill distribution, habitat use, and breeding ecology. We also used Citizen Scientists from Bitterroot Audubon to survey for poorwills in other parts of the valley. On the MPG Ranch, we found poorwills widely distributed in habitats with a mixture of a shrubby overstory, steep terrain, and talus slopes. In some cases poorwills roosted and/or nested in areas with tree cover. We captured 11 individuals and tested radio telemetry techniques to approximate range size, roost use, and site fidelity. We monitored activity at six nests and deployed motion-sensing cameras when possible to observe nesting behavior. We also used acoustic monitors and roadside observations to document arrival and departure dates. We plan to expand this project in 2016.

****INFLUENCE OF INFANTICIDE RISK ON BROWN BEAR DEN-SITE SELECTION**

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The risk of infanticide in brown bears (*Ursus arctos*) may influence den-site selection and chronology for female brown bears with dependent young. Strategies to reduce risk of infanticide include females avoiding larger, more dominant adult males through spatial or temporal segregation. We assessed whether variation in den location, den habitat, and den entrance and emergence dates of male and female bears supported sexual segregation in Lake Clark National Park and Preserve, Alaska. Den-sites (*n* = 56) were located using GPS telemetry data from bears in 2014 (*n* = 21) and 2015 (*n* = 35). We used mixed model analysis of variance to compare slope, elevation, and aspect of den sites for adult male and adult female bears with and without dependent young. We also used these variables to model probable denning habitat using maximum entropy modeling. We examined timing of female den entry and emergence in relation to males using generalized linear mixed models. Our preliminary results using 2014 data suggest that females with dependent may den at higher elevations (944 ± 140 m, $\bar{x}$ ± SD) than solitary females (866 ± 189 m) but at lower elevations (984 ± 118 m) than males. They also may use less steep slopes (25 ± 11.8°) than solitary females (29 ± 9.9°) or males (34 ± 4.9°). Additionally, females with dependent young (Julian day: 289 ± 8 days) denned 2 days later than solitary females (287 ± 6 days) and 20 days earlier than males (309 ± 21 days). Females with dependent young (122 ± 17 days) also emerged from dens 6 days earlier than solitary females (128 ± 9 days) and 10 days earlier than males (132 ± 10 days). Differences in den entrance and emergence dates suggest support our hypothesis that females with dependent young temporally segregate from male bears.

DIET COMPOSITION AND BODY CONDITION OF NORTHERN CONTINENTAL DIVIDE GRIZZLY BEARS, MONTANA

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From 2009–2013, we documented apparent population health by investigating food use and physiological condition of grizzly bears in the Northern Continental Divide Ecosystem (NCDE), Montana. We used stable isotope analysis upon hair and blood tissue to obtain information on percent terrestrial meat and plant matter in the diets of NCDE bears. We also assessed body fat content of grizzly bears via bioelectrical impedance analysis. Adult females used less meat compared to subadults and adult males ($P < 0.0001$). Bears within regions on the southwestern, southern, and eastern periphery of the ecosystem consumed a significantly higher proportion of meat than those in the interior or northwestern periphery ($P < 0.0001$).

Diets of bears in the Whitefish Mountains and North and South Fork of the Flathead River were, on average, composed of 70% less meat than those on the East Front. Adult males had significantly higher den entrance body fat contents than adult females and subadults ($P < 0.0001$). Average body fat of adult females varied significantly between those in areas of high consumption of meat and those otherwise. However, we find adult females across all regions enter dens at mean fat levels above those thought to be critical for cub production (i.e., > 20%). We conclude that, within each region, the quantity and quality of foods appear adequate to meet the needs of reproductively-active adult females. As truly opportunistic omnivores, grizzly bears in each region of the NCDE exploit diverse combinations of food items to arrive at productive body conditions.

EFFECTS OF HUNTER ACCESS ON HUNTING SEASON ELK DISTRIBUTIONS IN THE MISSOURI RIVER BREAKS

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Increasing harvest of adult female elk is the primary management tool for curtailing elk population growth and reducing elk populations. However, this tool is not effective when elk are located on private properties that restrict hunter access to elk during the hunting season. The purpose of this project was to evaluate the effects of hunter access and other landscape factors on elk resource selection during the archery and rifle hunting seasons in the Missouri River Breaks area. We sampled 46 adult female elk for 2-years in 2 adjacent populations: the Missouri River Breaks (MRB) population and the Larb Hills population. The MRB archery and rifle season elk population ranges were 97% accessible to hunters. Several large properties in the center of the Larb Hills range restricted or did not allow hunter access, and the archery and rifle season elk population ranges were 79% accessible to hunters. To quantify the effects of hunter access and other factors on elk selection of home ranges and elk selection of locations within their home range, we conducted a resource selection modeling exercise. Second-order population-level selection coefficients showed that elk in both MRB and Larb Hills selected home ranges in areas with no hunter access, and hunter access was the strongest predictor of second-order selection. Similarly, third-order population-level selection coefficients showed elk in both populations selected locations within their seasonal home range with no hunter access, and the strength of selection for locations with no hunter access was stronger in the archery season than the rifle season. However, individual models revealed that although third-order population-level selection for no hunter access was strong, only 43% of MRB elk selected for no hunter access during the archery season and 18% of elk selected for no hunter access during the rifle season. Additionally, the majority of all MRB elk locations (i.e., 68% of archery locations and 91% of rifle locations) occurred in areas accessible to hunters. In Larb Hills, individual models confirmed results of the population-level analysis, and 76% and 60% of elk selected for locations with no hunter access during the archery and rifle seasons. Even if hunter access is restricted or in a relatively small geographic area within an elk population range, elk refuge situations may have a disproportionate affect on elk distributions and prevent effective harvest

of female elk to maintain elk populations at objective levels. Working cooperatively with stakeholders to minimize these situations is necessary for curtailing further elk population increases and maintaining a distribution of elk across public and private lands. If elk refuge situations cannot be resolved, stakeholders may need to choose between allowing some level of hunter access to harvest female elk or accepting higher numbers of elk, and associated property damage issues.

****MEXICAN SPOTTED OWL SITE OCCUPANCY TRENDS AND SMALL MAMMAL ABUNDANCE IN THE CANYONLANDS OF UTAH**

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The Mexican Spotted Owl (*Strix occidentalis lucida*) is widely distributed in forest habitat from the central highlands of Mexico north to the four-corners region of the southwest U.S. However, in southern Utah, Mexican Spotted Owls are only found in arid rocky canyonlands, e.g., ~30 owl pairs occupy narrow canyons within Zion National Park, and up to 10 territories occur in Capitol Reef National Park. We studied the owl's territorial occupancy and primary prey species in Capitol Reef and adjacent environs during 2000-2015. We recorded Spotted Owl territorial occupancy states, including absence, single, or owl pair (and we searched for young). At a sample of territories, we measured relative abundance of primary prey species (*Neotoma* and *Peromyscus species)* using mark-recapture techniques. We were specifically interested in Woodrats and White-footed Mice because they have been identified as the primary prey of Spotted Owls in rocky canyon habitat using pellet analysis. We successfully captured, marked, and released over 6000 small mammals of various species at five owl territories in Capitol Reef and three territories in Grand Staircase-Escalante National Monument (GSENM). We also recorded various habitat measurements at each small mammal trap location. Spotted Owl territorial occupancy varied strongly during 2000-2007 in GSENM, and during 2013-2015 in Capitol Reef. We observed that low site occupancy in GSENM was correlated with low relative abundance of prey species, and associated with a severe drought throughout the region. During 2013 and 2014 in Capitol Reef, we observed low owl occupancy, with only one occupied territory. During 2015, six extinct territories were re-colonized by Spotted Owls, however, small mammal abundance declined during 2013 to 2015. We will continue to measure long-term patterns among owl occupancy, prey relative abundance, vegetation changes and variation in climate.

****SEEKING OUT THE HOARY MARMOT: HABITAT CHARACTERISTICS OF AN ALPINE OBLIGATE**

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Alpine ecosystems likely will be impacted by climate change, which will shift distributions of alpine species. To predict these shifts reliably, an increased understanding about the habitat characteristics that are important to alpine species will be necessary to manage for their continued presence on the landscape. We have very limited information about habitat for

hoary marmots (*Marmota caligata*) in Montana. To address this knowledge gap, we investigated the relative importance of habitat characteristics for marmot occupancy. During the summers of 2014 and 2015, we surveyed 184 sites in 5 mountain ranges throughout western Montana. We surveyed each site 2-5 times (average = 4.25 surveys/site) and detected marmots in 61 sites using two survey methods. Wind speed, survey method, cloud cover, and percent of the site that was visible all influenced detection probability. We estimated that marmots occurred in 36% of all sites (95% CI = 29-46%). Occupancy of marmots increased with snow and shrub cover and decreased with slope and distance to water. Given that snowpack, precipitation, and water sources are predicted to be impacted by climate change, our results begin to illustrate where this species of concern may become susceptible. If snowpack and the number of water sources decrease or shift geographically, this may reduce or alter the available habitat for marmots. We hope to augment the paucity of information about hoary marmots at the southern end of their distribution and aid management of this species under an uncertain climate future.

****GRIZZLY BEAR USE OF FOREST SERVICE GRAZING ALLOTMENTS IN THE GREATER YELLOWSTONE ECOSYSTEM (POSTER)**

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Range expansion of the Greater Yellowstone Ecosystem (GYE) grizzly bear population has led to increased human-bear conflicts, including livestock depredation. In 2015, we began a study to evaluate spatio-temporal patterns between public land livestock grazing, grizzly bear habitat use, and livestock depredations. In collaboration with the U.S. Forest Service and the Interagency Grizzly Bear Study Team, we will obtain 25 years (1989-2014) of data related to Forest Service grazing allotments, including livestock stocking and on-off dates, locations of individual collared bears, grizzly bear depredations and management removals, bear density, and habitat characteristics pertinent to bear space use (e.g. landcover, elevation, human activity) within the GYE. Bear and conflict locations will be related to allotment information, habitat characteristics, and bear density using generalized linear models to evaluate what factors are influencing grizzly bear space use and depredation events, and how they have changed across seasons and years. Habitat selection by individual bears will be evaluated at two scales, home range selection within the landscape and selection within the home range, to give more insight into factors affecting space use and how they differ among individual bears. Our results should facilitate the development of adaptive approaches to conserve grizzly bears while also conserving the economic viability of livestock operations, and should have utility for bear and land management in the GYE.

****DEVELOPING PHYSIOLOGICAL PROFILES USING NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY TO INFORM BIGHORN SHEEP (*Ovis canadensis*) MANAGEMENT**

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This study employs new techniques using nuclear magnetic resonance (NMR) to assess the relative health, physiological condition, and reproductive function of wild bighorn sheep in Montana and Wyoming. Ongoing bighorn studies in Montana and the Greater Yellowstone Ecosystem are focused on herd attributes and the population dynamics which are affected by disease, climate, habitat and physiology. Indices of herd health and physiological status are typically obtained through expensive and time consuming lab assays and field measurements. Recently, NMR spectroscopy has been used to revolutionize the assessment of human metabolic health, and we expect that there is similar potential for studies of wildlife populations. Using NMR spectroscopy to assess metabolites associated with disease, nutrition and stress may eliminate the need for many traditional assays and techniques used today. NMR can be used to evaluate a large suite of metabolites associated with a variety of physiological functions from as little as 500 μL of serum or plasma. Blood samples from 242 sheep from 13 different herds were collected during the winters of 2013-14 and 2014-15 to develop a comprehensive metabolite panel for bighorn sheep. We have used a recently developed statistical program known as MetaboAnalyst™ to begin to analyze and evaluate differences in NMR metabolic profiles among herds and across the fall-winter season when nutritional and physiological stress is expected to be acute. We will be presenting the results of this preliminary study and discussing the potential for application in wildlife management.