

# THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY

57TH ANNUAL CONFERENCE

BUILDING A CONSERVATION ETHIC IN THE NEW OUTDOOR ECONOMY

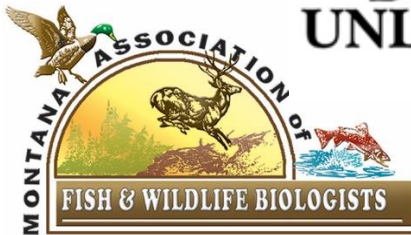
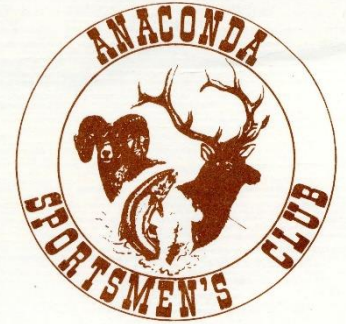


*February 26 – March 1, 2019*

**DELTA HOTELS MARRIOTT – HELENA COLONIAL**

**HELENA, MONTANA**

*Thank you to our sponsors for their generous contributions and support.  
We in turn can show our appreciation through our patronage and personal thanks.*



Tom Roberts - Wildlife Artist

Shawn Stewart  
Wildlife Photographer



Skyline Sportsmen's Association, Inc.



DIVISION OF FISH, WILDLIFE,  
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Jefferson Valley  
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The Montana Department of  
Natural Resources  
& Conservation



**THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY  
57<sup>TH</sup> ANNUAL CONFERENCE, 2019**

***“BUILDING A CONSERVATION ETHIC IN THE NEW OUTDOOR ECONOMY”***

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# ABOUT THE WILDLIFE SOCIETY AND THE MONTANA CHAPTER

Founded in 1937, The Wildlife Society's mission is "To inspire, empower, and enable wildlife professionals to sustain wildlife populations and habitats through science-based management and conservation." The Society's membership of nearly 10,000 includes research scientists, educators, communications specialists, managers, conservation law enforcement officers, administrators and students in more than 60 countries.

## The principle objectives of The Wildlife Society are:

1. To develop and promote sound stewardship of wildlife resources and of the environments upon which wildlife and humans depend;
2. To undertake a role in preventing human-induced environmental degradation;
3. To increase awareness and appreciation of wildlife values; and
4. To seek the highest standards in all activities of the wildlife profession.

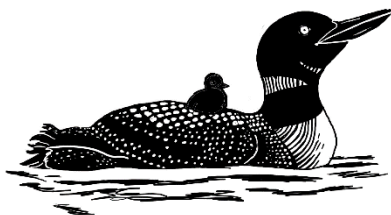
The Montana Chapter of The Wildlife Society was chartered in 1962 and formally organized with the election of its first officers in 1963. Adoption of chapter bylaws occurred in 1964. The mission of the Montana Chapter of The Wildlife Society is to encourage and support effective wildlife management in Montana by fostering development of current and future wildlife professionals, providing science based information for policy and education, and communicating and collaborating with conservation organizations and the public.

## Core Values of the Montana Wildlife Society include:

1. Sound stewardship of wildlife and habitat including the North American Model of Wildlife Conservation;
2. Dedicated, passionate, and responsible wildlife professionals;
3. A diversity of perspectives, backgrounds, and individuals unified behind our core mission;
4. Integrity and ethical conduct; and
5. A land ethic influenced by informed public input.

**Our chapter is as strong as our members and participation. We have numerous committees that can use participation; there are elected positions which we encourage acceptance of nominations; and the presentation of research and management activities are always needed to continue communication between agencies and the various wildlife organizations in the state!** Please see the Committees Page to find out more about the various committees in your chapter as well as chairperson contacts.

The Montana Chapter of the Wildlife Society has been a primary sponsor of the Intermountain Journal of Sciences (ISSN 1081-3519) since its inception in 1995. This journal provides the official publication for the printed proceedings of our annual meetings and submission of multidisciplinary scientific manuscripts for review and publication.



## 2018 - 2019 MONTANA TWS CHAPTER OFFICERS

**President:** Kelvin Johnson (Montana Fish, Wildlife & Parks)

**Past-President:** Vanna Boccadori (Montana Fish, Wildlife & Parks)

**President-Elect:** Liz Bradley (Montana Fish, Wildlife & Parks)

**Secretary:** Dan Bachen (Montana Natural Heritage Program)

**Treasurer:** Lorelle Berkeley (Montana Fish, Wildlife & Parks)

**Montana State University Student Chapter President:** Carl Young V

**University of Montana Student Chapter President:** Megan Robbins

## 2018 - 2019 MONTANA TWS COMMITTEE CHAIRS

**Programs:** Liz Bradley

**Awards:** Brendan Moynahan

**Education/Information:** Brent Lonner

**Financial Management:** Lorelle Berkeley

**Membership:** Dan Bachen

**Nominating and Elections:** Kelvin Johnson

**Resolutions/Public Statements:** Executive Board

**Scholarships:** Bob Garrott – MSU

Chad Bishop – UM

**Species of Concern Committee (Ad hoc):** Bryce Maxell

**Effects of Recreation (Ad hoc):** Bryce Maxell

**Grants (Ad hoc):** Claire Gower

**Conservation Action (Ad hoc):** Open

**Intermountain Journal of Sciences (Ad Hoc):** Terry Lonner and Rick Douglass

### THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY PROFESSIONAL CONDUCT DISCLAIMER 2019

Conference attendees are expected to conduct themselves in a safe, appropriate and professional manner. The Montana Chapter of The Wildlife Society (MTTWS) accepts no liability for harm done by individuals that fail to conduct themselves in a such a manner during formal conference activities. MTTWS is dedicated to providing a safe, professional and harassment-free conference experience for everyone. We do not tolerate harassment of conference participants in any form. Conference participants violating these rules may be sanctioned or expelled from the conference, without a refund, at the discretion of the conference organizers.

# WELCOME TO THE 57<sup>TH</sup> ANNUAL CONFERENCE OF THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY

## *“Building a Conservation Ethic in the New Outdoor Economy”*

Greetings! This conference has always been a highlight of the year for me as a wildlife professional. It’s an opportunity for all of us to get together in one place, catch up, and share what we’ve been learning. Montana is such a big state and we’re all so busy that this can be the one time of the year I get to see many of my wildlife friends. Whether we are current professionals, retirees seasoned with wisdom or the future generation of wildlifers, it’s a great time to visit and celebrate one another’s research and accomplishments. We all have something to learn from and help cultivate in each other. I’m honored to be your incoming president and to work with an amazing team to carry on The Wildlife Society tradition by helping put together this conference. I hope you will all enjoy it and ideally, draw a little inspiration from it, too.

Our conference theme this year is *“Building a Conservation Ethic in the New Outdoor Economy.”* It has been 20 years since we explored recreation as a conference topic. I believe it is more relevant now than ever, with a growing recreation economy in Montana. Most of us are outdoor enthusiasts and were likely drawn to wildlife work because of our love of the outdoors. We fish, hunt, raft, canoe, backpack, hike, bike, ski, climb, take pictures and more. If you’re like me, you are happiest with the stars as a roof over your heads. And we all know the sinking feeling when there are too many (or any) other people in “our” spot. Here’s a little more about the theme:

The outdoor recreation industry is growing faster than ever in Montana. More people are flocking to parts of Montana because of our incredible natural beauty and outdoor opportunities. Wild places that may have been a secret a decade ago are more accessible to people than ever from information sharing through social media and new technologies that make it easier to get there. People are recreating in new and diverse ways, from shooting at extreme ranges to extreme mountain sports. As growing pressures on wildlife and habitat continue to build, we need to foster and grow our constituencies. On the one hand we need more people to get outside and care about wildlife and wild places. But are we adequately connecting and helping build a conservation ethic in this growing sector of the public that are already out there? This conference will explore the changing face of recreation as it relates to conservation and the challenges and opportunities therein.

I was drawn to this topic not only because of its impacts on wildlife conservation but also its relevance to our Montana culture and our own outdoor ethics. We have five outstanding plenary speakers and an excellent banquet speaker who will explore this topic. On Tuesday evening after the welcome reception we will have *Movie Night* and show four films that explore the wildlife/recreation interface.

The Board has worked hard this year to encourage student participation in the conference by providing more grants for student travel for more colleges, continuing to support our MSU and UM student chapters, and running a student artwork contest (see cover!). We are delighted by the high number of presentations (20) and posters (11) submitted by students this year.

Overall, we have a great selection of workshops, talks, speakers, awards, raffles and social opportunities. May you find this conference engaging, enriching—and of course, entertaining, too. Welcome to the 57<sup>th</sup> Annual Conference!

# ACKNOWLEDGMENTS

I want to thank the 2018-2019 TWS Executive Board for being such a great team to work with: Kelvin Johnson (President), Vanna Boccadori (Past President), Lorelle Berkeley (Treasurer), and Dan Bachen (Secretary). Putting this conference together was definitely a team effort and I am thankful for all their hard work to help make it happen. We built a new website this year and the Board put a lot of time into making sure all parts were functioning in time for conference registration and abstract submission. Many thanks to Lorelyn Mayr for creating the website and helping us work through the kinks. Thanks to Lorelle for handling all things registration and \$ related, and Dan Bachen for handling communications and membership. Thanks to Kelvin Johnson, Martha Lonner, and Rose at Insty-Prints for putting together our conference program this year.

Many thanks to all of our sponsors who are mentioned on the inside cover. Thanks to Vanna Boccadori for putting together the silent auction and raffle and thanks to all who donated and rounded up items. Thanks to the International Wildlife Film Festival for sponsoring movie night and donating an all access pass to their film festival.

A big thanks to our plenary speakers: Rachel VandeVoort, Lauri Hanauska-Brown, Ryan Busse, Caroline Byrd and Hal Herring for taking the time to attend our conference and share their thoughts and insights on different aspects of recreation. Thanks to Tom Dickson for moderating the plenary session and providing inspiration by exploring the topic in the Nov/Dec 2018 issue of Montana Outdoors. Thanks to Steven Gnam for traveling to Montana to be our banquet speaker and sharing his experiences as a photographer and how he developed his own conservation ethic.

Thanks to those who put together and ran our three workshops this year: Bebe Crouse, Kristina Boyd (Communications Workshop), Bob Inman, Vanna Boccadori, John Olson, Tim Hiller (Trapping Matters workshop), and Braden Burkholder and Dan Bachen (Digital Tools Workshop).

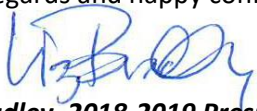
Thanks to all who submitted abstracts and posters – we wouldn't have a conference without you! Thanks to all the session moderators: Ray Vinkey, Tabitha Graves, Hillary Cooley, Carly Lewis, Ken Plourde, Catherine Wightman, Lance McNew, Scott Eggeman, Brett Dorak, Whisper Camel-Means, Megan O'Reilly, and Sam Milodragovich. Thanks to all the poster and presentation judges: Ray Vinkey, Sonja Andersen, Torrey Ritter, Heather Harris, Ben Jimenez, Vanna Boccadori, Dan Bachen, Ken Plourde, Brandi Skone, Drew Henry, Kristina Smucker, Brent Lonner, Jake Doggett, Ryan Rauscher, Heather Nenninger, and Tonya Chilton-Radandt. Thanks to all the student volunteers who helped at the registration desk, selling raffle tickets, and filling in as needed. Thanks to those that offered their artistic talent: to the students that submitted artwork for this year's contest, including our winner, Gabriel Aponte, whose fine piece graces the cover of this program. A special thanks to Rebecca Mowry for doing the amazing artwork for the t-shirts and providing four different designs!

Thanks to Mike Mitchell, Julie Cunningham and Rebecca Mowry for running this year's Pub Trivia. Thanks to Molly Parks for her help on movie night and abstracts/scheduling for this year's talks. Thanks to my FWP Region 2 team for summertime brainstorming on the conference theme/speakers at one of our Trough meetings - especially Mike Thompson, Scott Eggeman, Ben Jimenez and Nick DeCesare. Thanks to others in my wildlife office that helped me decide what color t-shirts to order and other decisions that don't come easy to a wildlife biologist turned conference planner.

Thanks to Brendan Moynahan (Chair) and other members of the Awards Committee: Jenny Sika, Ray Vinkey, Lewis Young and Allison Begley for driving the awards process and helping us recognize our outstanding peers. Thanks to Claire Gower for heading up the small grants committee. Thanks to Chad Bishop (UM) and Bob Garrott (MSU) for spearheading student awards. Thanks to all other committee and working group members/chairs for your great work.

Most of all thanks to the Montana Chapter of the Wildlife Society members; without you, none of this would occur!

Best regards and happy conferencing,



**Liz Bradley, 2018-2019 President-elect**

# 2019 NOMINEES FOR EXECUTIVE BOARD OFFICERS

## PRESIDENT-ELECT CANDIDATE



### BRETT DORAK

**Brett Dorak** has worked for Montana Fish, Wildlife & Parks for approximately 5 years. He started as a Wildlife Management Area Technician in Glasgow and moved on to be a Habitat Access Technician and then onto a Wildlife Technician. From there he went to work for Ducks Unlimited Inc. where he covered the northern half of Montana as a Conservation specialist working on a variety of habitat projects on private lands. Since 2016, Brett has been the Malta area wildlife management biologist where he currently works on a variety of wildlife and habitat projects spanning across private and public lands. He received his B.S. from the University of Wisconsin – Stevens Point and a M.S. in Natural Resources and Environmental Sciences from the University of Illinois where he conducted research on the winter ecology of Canada geese in the Greater Chicago Metropolitan Area. When not working he enjoys spending time with his wife, Sheena, and their two children, Una and Cameron, as well as their lab, Gunner. Depending on the time of year you can find them hunting, fishing, trapping, hiking, running, camping, or doing any other activity that brings them into the wonderful outdoors that Montana has to offer.



# SECRETARY CANDIDATES



## REBECCA MOWRY

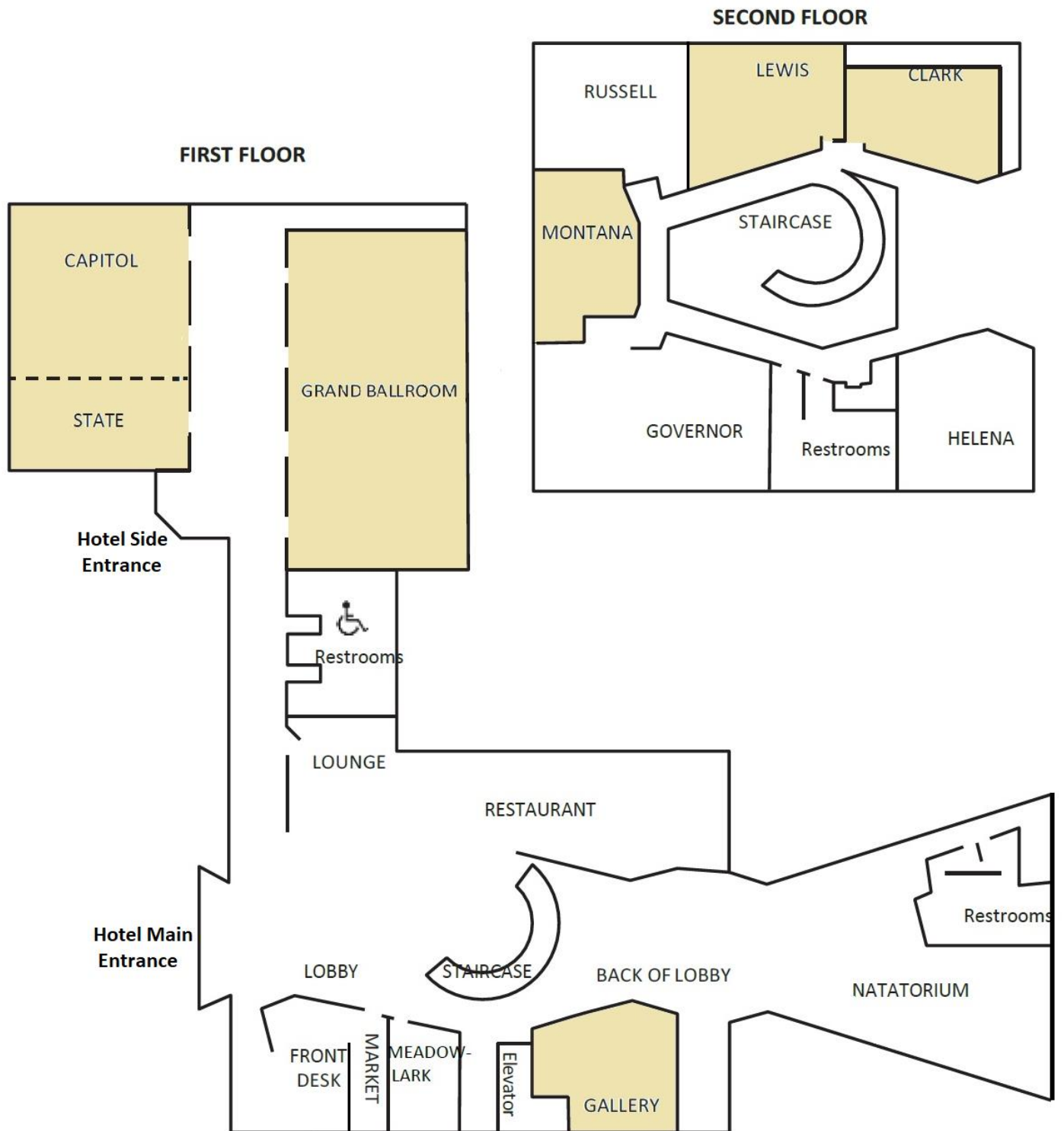
Rebecca Mowry has worked as the Bitterroot area wildlife biologist for Montana Fish, Wildlife & Parks for the last 4 years. Prior to arriving in Montana, Rebecca was a biologist for Texas Parks and Wildlife, and holds a M.S. from University of Missouri and a B.S. from University of Idaho. She is a 2017 Wildlife Society Leadership Institute alumnus and currently works with the Montana Chapter on t-shirt designs and Trivia Night for the annual conferences. When she's not chasing deer, bighorn sheep, or fisher around the Bitterroot, Rebecca likes to write novels, play guitar, and jog to the brewpub with the local running club.



## JASON HANLON

Originally from Albuquerque, NM, Jason moved to Boston, Massachusetts after graduating high school. In Boston, he completed a five-year apprenticeship program and worked for ten years as an electrician with International Brotherhood of Electrical Workers. During his electrical career he learned the benefits of hard work and persistence. Not completely satisfied with his first career choice, and becoming restless, he moved around a bit. Throughout his life he worked as a cook, janitor, camera repair, artist, painter, landscaper, caregiver, and pool cleaner, all of which were learning experiences. These and other experiences shaped the course of his life, and in 2011, he moved to Montana to attend the University of Montana. His degree of choice was wildlife biology, mostly because he wanted to be outdoors. However, he quickly became passionate and excited about wildlife and learning. During his time at UM he participated in TWS and served as President of the student chapter in 2015. While attending UM Jason worked seasonally for The Nature Conservancy. After working seasonally for a few years around Montana, TNC brought him on as a full-time team member in 2017. Working for TNC, Jason has contributed to research and monitoring projects, ranch operations, stewardship efforts, and is currently a certified drone pilot flying drones for TNC. Jason is headquartered at the Matador near Malta, MT. and he enjoys being outdoors and taking in all that the grasslands offer.

# DELTA HOTELS MARRIOTT ROOM MAP



NOTE: Shaded rooms are where meetings, workshops, concurrent sessions, and the awards banquet will be held.

# GENERAL CONFERENCE SCHEDULE

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	
<b>Monday</b>							<b>Conference Preparations</b> Volunteers are welcome to help prepare for the conference. Contact an executive board member for details.									
<b>Tuesday</b>	<b>News Media Communication Training</b> 8:00 - 5:00pm <i>Clark Room</i> <i>Bebe Crouse</i>		<b>Trapping Matters</b> 8:00 - 5:00pm <i>State Room</i> <i>John Olson, Tim Hiller, Bob Inman, Vanna Boccadori</i>		<b>Harlequin Duck Working Group</b> 10:00 - 12:00pm <i>Lewis Room</i> <i>Chris Hammond</i>		<b>News Media Communication Training</b> 8:00 - 5:00pm <i>Clark Room</i> <i>Bebe Crouse</i>		<b>Trapping Matters</b> 8:00 - 5:00pm <i>State Room</i> <i>John Olson, Tim Hiller, Bob Inman, Vanna Boccadori</i>		<b>Bat Working Group</b> 1:00 - 5:00pm <i>Lewis Room</i> <i>Dan Bachen</i>		<b>MTTWS Welcome Reception</b>  6:00 - 9:00pm  <i>Natorium</i>		Movie Night!! 9:00 - 11:00pm <i>Natorium</i>	
<b>Wednesday</b>	<b>Digital tools for recording species observation and survey data</b> 8:00 - 12:00pm <i>Clark Room</i> <i>Braden Burkholder, Dan Bachen</i>				<b>Partners for America</b> 10:30 - 11:30am <i>Gallery Room</i> <i>Leader</i>		<b>Plenary Session</b>  1:00 - 4:45pm  <i>Capitol/State Room</i>				<b>MAFWB Meeting</b>  5:00 - 6:00pm  <i>Montana Room</i>		<b>Student - Professional Mixer</b>  6:00 - 9:00pm  <i>Ballroom</i> <i>Mike Mitchell, Julie Cunningham, Rebecca Mowry</i>			
<b>Thursday</b>	Business Meeting 7:00 - 9:30am  <i>Gallery Room</i>	<b>Concurrent Session A</b> 8:20 - 10:00am <i>Capitol Room</i> <i>Ray Vinkey</i>	<b>Concurrent Session B</b> 8:20 - 10:00am <i>State Room</i> <i>Lance McNew</i>	Break	<b>Concurrent Session A</b> 10:20 - 12:00pm <i>Capitol Room</i> <i>Scott Eggeman</i>	<b>Concurrent Session B</b> 10:20 - 12:00pm <i>State Room</i> <i>Whisper Camel-Means</i>	Lunch	<b>Concurrent Session A</b> 1:20 - 3:00pm <i>Capitol Room</i> <i>Hilary Cooley</i>	<b>Concurrent Session B</b> 1:20 - 3:00pm <i>State Room</i> <i>Sam Milodragovich</i>	Break	<b>Concurrent Session A</b> 3:20 - 4:40pm <i>Capitol Room</i> <i>Brett Dorak</i>	<b>Concurrent Session B</b> 3:20 - 4:40pm <i>State Room</i> <i>Megan O-Reilly</i>	<b>Poster Session</b>  5:00 - 6:00pm  <i>Hallway</i>	<b>Banquet Dinner</b>  6:00 - 9:00pm  <i>Ballroom</i>  <i>Awards: Brendan Moynahan</i> <i>Silent Auction: Vanna Boccadori</i>		
<b>Friday</b>	<b>Concurrent Session A</b> 8:20 - 10:00am <i>Capitol Room</i> <i>Carly Lewis</i>		<b>Concurrent Session B</b> 8:20 - 10:00am <i>State Room</i> <i>Ken Plourde</i>		Break	<b>Concurrent Session A</b> 10:20 - 12:00pm <i>Capitol Room</i> <i>Tabitha Graves</i>		<b>Concurrent Session B</b> 10:20 - 12:00pm <i>State Room</i> <i>Catherine Wightman</i>		<b>Conference Adjourned</b>  Safe Travels!						

# 2019 CONFERENCE DAILY SCHEDULE

## Tuesday, February 26

- **Workshops**
  - **News Media Communication Training:** 8:00am – 5:00pm (Clark Room)
  - **Trapping Matters:** 8:00am – 5:00pm (State Room)
- **Meetings**
  - **Harlequin Duck Working Group:** 10:00am – 12:00pm (Lewis Room – 2<sup>nd</sup> floor)
  - **Bat Working Group:** 1:00pm – 5:00pm (Lewis Room – 2<sup>nd</sup> floor)
- **Montana TWS Conference Welcome Reception:**  
6:00pm – 9:00pm (Natatorium – behind the grand staircase)
- **Movie Night!!!:** 9:00pm – 11:00pm (Natatorium)

## Wednesday, February 27

- **Workshop**
  - **Digital tools for recording species observation and survey data:**  
8:00am – 12:00pm (Clark Room – 2<sup>nd</sup> floor)
- **Meetings**
  - **Partners of America:** 10:30am – 11:30am (Gallery Room)
- **Plenary Session:** 1:00pm – 4:45pm (Capitol/State Room)
  - **Welcome & State of the Chapter Address** (MT Chapter President Kelvin Johnson)
  - **Legislative Update** (Audubon lobbyist Amy Seaman)
  - **Plenary Session & Panel Discussion: “Building a Conservation Ethic in the New Outdoor Economy”** (Introduction by MT Chapter President-Elect Liz Bradley, panel discussion moderated by Tom Dickson, editor, Montana Outdoors, FWP)
  - **Panelists:**
    - Rachel VandeVoort, Director, MT Governor’s Office of Outdoor Recreation
    - Lauri Hanauska-Brown, Nongame Wildlife Management Bureau Chief, MTFWP
    - Ryan Busse, Chair, Board of Directors, Backcountry Hunters & Anglers
    - Caroline Byrd, Executive Director, Greater Yellowstone Coalition
    - Hal Herring, Contributing Editor, Field and Stream Magazine
- **Evening Meetings**
  - **Montana Association of Fish & Wildlife Biologists:** 5:00pm – 6:00pm  
(Montana Room – 2<sup>nd</sup> floor)
- **Student Professional Mixer:** 6:00pm – 9:00pm (Ballroom)

## Thursday, February 28

- **Business Meeting:** 7:00am – 9:30am (Gallery Room)
- **Concurrent Session A:** 8:20am – 12:00pm and 1:20pm – 4:40pm (Capitol Room)
- **Concurrent Session B:** 8:20am – 12:00pm and 1:20pm – 4:40pm (State Room)
- **Lunch provided by MT TWS:** 12:00pm – 1:20pm
- **Poster Session:** 5:00pm – 6:00pm (Hallway)
- **Awards Banquet & Silent Auction** 6:00pm – 9:00pm (Ballroom)

## Friday, March 1

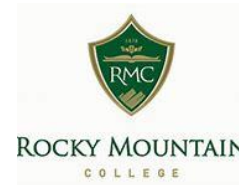
- **Concurrent Session A:** 8:20am – 12:00pm (Capitol Room)
- **Concurrent Session B:** 8:20am – 12:00pm (State Room)

### CONFERENCE LOGO ARTIST

### **AND WINNER OF THE 2019 STUDENT ARTWORK CONTEST**



**GABRIEL APONTE**



**Gabriel Aponte** is a recent graduate from the Rocky Mountain College Environmental Science and Environmental Management and Policy undergraduate programs. During his academic career he was one of the leads in the Snapping and Spiny Softshell Turtle Research Project with the Yellowstone River Research Center. He is currently working on publishing a paper on their findings for spiny softshell turtle populations in Eastern Montana and transitioning into the next stage of his career.

About the cover: "**Titans**" by Gabriel Aponte, Rocky Mountain College

*"With this artwork I wanted to highlight a variety of Montana wildlife. Their size represents the magnitude of their existence as a species, their value to the ecosystem. The species included are: western meadowlark, bison, common snapping turtle, pronghorn, grizzly bear, and westlope cutthroat trout. Humans are shown as outside observers, blending the benefits of modern technology with the appreciation and respect for the wild. This is set against the backdrop of the Beartooth Mountains." Gabriel*

# PROFESSIONAL DEVELOPMENT WORKSHOPS

## News Media Communication Training

**Instructor:** Bebe Crouse

**Date and Location:** Tuesday, February 26, 8:00am – 5:00pm (Gallery Room)

**Cost and participant limits:** \$15 per person, limited to 10 participants

This workshop is back by popular demand! It is designed to help you communicate with media outlets, find the great stories in your work, and deliver them in ways that are engaging and effective. You'll gain a better understanding of media needs and how to make strong pitches and ace interviews. It is interactive, so come prepared to talk about your projects. Your mentor will be Bebe Crouse, who spent over 25 years as a working journalist before taking her current position as Director of Communications for The Nature Conservancy in Montana and Wyoming. Bebe has reported and produced award-winning radio and television news stories and documentaries for NPR, CBS, NBC, Wall Street Journal, BBC and PBS.

The foundational session of the workshop runs from 8:00am-12:00pm, and includes presentation, discussion, and practice of effective media interaction and storytelling. The afternoon session, from 1:00-5:00pm, includes the video recording and review of practice interviews by workshop attendees. Workshop participants will review the tapes with Bebe and receive coaching as a group so that each person learns from another.

SPECIAL OPPORTUNITY!! If you are an early career wildlife professional with 1-10 years of work experience, we have 2 scholarships available for the cost of registration for this workshop (this does not include single-day or full conference registration fees). This opportunity is first-come first-serve! Contact workshop coordinator Kristina Boyd at [boyd.kristina@yahoo.com](mailto:boyd.kristina@yahoo.com) for details.

## Trapping Matters

**Hosted by:** Association of Fish and Wildlife Agencies & Montana Chapter of The Wildlife Society

**Instructors:** John Olson (Wisconsin DNR ret.), Tim Hiller (Wildlife Ecology Institute), Bob Inman (Montana FWP), Vanna Boccadori (Montana FWP).

**Date and Location:** Tuesday, February 26, 8:00am – 5:00pm (Capital Room)

**Cost and participant limits:** Free, limited to 40 participants

The topic of regulated trapping can be among the most contentious and least understood subjects within wildlife management programs. Many wildlife professionals are unfamiliar with trapping and readily shy away from trapping related discussions with their peers and the public because of their lack of knowledge and familiarity with it. Yet, it is essential that wildlife professionals understand the diverse ways that trapping provides environmental, social and economic benefits. This workshop will help participants understand and better communicate the benefits of regulated trapping and the many ways in which it contributes to wildlife management programs. Primary tools and techniques of trapping will be presented with specific emphasis on the development of trapping Best Management Practices, their availability, and how they can be used effectively by wildlife professionals. Information provided during the workshop will include a review of public opinion data, focus group and human dimensions studies on the topic of trapping, and the lessons learned and effective communication measures to use when discussing this topic among varied audiences. Participants will leave with scientifically sound information and be trained in skills that will make them effective communicators on this subject matter

## Digital tools for recording species observation and survey data

**Instructors:** Braden Burkholder, Dan Bachen

**Date and Location:** Wednesday, February 27, 8:00 – 12:00pm (Clark Room – 2<sup>nd</sup> floor)

**Cost and participant limits:** \$5 per person, limited to 50 participants

With recent technological advancements, recording field data in a digital format is now more accessible to biologists and the general public than ever before. These digital tools can simplify data collection and reduce effort in the field, facilitate efficient transfer of field data to databases, and ultimately increase data quality. In this workshop, we will give an overview of applications and tools such as Survey 123, iNaturalist, and others. Our primary focus will be to help participants understand the advantages and limitations of using a digital platform and which tools are appropriate for citizen scientists, incidental observations by professional biologists, and collection of formal survey data. We will finish by taking a closer look at Survey123 to demonstrate what is required to create custom applications tailored to individual project needs. The workshop will be geared toward field use of the apps and technical expertise is not required. Participants are encouraged to bring a GPS-enabled smart device (e.g. phone or tablet) to explore data collection tools during the workshop.

## Legislative Opportunity

**Leaders:** Amy Seaman, Nick Gevock

**Date and Location:** To be announced at the conference

**Cost and participant limits:** No cost and no limits on participants

During the conference we will be offering one or more opportunities to visit the capital and attend floor sessions and legislative hearings with Amy Seaman (MT Audubon) and Nick Gevock (MT Wildlife Federation). Both Nick and Amy are experienced lobbyists on conservation issues. We will announce these opportunities once the legislative schedule is in place for the week of the conference.

## BANQUET SPEAKER



### STEVEN GNAM

S T E V E N   G N A M   P H O T O G R A P H Y

**Steven Gabriel Gnam** is a photographer using the medium to explore and illuminate our connection to Nature. His work is a celebration of the wild, and encourages protecting the wildlands of the American West, with a focus on the Rocky Mountains and the Pacific Northwest. Steven's photographs are used by clients including: National Geographic, The Nature Conservancy, The

Trust for Public Land, Nikon Inc., Patagonia, and others. Steven lives with his wife Alyson in the Pacific Northwest. To see more of his work, visit his website: [www.gnam.photo](http://www.gnam.photo)

## PLENARY SESSION SPEAKERS



**RACHEL VANDEVOORT**



Based out of Whitefish with her husband and two sons, Rachel has worked in and around the outdoor recreation industry for over 25 years, most recently in the firearms segment of the economy. She now directs the Montana Governor's Office of Outdoor Recreation.



**LAURI HANAUSKA-BROWN**



**Lauri Hanauska-Brown** has a B.S. from the University of Wisconsin-Stevens Point and a M.S. from Boise State University. She managed nongame and federally listed species for the Idaho Department of Fish and Game from 2001-2008 including work with trumpeter swans, peregrine falcons, pygmy rabbits, grizzly bears and wolves. Lauri has worked for Montana Fish, Wildlife and Parks for nearly 11 years during which time she has worked to develop a nongame program that is integrated with game and habitat conservation programs. Her professional objectives include encouraging the persistence of native species through habitat conservation, outreach, and education, and building long term partnerships among constituency groups and government agencies. She is currently working with partners to conserve Montana's bats, recover black-footed ferrets, and save habitat for grassland and prairie species. In addition, Lauri is the Montana lead on national efforts to secure long term and adequate conservation funding for all species and their habitats. Lauri's personal goals revolve first and foremost around raising a responsible, spunky little girl who will someday appreciate the wonders of Montana and the world in the same way her mother does by hiking, skiing, hunting, floating, and camping.



## RYAN BUSSE



**Ryan Busse** grew up on a farm & ranch where he was a passionate participant in many outdoor pursuits beginning at a very young age. He obtained a degree in political science and then entered his professional career. His love of the outdoors led him to the sporting goods industry where he has spent the last 25 years. Most of that has been spent as Vice President at Kimber, a leading firearms manufacturer. Ryan has always been passionate about conservation and environmental policy and is a frequent speaker and writer on those topics. He has served in advisory leadership roles for numerous organizations including Montana Conservation Voters and most recently as North American Board Chairman for Backcountry Hunters and Anglers. Ryan lives in Kalispell with his wife Sara and their two boys Lander and Badge.



## CAROLYNE BIRD



**Caroline Byrd** has a deep and varied background in conservation and outdoor work throughout the West. Since 2013, Caroline has been the Executive Director of the Greater Yellowstone Coalition leading the organization's mission of working with people to protect the lands, waters and wildlife of the Greater Yellowstone Ecosystem now and for future generations. At GYC, Caroline heads a staff of 30 in six offices spread through Montana, Wyoming and Idaho. She came to GYC from The Nature Conservancy where she was the Western Montana Program Director based out of Missoula. With TNC she worked on the Montana Legacy Project and the Blackfoot Community Project, two landscape scale conservation efforts in which the Conservancy purchased and protected more than 400,000 acres of Plum Creek Timber lands in and around the Crown of the Continent. Before coming back to Montana, Caroline was The Nature Conservancy's Southwest Colorado Program Manager in Telluride, CO. In Wyoming, she was a staff attorney and the Greater Yellowstone Program Director for the Wyoming Outdoor Council in Lander. Also, out of Lander, she led National Outdoor Leadership School courses in leadership and outdoor skills in the Rocky Mountains, Southwest deserts, North Cascades, Canada, Alaska and East Africa. She also taught for Earlham College; she directed their Kenya program as well as their Southwest Field Semester. Caroline has served on many boards including the Blackfoot Challenge and High Country News. She worked seasonally for the Forest Service as a wilderness ranger and on the trail crew in Wyoming and Alaska. She has several mountaineering highpoints to her name, including being the first woman to climb the Northwest Buttress of Denali and as a member of the first American women's expedition to climb an 8,000-meter peak (Cho Oyu) without oxygen or Sherpa support. Throughout her career, Caroline has worked with a wide array of partners and communities to come to long term conservation solutions. She has an undergraduate degree in environmental studies and anthropology from the University of California Santa Cruz, a master's degree in environmental studies from the University of Montana and a law degree from the University of Montana, School of Law.



## HAL HERRING



Hal Herring is an award-winning journalist and contributing editor at Field and Stream magazine. He has written for publications that range from the Atlantic Monthly and the Economist to Creative Nonfiction and Orion, and specializes in deeply reported, long-form journalism stories and essays. A lifelong outdoorsman, mountaineer, hunter and fisherman, Hal is based in Augusta, Montana.

## PLENARY SESSION ABSTRACTS

### Montana's New Office of Outdoor Recreation: economics and stewardship

**Rachel VandeVoort, Director, MT Governor's Office of Outdoor Recreation**

Outdoor recreation is not only intrinsic to the Montana lifestyle and a bedrock reason why so many of us call the Big Sky home, it is also one of the most crucial parts of the state's economy. According to the Outdoor Industry of America's most recent figures, outdoor recreation is now the single largest sector of Montana's economy. It generates over \$7 billion per year in consumer spending and supports over 70,000 jobs that pay more than \$2 billion worth of wages annually. Those figures don't even account for indirect economic effects, such as the thousands of startups and small businesses that choose to locate here because of the state's outdoor recreation opportunities. In many ways, America is in the midst of an outdoor recreation renaissance, a trend driven by a growing appetite to explore and connect with nature combined with rapid advances in innovation and awareness. The National Park Service and its array of sites are enjoying all-time high popularity. State parks across the U.S. are experiencing similar record crowds, including throughout Montana. The evolution of gear and activities is driving more people outdoors in search of unique experiences.

The new Office of Outdoor Recreation could play several critical roles in Montana's outdoor recreation economy: from helping protect public lands to helping properly fund the state and federal agencies responsible for the stewardship of our land, water and wildlife. It could also help rural communities gain access to resources to fully capture the benefits of outdoor recreation, from building trail systems to creating better outdoor infrastructure. Protecting and enhancing this infrastructure is essential to conserving our most vital and sustainable resources and we need to reframe the way we look at its impact on the future of Montana's economy.

## **Intersecting the Recreating Public with Wildlife and Habitat Conservation: It's About Passion, Data, and Advocacy**

**Lauri A. Hanauska-Brown, Wildlife Division, Montana Fish, Wildlife and Parks, Helena**

Campaigns such as *Hooked on Fishing*, *Nature RX*, *Every Kid in a Park* and *Families Afield* urge Americans to get outside to fish, hunt, camp or just observe. Some campaigns focus on increasing access to the outdoors and some even make it less expensive to recreate by offering loaner gear or waived park entrance fees. While increasing the general public's interest in the outdoors is good for them and economies of outdoor industries it does present resource managers with a challenge of balancing the needs of wildlife and habitat with increased human presence. Many recreationists already have a vested interest in the outdoors and may be cognizant of the potential impacts of their activities while people entirely new to outdoor recreation may not. It behooves organizations and agencies to engage all these recreationists as part of the larger conservation army in attempts to limit their impact and put their time outdoors to use. Attentive recreationists can help fill data gaps with new mobile applications such as Survey 1,2,3 and iNaturalist that make it easy for them to report the wildlife or even the weeds they see. Submitting information that is used to inform species distribution models and management strategies can result in recreationists feeling like they are part of the monitoring and conservation team. Citizens who volunteer their time to check osprey nests along the Yellowstone River, hair snares and camera traps for carnivores, and the 180,000 hunters who share information on their game harvest or wildlife observations each year are part of a team of recreationists vested in wildlife management and conservation. Specific programs like *Climbers for Bat Conservation* encourage recreationists with a passion for climbing to learn more about the animals they observe during their time on the rock. Climbers in Colorado have become advocates who contribute to bat conservation not only by collecting data but also by bringing climbers resistant to sharing their knowledge into the discussion. Being part of the team creates a sense of stewardship as seen when these same birders, skiers, hunters and climbers show up at public meetings where wildlife management, public land access, and habitat conservation are being discussed. Encouraging recreationists to add their voices to specific campaigns is another way to put their passions to use and secure their investment in the outdoors. Local movements like the Montana Outdoor Heritage Project or federal legislative proposals such as the Recovering America's Wildlife Act provide platforms for recreationists to support legislation and funding that will help conserve the places, access and species they love. Engaging all recreationists through our shared passions, information sharing, and advocacy will hopefully lead to a contagious enthusiasm for conservation and responsible use of the resources they enjoy while outside.

## **What's old is new again: Protecting the core tenets of conservation, North American Model, and ethics is the path to growth**

**Ryan Busse, Chair of the Board of Directors, Backcountry Hunters & Anglers**

Hunters and anglers are the traditional "constituency" or "beneficiary" of conservation policy and public lands use. For many years the general assumption has been that this constituency is getting older, more insular and less relevant. This has forced a myriad of questions about the way we manage our resources.

Who has the political clout to influence this management? Forces that wish to privatize or monetize land, water and wildlife have seized on this from multiple directions. They have mobilized fear of "a disappearing lifestyle" to encourage segments of outdoorspeople to tear at traditionally proven management policies such as the North American Model. They have embraced media and personalities within it to chip away at ethics, poke at professional management and open political chasms. By doing this they have driven potential new hunters and anglers from our ranks and have repelled growing allied constituency groups in the outdoor sports arena.

BHA and other examples I will offer tell another story – a hopeful and exciting story about how the core principles of wildlife professionals are laying the groundwork for dynamic new advocacy and an era of increased participation in the outdoor world. In this new era, ethics, wild places, core principles of wildlife management and the managers themselves are cornerstones of success. It’s an era where new people, especially young people, join movements because of wild food and ethical activities which connect them to nature. Where old, divisive assumptions about politics and policies are dissolved. Where people are eager to be participants in improving and protecting resources, not just using them. It’s an era where the hard work and dedication of professionals in conservation help drive growth of an org like BHA, which now counts over 30,000 members and is growing every day. Where new hunters and non-hunters join because of a shared vision of the importance of wildness in the lives of everyone.

By staying the course and holding to bedrock, fundamental principles, wildlife and resource managers have helped invigorate a new age of activism.

## **Conservation and Recreation in the Greater Yellowstone Ecosystem**

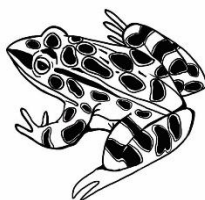
**Caroline Byrd, Executive Director, Greater Yellowstone Coalition**

Participation in outdoor recreation is increasing and communities of the Greater Yellowstone Ecosystem (GYE) are growing. Increasing recreational pressure is putting demands on resource strapped land management agencies and driving wedges between historically aligned interests around how to balance conservation values and recreational access. The GYE is unique in that it still hosts all the native carnivores and migratory ungulates and is comprised of vast wild landscapes. At the same time, outdoor recreation is important to the social and economic fabric of many places in the west, and threats like climate change and public land transfer highlight the need for a unified conservation and recreation movement. Given this context, we conducted an inventory of outdoor recreational use to better understand the benefits and challenges associated with recreation in the GYE. Following the inventory, we convened a symposium of diverse interests to begin to grapple with the growing tension between outdoor recreation and conservation. People we interviewed said they value wildlife, natural history, and solitude in the places they recreate. Yet we found important areas for wildlife and quiet, wild places intersect with hotspots of recreation infrastructure and demand. There are a variety of challenges ahead in building solutions that balance conservation and recreation, but a common theme at the symposium was interest in finding ways to build a new ethic for recreation in the GYE. At GYC, we think of it as Leave No Trace 2.0, and envision shared commitment to practices that inform how we recreate in the places we love, to ensure they stay wild and healthy for generations to come. Cultural shifts take a long time, but a few key questions surfaced throughout our work that should be considered in any efforts moving forward:

What does a new ethic need to look like (i.e. what are some best recreation practices) and what would it do?

What communities have historically been underrepresented in outdoor recreation and conservation and how do we ensure that building a shared vision for recreation in the GYE is inclusive?

If we are to build a new ethic, how do we collectively change our expectations (especially our expectations of public land management) in ways that ensure our recreational pursuits and conservation values align?



## Welcoming Conflict and Cultivating Ethics

**Hal Herring, Contributing Editor, Field and Stream Magazine**

We're going to see lots of pressures in the years to come. We must welcome conflict, and we must be open minded enough to know that we might find ourselves on one side of it at one time, and another some other time. If peregrine falcons need nesting cliffs to be closed to rock climbing during certain months, then by all means, close them, but be prepared to be specific about the need, and the places. Have the staff to carefully define the need. Blanket closures smack of laziness, and of unacceptable fiat. Make the case. Welcome dissent. Conflict is exhausting, and federal agencies, often with overworked employees, sometimes have little patience with it, but patience for conflict is necessary. Fiats will be met with resistance, and resistance can include anger enough to taint our politics. We have to meet with shared goals. We need, for so-called non-consumptive users (ie. non-hunters and fishermen) to create a way for them to bring money to support the lands and wildlife that we all love. A "backpack tax" - whatever. And no, it can't be just voluntary. Conflict is great, but when one side of the conflict is footing all the bills, then the argument of the other side is simply not going to be heard with the same gravity it might deserve.

As for cultivating an ethic, well, that can be done, as well, but it is a delicate hearts-and-minds project, one not well suited to fiat. Our myths all involve wild creatures and beasts and our interactions with them. There is something in us that wants to respect and revere wild creatures and the places, rife with mystery, that they call their homes. That something is best awakened in the wild places themselves, and it is best awakened when we are young. Outreach, education, experience, awakening. Without that, all the tax money in the world will not save us from a lesser future. The problems can be solved, the challenges met, the money and energy found. But most of us need to know what is at stake. We have to love something enough to fight for it. As Baba Dioum, the Senagalese environmentalist, said, "In the end we will conserve only what we love, we will love only what we know, and we will know only what we are taught."

## BANQUET SPEAKER ABSTRACT

### Restraint, the old tool that will help us build new ones

**STEVEN GNAM, Steven Gnam Photography**

More of us are spending less time outdoors, especially children, while some landscapes are simultaneously being 'loved to death.' How do we inspire others to build meaningful relationships with Nature while mitigating the deleterious effects of overuse? Steven Gnam will explore various aspects of the interface between technology, recreation, and ethics in hopes of finding balance and actionable ideas for our work and personal lives.



# CONCURRENT SESSION SCHEDULES

<b>Thursday Morning, February 28th</b>		
	<b>CONCURRENT SESSION A: CAPITOL ROOM</b> Moderator: Ray Vinkey	<b>CONCURRENT SESSION B: STATE ROOM</b> Moderator: Lance McNew
8:20	R. Newbury - Regional Differences in Winter Diets of Bobcats in their Northern Range	**K. Reintsma - Application of a Novel Nest Density Estimator: an Example Using Sagebrush-Steppe Songbirds
8:40	R. Newbury - A Winter Energetics Model for Bobcats in a Deep Snow Environment	**K. Ruth - Population Demographics, Breeding Ecology, and Responses to Grazing of Montana Sagebrush Steppe Songbirds
9:00	**A. Kumar - Short-term Response of Snowshoe Hares to Western Larch Restoration and Seasonal Needle Drop	**J. Pulliam - Assessing Habitat Quality for Four Grassland Songbird Species of Concern in Northern Mixed-Grass Prairie
9:20	**B. Davis - Weasely Recognized or Stoatally Camouflaged: Quantifying Coat Color of a Cryptic Predator	**M. Milligan - Effects of Rangeland Management on the Ecology of Sharp-tailed Grouse in Mixed-grass Prairies
9:40	**C. Gray - Sugar Content as a Driver of Resource Partitioning Between Foraging Bears and Tribal Harvest of Huckleberries on the Flathead Indian Reservation	**M. Yarnall - Precipitation and Reproductive Effort Alter Survival of Turkey Hens in the Northern Black Hills, South Dakota
<b>10:00</b>	<b>BREAK</b> Moderator: Scott Eggeman	<b>BREAK</b> Moderator: Whisper Camel-Means
10:20	**F. Hayes - Preliminary Results on the Drivers of Moose Calving Success and the Impacts of Mountain Pine Beetle Epidemics on Resource Selection	C. Sime - Montana's Greater Sage-Grouse Conservation Strategy: All Hands Balancing Conservation and Development Across All Lands
10:40	**E. Lula - Is Habitat Constraining Bighorn Sheep Distributions and Restoration: a Case Study in the Greater Yellowstone Ecosystem	J. Hanlon - Using UAVs, Infrared Cameras, and Machine Learning to Count Greater Sage-grouse
11:00	**C. Peterson - Estimating Forage Quality and Abundance to Better Understand Mule Deer Resource Selection	J. McFadden - Montana's Spatiotemporal Model for Estimating Gains and Losses of Greater Sage-Grouse Habitat in a Mitigation Framework: Time is of the Essence
11:20	N. Mikle - Recent Trends in Ungulate Forage Inferred from Remote Sensing Datasets	**J. Waxe - Influence of Pre-breeding Body Condition on Reproductive Metrics in Greater Sage-grouse
11:40	J. DeVoe - Eating their Greens: Relationships of NDVI with Elk Forage and Nutritional Condition	A. Pratt - Greater Sage-Grouse Response to Bentonite Mining
<b>12:00PM</b>	<b>LUNCH</b>	<b>LUNCH</b>

\*\* Student Presenter

# CONCURRENT SESSION SCHEDULES - CONTINUED

Thursday Afternoon, February 28th		
	<b>CONCURRENT SESSION A: CAPITOL ROOM</b> Moderator: Hilary Cooley	<b>CONCURRENT SESSION B: STATE ROOM</b> Moderator: Sam Milodragovich
1:20	**A. Keever - Methods to Estimate Recruitment for Social Species with Limited Data	L. Breidinger - Avian Response to Old-Growth Maintenance Logging in the Swan River State Forest
1:40	**A. Keever - Recruitment of Gray Wolves in Montana	B. Busby - Estimating Natal Origins of Juvenile Northern Goshawks Using Stable Hydrogen Isotopes
2:00	**S. Sells - Improving Estimates of Wolf Abundance in Montana	M. Larson - Project WAFLs: Predicting Responses of Short-eared Owl Population Size, Distribution, and Habitat Use in a Changing Climate
2:20	**C. Henderson - Optimal Use of Wildlife Monitoring Resources	S. Capoccia - Miners Gone Birdy! The Importance of Citizen Science and Speciation in Waterfowl Protection at the Berkeley Pit, Butte, Montana
2:40	D. Henry - Limited Permit Mule Deer Buck Hunting Restrictions in Eastern MT- Historical Information, Analysis, and Public Expectation of HD 652	M. Pearson - Adventure Scientists: Igniting the Outdoor Community to Collect Game-Changing Data
<b>3:00</b>	<b>BREAK</b> Moderator: Brett Dorak	<b>BREAK</b> Moderator: Megan O'Reilly
3:20	T. Paterson - Estimating Carnivore Density Using Spatial Capture-Recapture Models: Sampling Designs and Potential Pitfalls	**M. Levandowski - Complementing Visual Surveys with Wildlife Cameras for Long-term Wetland Monitoring
3:40	**M. Forzley - Annual Elk Calf Survival Following Increased Mountain Lion Harvest	**K. Loonam - Time-to-Event Density Estimation of Low Density Species with Remote Cameras
4:00	T. Paterson - An Improved Understanding of Population Dynamics using Count Data: Insights from Elk in Western Montana	**B. Tournabene - Effects of Contamination from Oil Extraction on Amphibian Abundance, Survival, and Size
4:20	K. Proffitt - Integrated Carnivore-Ungulate Management: a Case Study in West-Central Montana	M. Schertz - How Far Have They Slithered? Genetic Variation Among Garter Snakes in Western Montana
<b>4:40</b>	<b>ADJOURN</b>	<b>ADJOURN</b>

\*\* Student Presenter

## CONCURRENT SESSION SCHEDULES - CONTINUED

<b>Friday, March 1st</b>		
	<b>CONCURRENT SESSION A: CAPITOL ROOM</b>	<b>CONCURRENT SESSION B: STATE ROOM</b>
	<b>Moderator: Carly Lewis</b>	<b>Moderator: Ken Plourde</b>
8:20	M. Fyiling - Using GPS Technology on a Migratory Songbird to Determine Overwintering, Migration Route, and Connectivity	W. Wright - Estimating Occupancy and Activity of Montana Bat Species Prior to the Arrival of White-nose Syndrome
8:40	W. Blake - Motus: Developing the Intermountain West Collaborative	D. Bachen - Establishing range for Montana's rarest bat species: the Northern Myotis
9:00	J. Dullum - Example of Multi-Agency Data Management to Adaptively Manage Centennial Valley Arctic Grayling	B. Skone - Identification of Alternate Bat Hibernacula Outside of Caves and Mines in Eastern Montana
9:20	M. McTee - Free Lunch, May Contain Lead: Scavenging Shot Small Mammals	T. Ritter - Young and Restless: A Guide to Getting Your Own Colony as a Juvenile Beaver
9:40	K. Stone - Love Triangles Caught on Camera! Exposing the Intimate Relationships Between Hunters, Gut Piles, and Scavengers	H. Harris - Interpreting and Adapting Monitoring Efforts of a Reintroduced Population of Swift Fox in Northeastern Montana
<b>10:00</b>	<b>BREAK</b> <b>Moderator: Tabitha Graves</b>	<b>BREAK</b> <b>Moderator: Catherine Wightman</b>
10:20	H. Cooley - Grizzly Bear Recovery Update	A. Begley - Montana's State of the Bird (Monitoring)
10:40	J. Zelenak - The U.S. Fish and Wildlife Service Proposal to Delist the Canada Lynx	H. Specht - Assessing Occupancy for Montana Species of Greatest Inventory Need
11:00	M. Sawaya - Demographic Fragmentation of a Protected Wolverine Population Bisected by a Major Transportation Corridor	B. Maxell - Invasive and Pest Species Information at the Montana Natural Heritage Program
11:20	N. DeCesare - Phylogeography of a Range Edge Subspecies: Is There Such Thing as Shiras Moose?	E. Almberg - Chronic Wasting Disease in Montana
11:40	S. Mills - Elephant Friendly Tea: an Example of Wildlife Science-based Commercialization to Save an Endangered Species	J. Bailey - Mission of the Montana Wild Bison Restoration Coalition
<b>12:00</b>	<b>ADJOURN</b>	<b>ADJOURN</b>

# CONCURRENT SESSION AND POSTER ABSTRACTS

## Alphabetical by Presenter's Name

\*Indicates Presenter

\*\*Indicates Student Presentation

( ) Indicates Posters

### CHRONIC WASTING DISEASE IN MONTANA

Emily Almberg\*, Wildlife Health Program, Montana Fish, Wildlife, & Parks, Bozeman, MT  
John Thornburg, Wildlife Health Program, Montana Fish, Wildlife, & Parks, Bozeman, MT  
John Vore, Wildlife Division, Montana Fish, Wildlife, & Parks, Helena, MT  
Jennifer Ramsey, Wildlife Health Program, Montana Fish, Wildlife, & Parks, Bozeman, MT  
Keri Carson, Wildlife Health Program, Montana Fish, Wildlife, & Parks, Bozeman, MT  
Justin Gude, Research and Technical Services, Montana Fish, Wildlife, & Parks, Helena, MT

In the fall of 2018, Montana Fish Wildlife and Parks (MFWP) conducted monitoring and surveillance for chronic wasting disease (CWD) along the northern Hi-Line, around Philipsburg, and south of Billings, MT. MFWP detected 26 new cases of CWD from over 1941 samples tested from mule deer, white-tailed deer, elk, and moose. Of the new detections, 21 were along the Hi-Line in every county from Liberty County east to the North Dakota border, and 5 were detected within the CWD-positive area south of Billings. Prevalence of CWD in the northern CWD-positive hunt districts on the Hi-Line averaged 2% (95% CI: 1-3%) in mule deer, and 1% (95% CI: 0-3%) in white-tailed deer. South of Billings, CWD prevalence was estimated to be 2% (95% CI: 1-3%) in mule deer and 1% (95% CI: 0-3%) in white-tailed deer. Prevalence varied across hunt districts within the CWD positive areas; for example, among neighboring hunt districts south of Billings, CWD prevalence in mule deer ranged from <1% (95% CI: 0-3%, HD 502) to 6% (95% CI: 3-12%, HD 510). MFWP continues to plan for long-term CWD management in positive areas. In 2019, MFWP will consolidate "CWD positive areas" and "Transport Restriction Zones" into the single moniker "CWD Management Zones," and the southern portion of MFWP Region 7 will be included in the southern CWD Management Zone in anticipation of finding CWD positive cervids in that area. CWD surveillance/monitoring during fall 2019 will be focused in southeastern MT, around Philipsburg, and along the Hi-Line.

### ESTABLISHING RANGE FOR MONTANA'S RAREST BAT SPECIES: THE NORTHERN MYOTIS

Dan Bachen\*, Zoology, Montana Natural Heritage Program, Helena, MT  
Braden Burkholder, Information Systems and Services, MT Natural Heritage Program, Helena, MT  
Heather Harris, Wildlife Division, Montana Fish, Wildlife & Parks, Glasgow, MT  
Mike McGrath, Ecological Services, US Fish and Wildlife Service, Helena, MT  
Brandi Skone, Wildlife Division, Montana Fish, Wildlife & Parks, Miles City, MT

In 1978 a single Northern Myotis (*Myotis septentrionalis*) was found overwintering in a coal mine along the lower Missouri River. For 38 years this was the only confirmed detection of the species within the state. In response to population declines caused by White-Nose Syndrome across the eastern and central US, the species was listed as threatened by the US Fish and Wildlife Service in 2015. To better understand the species distribution within Montana, we began targeted surveys in 2015 using mist nets along the Missouri, Yellowstone, Tongue, Powder, and Little Missouri rivers and forested areas in southeastern Montana. Through August 2018, we have conducted 55 surveys and

captured 20 individuals at seven sites, expanding the known range to include forests along the Missouri and Yellowstone rivers upstream from the North Dakota border to Poplar and Glendive. Initial surveys following established protocols where nets are placed over water to capture drinking animals captured few Northern Myotis. To increase efficacy, we developed a novel technique targeting flyways within forested areas, which increased capture success at new and previously surveyed sites. Using this capture data, we predicted suitable habitat within and outside of known range with a presence-only model implemented in Maxent. The model indicates moderate to highly suitable habitat exists along the Missouri river upstream of the current known range. Future surveys should target these areas, as well as areas lacking survey effort adjacent to known populations in Wyoming to delineate the species range within the state.

## **MISSION OF THE MONTANA WILD BISON RESTORATION COALITION**

James A. Bailey\*, Coordinator, Montana Wild Bison Restoration Coalition, Belgrade, MT

Domestication is the major threat to persistence of wild plains bison on native range in the USA. It is the opposite of wild. For Montana bison, there is a legal definition and a biological definition of “wild”. But there are no wild bison, year-round in Montana. Although Olaus Murie recommended bison restoration in eastern Montana in 1937, the state has been unable to establish a public, wild herd. The landscape on and near the Charles M. Russell (CMR) National Wildlife Refuge is the best location for restoring wild plains bison in the USA. The Montana Wild Bison Restoration Coalition is formed to disseminate information on issues and opportunities for bison restoration in Montana and to promote bison on and near the CMR Refuge (see [mtwildbison.org](http://mtwildbison.org)). The Coalition supports at least 1,000 bison on at least 100 square miles of diverse habitat.

## **MONTANA’S STATE OF THE BIRD (MONITORING)**

Allison J Puchniak Begley\*, Wildlife Division, Montana Fish, Wildlife & Parks, Helena, MT  
Lauri Hanauska-Brown, Wildlife Division, Montana Fish, Wildlife & Parks, Helena, MT

The State of Montana has a long history of monitoring birds and has some of the most robust data on life history, status and trend. However, inventory and monitoring of some species remains challenging with current methodologies. There are 433 bird species in the state with 283 documented breeders, and 233 overwintering residents. Broad-scale landbird monitoring, species or taxa specific surveys and local assessments have all been used to provide a picture of the status of each bird species in the state and inform conservation of sensitive species. Montana Fish, Wildlife & Parks is currently reviewing available avian trend, density and occupancy data from broad-scale monitoring programs such as the USGS Breeding Bird Survey (BBS) and Integrated Monitoring in Bird Conservation Regions (IMBCR). BBS provides long-term trend data and IMBCR provides information on population density and species occupancy estimates. Individualized surveys provide increased focus on species of concern or those species or habitats that are underrepresented or inadequately surveyed by large-scale programs. These monitoring programs vary in their ability to provide information necessary for status assessments across species due to difficulties accessing some areas and habitats at biologically relevant time periods and detecting cryptic or rare species. By reviewing these data and incorporating known status and habitat types provided by the Montana Natural Heritage Program, FWP plans to highlight the status of bird species of interest and outline needs for monitoring in the state. Given the different products and methodologies, this summary will also serve to recognize the combined value of these programs, as each program provides different types of biological information to resource managers.

## **\*\* LURE EFFECTIVENESS IN DETECTING SMALL MAMMALS, SPECIFICALLY THE NORTHERN BOG LEMMING, ON TRAIL CAMERAS (POSTER)**

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Fens and bogs are unique wetlands that support a diversity of small mammals and other rare species. One such species is the northern bog lemming (*Synaptomys borealis*). This species is being considered for listing under the Endangered Species Act so determining their presence is helpful for management. Northern bog lemmings are difficult to trap and when they are caught, experience high mortality rates. Since they are so hard to capture and study, it is difficult to determine presence/absence of this species. This study used a non-invasive trail camera method to detect northern bog lemmings in Finley Fen and Meadow Creek in western Montana. We tested six different types of lure/scent to see if any had better detection rates than muskrat lure which is often used in small mammal studies but is not always readily available and is expensive. The six lures tested were; muskrat lure as the control, almond extract, vanilla extract, strawberry extract, clove oil, and lemongrass oil. Cameras were placed in both fen sites for approximately three weeks and were checked every week. Under each remote camera we placed 6 by 6-inch pieces of plywood with a metric ruler on the sides of the board for size reference. During each check boards received new scent and cameras new memory cards. During the last check before the cameras were removed, the boards were switched between camera sets so that each camera had approximately one week with a different lure under it. Preliminary results suggest that the muskrat lure still produced more photos of small mammals over the time period the cameras were deployed, followed closely in Finley fen by almond extract and strawberry extract. Northern bog lemmings were confirmed in 7 different pictures in Finley Fen, two of which were on almond extract boards. Bog lemmings weren't detected in Meadow creek, although it was a known bog lemming site as one was trapped there in 1992. The small detection rate for northern bog lemmings indicated that a larger sample size may be needed, or other lure types tested to definitively detect northern bog lemmings in a survey.

## **\*\* DAILY AND SEASONAL SPACE USE AND HABITAT SELECTION OF GREATER SAGE-GROUSE IN CARBON COUNTY, MONTANA (POSTER)**

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Greater sage-grouse (*Centrocercus urophasianus*; hereafter 'sage-grouse') are the focus of much research and conservation efforts owing to their obligate relationship with sagebrush (*Artemisia* spp.) and dramatic population declines over the last 50 years. Research suggests female survival, followed by chick, then nest survival, have the greatest impact on population growth, and to sustain sage-grouse populations, focus should be on increasing these vital rates. In addition, recent research has shown habitat partitioning occurs between broodless (i.e., females without a brood) and brood-rearing females such that broodless females have lower mortality risk than females with chicks. Moreover, greater nest attentiveness and incubation constancy can increase nest success. Our study was initiated in spring 2018 in Carbon County, Montana to identify seasonal habitat use and address the most important parameters influencing population growth. Our first objective, to aid the Bureau of Land Management in maintaining sustainable sage-grouse populations on public lands, will focus

on natural and anthropogenic landscape features influencing habitat selection during nesting, brood-rearing, summer, and winter life stages. Our second objective is to compare landscape and microhabitat characteristics between brood-rearing and broodless females. Our third objective is to examine nest attentiveness and microhabitat selected during incubation recesses. We captured 39 adult and yearling females in spring 2018 at 6 leks, attached solar-powered, rump-mounted transmitters and monitored 40 nests and 17 broods. In summer 2018, we measured vegetation characteristics (e.g., shrub, grass, and forb cover) at 133 grouse-use and 108 random locations for nests, incubation recesses, and brood and broodless females. Understanding female sage-grouse habitat use during all life stages will aid in directing management on public lands to conserve populations and increase population growth.

### **MOTUS: DEVELOPING THE INTERMOUNTAIN WEST COLLABORATIVE**

William Blake\*, Avian Science, MPG Ranch, Florence, MT

Kate Stone, Avian Science, MPG Ranch, Florence, MT

Migration is essential to thousands of species throughout most animal groups. Yet, we still do not know the migration strategies in most species, including winter grounds, migration patterns, and stopover sites. While larger wildlife performs well with tracking devices, most migratory wildlife is too small. The Motus Wildlife Tracking Network helps to fill that void by using small transmitters called nanotags and coordinating the placement of automated receiving units. Researchers deploy nanotags that operate on a single VHF frequency, but with different signal bursts allowing identification of individual organisms. Motus stations then detect the signals in the field, and data are uploaded and shared with collaborators. This community approach to science allows small organisms to be tracked long distances as they pass multiple Motus stations. The Motus network is most active in eastern North America, but also extends to wintering grounds of many western migratory species. In 2018, MPG Ranch established the Intermountain West Collaborative Motus project in the Bitterroot Valley, MT. We are currently expanding the network to gain coverage in more of western Montana and Idaho. We have worked with partners to deploy nanotags on Gray Catbirds and several bat species and will expand nanotag work in 2019. Already, we have detected one of our catbirds at a station in Texas. We hope this talk will encourage a dialogue with Montana researchers about potential sites for Motus stations and how they might deploy nanotags to make use of the network.

### **AVIAN RESPONSE TO OLD-GROWTH MAINTENANCE LOGGING IN THE SWAN RIVER STATE FOREST**

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Ross Baty, Forest Management Bureau, MT Dept of Natural Resources and Conservation, Missoula, MT

Logging in old-growth forests and how to maintain this age class on the landscape have long been concerns in the northwestern United States. Old-growth maintenance silvicultural treatment is a tool the Montana Department of Natural Resources and Conservation (DNRC) implements to retain old-growth attributes, remove encroaching shade-tolerant trees, and create small canopy gaps. Our objectives were to examine how these treatments effect avian diversity and density of associated bird species. We used a Before-After/Control-Impact Pairs (BACIP) study design and paired old-growth stands proposed for harvest (treatment) with untreated stands (control) based on habitat similarity. Vegetation was also measured in study stands. Logging created small openings, reduced basal area by 40%, and reduced overstory canopy cover by 31%. No large changes in bird species composition or diversity were detected. However, relative densities of evening grosbeaks (*Coccothraustes vespertinus*) ( $P=0.03$ ) and golden-crowned kinglets (*Regulus satrapa*) ( $P=0.09$ ) decreased significantly following harvest, while pileated woodpecker (*Drycopus pileatus*) ( $P=0.07$ ) and dark-eyed junco (*Junco*

*hyemalis*) ( $P=0.06$ ) densities increased significantly. Removal of insect-infested trees likely displaced evening grosbeaks and golden-crowned kinglets, while new openings and added logging slash likely attracted dark-eyed juncos and pileated woodpeckers. Old-growth associated birds continued to occupy treatment stands with some species increasing in density and others decreasing under the landscape conditions we observed. We did not evaluate avian survival or reproductive success, which would provide beneficial metrics for further interpretation of results.

## **ESTIMATING NATAL ORIGINS OF JUVENILE NORTHERN GOSHAWKS USING STABLE HYDROGEN ISOTOPES**

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Robert Domenech, Raptor View Research Institute, Missoula, MT  
Adam Shreading, Raptor View Research Institute, Missoula, MT

From 2004 to 2007, we collected hatch-year feathers from 44 juvenile Northern Goshawks (*Accipiter gentilis*) captured at our Rocky Mountain Front banding station near Lincoln, Montana. Due to the relative scarcity and secretive nature of goshawks, little is understood about their migration patterns or the geographic origins of birds encountered at raptor migration count and banding sites. Most studies suggest goshawks are partial migrants, often moving <100km, but select band returns and radio and satellite telemetry have shown that some individuals occasionally travel thousands of kilometers. We performed a stable hydrogen isotope analysis on the feathers we collected from young goshawks to determine their predicted natal origin. We found that 69% of goshawks had predicted natal origins relatively close to our capture site, 24% from areas in northwestern Canada and eastern Alaska, and 7% somewhere significantly south, east or west of our capture site. We did not find any significant patterns with sex and passage date or latitudinal origin, nor did we find a meaningful relationship between latitudinal origin and passage date. Our findings support the current understandings of goshawk migration and dispersal, with most individuals traveling short distances from their natal grounds and a few outliers traveling great distances, not always in a southerly direction.

## **\*\* SWAINSON'S THRUSH STOPOVER HABITAT IN THE BITTERROOT VALLEY (POSTER)**

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Vanessa Haflich, Teacher, Florence-Carlton High School, Florence, MT  
Kate Stone, Avian Science, MPG Ranch, Florence, MT

The migratory songbird Swainson's thrush (*Catharus ustulatus*) is a common breeding songbird across North America. We think their populations are in decline due to habitat loss. During fall migration, they travel in large numbers through the Bitterroot Valley. We wanted to study the stopover habitats they use at this time. We used acoustic data from 2017, collected by an autonomous recording unit, at 16 recording stations placed throughout the Bitterroot Valley. The dates ranged from the second week of July to the first week in October. These stations recorded the Nocturnal Flight Calls (NFCs) of songbird migrants, including the Swainson's Thrush. We looked at Swainson's Thrush NFCs that occurred sixty minutes before sunrise because calls given at this time might indicate that birds were close to landing and stopping over. We used Google Maps to assess the features and vegetation near each station that would offer the habitat we deemed important for migrating birds. We found two sites that had higher Swainson's Thrush calls than other sites: one site north of Darby near the Bitterroot River, and one in the mountains northwest of Florence. These two settings are very similar because they are both located at approximately 3,800 feet, which could indicate an ideal elevation for migration. Additionally, both sites have heavy coniferous forest cover, an important habitat characteristic for Swainson's Thrush. There is not much research available regarding stopover habitat

of the Swainson's thrush specifically in Montana. Through this research, we hope to better determine what sites are important to the Swainson's thrush and hopefully be able to preserve said sites to aid the bird in their annual migration.

## **MINERS GONE BIRDY! THE IMPORTANCE OF CITIZEN SCIENCE AND SPECIATION IN WATERFOWL PROTECTION AT THE BERKELEY PIT, BUTTE, MONTANA**

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Gary Swant, GoBirdMontana, Deer Lodge, MT

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This work demonstrates how citizen science is improving the waterfowl protection plan at the Berkeley Pit. On November 28th, 2016, tens of thousands of Snow and Ross's geese (*Chen caerulescens* and *Chen rossii*) landed on the Pit during their migration south; roughly 3000 died during the event. The occurrence initiated a change in the waterfowl protection plan at the Pit. For the 20 years prior, avian monitoring took place multiple times per day and mitigation action occurred for every bird observed on the Pit water. Records were taken on bird type, numbers, time of day, and hazing action. Little was known about species, activity patterns, and variation in seasonality which made it challenging to understand the complexities of mitigation actions. In 2017, we trained the mining personnel to identify the waterfowl known to the region so new records include species and sometimes sex and age class. We now have a growing body of data that shows species and corresponding differences in bird activity. We are using these data to understand how these differences vary in fall versus spring migrations and how to match mitigation and bird type. This undertaking exemplifies how utilizing citizen science improves protection efforts. The importance of this initiative is supported by research by Belt and Krausman (2012) who emphasize that well-trained citizens - in this case, miners - generate data and results on par with scientists. Ultimately, we demonstrate how the use of citizen science will result in improved strategies for waterfowl protection at the Berkeley Pit.

## **CONSERVATION DESIGN AND DECISION SUPPORT IN THE NORTHERN GREAT PLAINS JOINT VENTURE (POSTER)**

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Kevin Ellison, Northern Great Plains Program, World Wildlife Fund, Bozeman, MT

The Northern Great Plains Joint Venture (NGPJV) covers portions of four states, including 22 counties in eastern Montana. This geography contains some of the most intact, contiguous grassland habitat on the continent, comprising more than 75% of the landscape. It also supports a high diversity of grassland obligate bird species, several of which have seen population declines of 75-90% over the past 50 years. The NGPJV partnership is focused on addressing these declines through the maintenance and management of intact prairie habitats, especially on private working lands. We have developed conservation design and decision support tools to inform voluntary and incentive-based (e.g. Farm Bill) programs and practices, through our Conservation Delivery Network of private lands biologists. Our Conservation Guidance Directory database uses the "plowprint" analysis developed by World Wildlife Fund as a measure of net landscape change (conversion to cropland); using these data in conjunction with soil classes defines both threat and conservation opportunity for each of the counties in the NGPJV. We are then using priority grassland species models (Baird's Sparrow, Chestnut-collared and McCown's Longspurs, Lark Bunting and Sprague's Pipit) to set spatial priorities

for habitat restoration, enhancement and protection in a local and regional context. "Conservation Road Show" events at 26 Montana Conservation District offices are helping us address local concerns as we provide technical and financial assistance to our partners. We are using the tool to direct conservation grant money and will be building a web platform to broaden its use in 2019 and beyond.

## **GRIZZLY BEAR RECOVERY AND DELISTING: PROGRESS REPORT**

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The USFWS listed grizzly bears as a Threatened species in the lower-48 States in 1975 and subsequently designated six recovery zones. Due to the success of conservation efforts and collaboration among a variety of stakeholders, two of these populations (Greater Yellowstone Ecosystem, Northern Continental Divide Ecosystem) have achieved recovery goals and the USFWS is working towards delisting. Conservation success, however, brings significant management challenges as both populations are expanding into human-dominated landscapes. We review population status, management issues, and litigation challenges. We also present updates on recovery and management in the small Cabinet-Yaak and Selkirk Ecosystems and the currently unoccupied North Cascades and Bitterroot Ecosystems.

## **\*\* WEASELY RECOGNIZED OR STOATALLY CAMOUFLAGED: QUANTIFYING COAT COLOR OF A CRYPTIC PREDATOR**

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At least 21 species of birds and mammals across the globe undergo seasonal changes in coloration, molting white in winter to match snow cover to reduce predation risk from visually hunting predators. As snow duration decreases, animals in white winter coats become more conspicuous against snowless ground. For example, camouflage mismatched snowshoe hares (*Lepus americanus*) suffer increased mortality compared to camouflaged hares. Yet, the generality of this climate-induced camouflage mismatch across species is unknown. Given the adaptive value of seasonal camouflage against local snow duration, we hypothesize that sympatric color molting species would show convergent coat color phenology. Therefore, we documented coat color phenology of three sympatric coat color changing species in Montana; short-tailed weasels (*Mustela erminea*), long-tailed weasels (*Mustela frenata*), and snowshoe hares. We used a non-invasive sampling framework consisting of remote cameras and bait tubes to quantify coat color phenology for all 3 species, including molt initiation, rate, and completion. Over a 2-year period we deployed >50 remote cameras over >6000 trap nights. We detected >3000 photographic hare events and >1000 photographic weasel events. Although we are currently completing our analysis it appears that there may be phenology differences between hares and weasels. We conclude that camera trapping is a useful tool for quantifying phenology of sympatric coat color changing species, contributing to the growing knowledge base to determine the potential scope for evolutionary rescue to climate change in wildlife populations.

## PHYLOGEOGRAPHY OF A RANGE EDGE SUBSPECIES: IS THERE SUCH THING AS SHIRAS MOOSE?

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The taxonomic designation of subspecies has implications for species conservation, yet subspecies definitions suffer from inconsistencies across taxa and time. We used mitochondrial genomics (mtDNA), nuclear microsatellite DNA, and fossil record data to evaluate a poorly studied subspecies of moose, *Alces alces shirasi*, at the southern range edge. We sequenced the complete mitochondrial genome (16,206 base pairs; N=60 moose) and genotyped 13 nuclear microsatellites (N=253) for moose across 10 states and provinces of western North America. We also reviewed the fossil record for all North American cervids to comparatively assess evidence of a southern refugium corresponding to *A. a. shirasi* during Pleistocene glacial cycles. Analysis of mtDNA did not support a distinct clade of moose corresponding to *A. a. shirasi*, and mitogenomic haplotypes did not distinguish individuals among subspecies. Analysis of nuclear microsatellites did show support for a southern cluster of related moose within the range of *A. a. shirasi*, yet these results reflect recent, not deep, divergence and may be confounded by a significant effect of distance on gene flow across this region. Review of the fossil record failed to provide evidence of moose south of the Wisconsin ice age glacier >15,000 years ago. We found multiple lines of evidence that contradict the delineation of *A. a. shirasi*, yet, to be fair, the question asked in our title cannot be fully answered by neutral genetic markers alone. Complementary analyses of phenotype data, such as morphometrics originally used to delineate moose subspecies, are also necessary for definitive assessment of subspecies designations.

## EATING THEIR GREENS: RELATIONSHIPS OF NDVI WITH ELK FORAGE AND NUTRITIONAL CONDITION

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The distribution and availability of nutritional resources strongly influence elk (*Cervus canadensis*) movements and behaviors and are important for females to meet nutritional requirements of lactation, mass gain, and pregnancy. Past studies demonstrated that elk during the summer select strongly for areas with high values of the Normalized Difference Vegetation Index (NDVI), a remotely-sensed indicator of net primary productivity. There is, however, considerable uncertainty regarding relationships between NDVI, forage availability and quality, and elk nutrition. To fill these knowledge gaps and provide recommendations for managing elk habitat in western Montana, we evaluated the

relationships of NDVI with ground-sampled vegetation and nutritional condition measurements from elk in 4 populations (Elkhorn, North Sapphire, and East Fork and West Fork of the Bitterroot). We sampled 510 vegetation plots in summer and 172 elk in fall and winter during 2011-2017. We found some evidence that NDVI was associated with forage quality, forage abundance, and body fat, but not with pregnancy. These results indicate that managing areas for greater levels of NDVI may increase the availability of summer forage and improve the ability of elk to gain body fat; however, NDVI alone is insufficient to fully characterize summer forage. We suggest that combining forest management treatments on public lands with other strategies, such as restricting availability of high-quality forage on private lands, increasing hunter access on private lands, or altering harvest regulations, may provide a more holistic approach to encouraging elk to remain on public lands during the summer and hunting seasons.

### **\*\* EFFECT OF WILDFIRE SMOKE ON NOCTURNAL BIRD MIGRATION (POSTER)**

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Many migratory songbirds travel at night, producing unique nocturnal flight calls (NFCs) for orientation and communication with other individuals. During the fall of 2017, western Montana experienced many wildfires. Preliminary data suggested smoke density may influence bird migration, either by causing more communication from lack of visibility or a decrease in calls due to harmful anatomical effects. The relationship between smoke and NFCs at two locations in western Montana was studied. NFCs were recorded using autonomous recording units placed at Florence-Carlton High School (FCHS) and east Lolo. Total NFCs were quantified for all species as well as a few individual species: Swainson's Thrush, Savannah Sparrow, Chipping Sparrow, and Wilson's Warbler. Smoke density data was obtained from the Montana Department of Environmental Quality (MT DEQ) in the respective towns. To look at the relationship between smoke and bird activity, Spearman's correlation tests and general linear models that included air quality, time, and location variables to predict the number of NFCs for all birds and individual species were constructed. These variables were analyzed at both nightly and hourly time scales. However, analyses supported only a weak relationship between NFCs and air quality. While analyzing the data differently may result in stronger correlations, it is likely these migration patterns are most influenced by other factors, as smoke may only temporarily alter migration activity. By comparing the frequency of NFCs with smoke density across multiple seasons and locations, a better understanding of the impact wildfire smoke has on migration is hoped to be gained.

### **EXAMPLE OF MULTI-AGENCY DATA MANAGEMENT TO ADAPTIVELY MANAGE CENTENNIAL VALLEY ARCTIC GRAYLING**

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Montana Arctic grayling declined to about 4% of their perceived historic distribution by the 1990s, which led to formal consideration for listing under the Endangered Species Act. Over the past 70 years numerous hypotheses were posited regarding drivers of the grayling population, including 1) reduction and alteration of spawning habitat, 2) predation by, and competition with, non-native fishes, and 3) limited winter habitat. A multi-agency adaptive management project was initiated to elucidate the relative effect of hypothesized drivers of grayling abundance to direct future

management of this population. Data are considered a trust resource. If data are not organized, maintained and accessible, the status, trends, and processes over temporal and spatial scales cannot be addressed. Data are collected by the US Fish & Wildlife Service (USFWS) and Montana Fish, Wildlife & Parks (FWP) and each agency manages it differently. These data include netting, trapping, electrofishing, stream temperature, fish demographics, tagging, spawning habitat, overwintering, beaver dams, and angler harvest data on hybrid cutthroat. FWP Fish Information System (FIS) is a centralized database, commonly referred to as “Godzilla”, which houses most fish data for FWP. USFWS does not have a centralized database system but data are entered into relational databases and stored on local servers. The Centennial Valley Arctic grayling database was created to house similarly formatted data from Godzilla and USFWS. The collation of data presented unique challenges. Data are assembled and fed into the models annually, *biases are slowly disappearing*, and the grayling population is being adaptively managed.

**\*\* RESEARCH IN PROGRESS: ASSESSING THE IMPACT OF INCREASING WOLF AND GRIZZLY BEAR POPULATIONS ON THE HABITAT SELECTION AND FORAGING PATTERNS OF COUGARS IN THE SOUTHERN GREATER YELLOWSTONE ECOSYSTEM (SGYE) (POSTER)**

Jennifer A. Feltner\*, Wildlife Biology Program, University of Montana, Missoula, MT

Since the early 2000’s, recovering wolf and grizzly bear populations in the SGYE north of Jackson, Wyoming have been reviving long absent competitive interactions amongst species of the large carnivore guild, potentially leading to behavioral shifts by subordinates such as cougars that can have population and community-level consequences. Research efforts are needed to clarify the responses of cougars following wolf and grizzly bear recovery and resultant impacts to prey populations. In the SGYE, management and monitoring of large mammals is complex. Multiple federal and state agencies, as well as non-profit organizations collect data and conduct research on these species, and anthropogenic impacts ranging from hunting to recreation to supplemental feeding of elk also play strong roles in the system. However, datasets on the populations, movements and food habits of wolves, cougars, and grizzly bears, as well as their primary prey, elk, from 2001 to the present exist. The aim of this study is to assess the impact of competition from recovering wolves and grizzly bears on cougars by investigating key factors driving cougar habitat selection and foraging patterns, including prey availability, risk of dominant competitor encounter, human activities and other environmental factors. Sixteen years of location data from cougars, wolves, grizzly bears and elk and predation data from cougars shared by my collaborators are currently being analyzed for this study. This project will advance understanding of how competition shapes the behavior of cougars, highlighting potential fitness impacts to cougars and subsequent behavioral shifts that could in turn impact prey species.

**\*\* ANNUAL ELK CALF SURVIVAL FOLLOWING INCREASED MOUNTAIN LION HARVEST**

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From 2011 to 2014, we evaluated the factors driving the survival and recruitment of elk calves in the upper Bitterroot Valley of Montana. After three years, we identified mountain lions as a major source

of elk calf mortality and determined that increasing elk calf survival in the southern Bitterroot might have positive effects on elk abundance and recruitment in the area. In 2012, wildlife managers increased harvest opportunity for mountain lions in the study area, which resulted in increased harvest of both male and female mountain lions. To evaluate possible changes in calf survival and cause-specific mortality several years after increased opportunity for mountain lion harvest ended, we monitored 248 elk calves via radio telemetry from 2016-2018 in the study area to determine the timing and cause of death. We estimated period-specific rates of seasonal mortality and cause-specific mortality using data collected prior to (n = 202), during (n = 84), and after (n = 248) increased mountain lion harvest opportunity. Estimated calf survival rates will be compared among the 3 periods of mountain lion harvest opportunity in the upper Bitterroot study area. Possible changes in rates of cause-specific mortality will also be compared among the periods. We will also present the results of an evaluation of the associations between calf survival and (1) spatiotemporal covariates and (2) characteristics of individual calves.

### **USING GPS TECHNOLOGY ON A MIGRATORY SONGBIRD TO DETERMINE OVERWINTERING, MIGRATION ROUTE, AND CONNECTIVITY**

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Kate Stone, Avian Science, MPG Ranch, Florence, MT

Little is known about the connectivity of migratory songbirds in part because mark-recapture methods result in few observations. With rapidly improving technology, tracking devices are becoming more relevant for small animals. We studied migration ecology of Gray Catbirds (*Dumetella carolinensis*) that breed in the Intermountain West. We retrieved 6 geolocator units and, more recently, 12 GPS pinpoint tags that provide information on overwintering location, migration route, and timing of arrival and departure. Our results indicate that catbirds winter in northeastern Mexico and those locations appear to be distinct from wintering locations of eastern Gray Catbird populations. Additionally, our results show that catbirds may have a “second migration” in the spring, moving further south in Mexico at a time when we would expect them to return northward.

### **\*\* SUGAR CONTENT AS A DRIVER OF RESOURCE PARTITIONING BETWEEN FORAGING BEARS AND TRIBAL HARVEST OF HUCKLEBERRIES ON THE FLATHEAD INDIAN RESERVATION**

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Huckleberries (*Vaccinium spp.*) facilitate important ecological relationships for Native Americans within the Flathead Indian Reservation of Montana and throughout the Pacific Northwest. Huckleberries provide cultural resources such as traditional foods and customs, social elements and economic products. Huckleberries are also an important food source for bears, another culturally important animal for the Confederated Salish and Kootenai Tribes (CSKT) along with many other Native American Tribes. Phenological data on huckleberries is extremely limited. The opportunity for traditional ecological knowledge (TEK) to be utilized to expand knowledge was a key focus for this project. To gain a better understanding of the role that huckleberries play in cultural and ecological networks, ecological characteristics of huckleberries across a range of habitats on the reservation were examined in addition to interviews with enrolled tribal members and tribal elders about historic and modern use of huckleberries. Recorded phenology data at 10 sites at different elevations across the reservation was used to develop a baseline understanding of the time of flowering and berry production. We evaluated the relationship between site productivity of huckleberries and sugar

content (measured in brix%) of berries at peak ripeness and compared those metrics with bear use, measured by the amount of bear sign at each site. Bear sign was most prevalent at the more remote locations with higher brix% ( $R^2=0.82$ ,  $p=0.012$ ) and plentiful berries. Finally, community interviews were conducted with adult tribal members about the importance of huckleberries for the tribal community and the people's understanding of the niche bears maintain concerning huckleberries. This research contributes to collaborative studies in Northwest Montana focusing on huckleberries as a food source for bears in the face of climate change, as well as supporting CSKT in asserting traditional food sovereignty.

## **USING UAVs, INFRARED CAMERAS, AND MACHINE LEARNING TO COUNT GREATER SAGE-GROUSE**

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UAVs have the potential to increase data quality and improve efficiency of wildlife monitoring. However, little information exists on how data collected from UAVs compares to traditional visual based surveys. Here we deployed a UAV autonomously over Greater Sage-grouse (*Centrocercus urophasianus*) leks in Phillips County, Montana to compare traditional field-based lek counts to manual and automated UAV video counts. We conducted 28 paired observations of sage-grouse using traditional visual methods and UAV mounted thermal infrared video. For analysis, we manually counted the sage-grouse in the videos, comparing counts of a trained and untrained observer. We completed field counts before each flight to compare counting methods. Results of our analysis show good agreement between trained and untrained observer manual video counts but less agreement between manual video counts and standard field counts. Next, we built an algorithm to identify, track, count, and size the sage-grouse from the videos. While the algorithm worked exceptionally well tracking and counting, more refinement is necessary to detect all the sage-grouse. The algorithm was also able to detect a size difference between birds which could signify males versus females. However, methods would have to be developed to validate the size difference detected. Overall, our results show that drones in combination with autonomous methods show enormous potential for counting sage-grouse. Furthermore, counting sage-grouse in the spring is difficult and inconsistent given field conditions. UAVs are tools that can help us overcome tough field conditions and give us visual access to otherwise inaccessible leks.

## **INTERPRETING AND ADAPTING MONITORING EFFORTS OF A REINTRODUCED POPULATION OF SWIFT FOX IN NORTHEASTERN MONTANA**

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Swift fox (*Vulpes velox*) were designated extirpated in Montana in 1969. However, reintroductions initiated in Canada from 1983-1997, reestablished a self-sustaining population in southern Alberta and Saskatchewan and northeastern Montana. Swift foxes are listed as a threatened species in Canada. In Montana, at the northern edge of the species range, swift fox are considered a furbearer, with a limited harvest and a Species of Concern level 3, potentially at risk but abundant in some areas. The swift fox population in Canada and Montana is interdependent and therefore it is important for agencies to collaborate on monitoring efforts that are measured against management and/or recovery goals which may differ across jurisdictional and international boundaries. Four international

population surveys have been conducted on the Canada/northeast Montana population in 2000/01, 2005/06, 2014/15, and 2018. Monitoring abundance and distribution of swift fox are key components of the Montana Swift Fox Conservation Strategy. Swift fox are elusive and nocturnal, therefore, conducting surveys for the species is both difficult and expensive. Monitoring data are derived from international population surveys, from harvested fox and anecdotal observations. We will review and compare results of each international survey which has advanced our knowledge of this reintroduced population and has helped guide management of swift fox in northeastern Montana.

## **\*\* PRELIMINARY RESULTS ON THE DRIVERS OF MOOSE CALVING SUCCESS AND THE IMPACTS OF MOUNTAIN PINE BEETLE EPIDEMICS ON RESOURCE SELECTION**

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Understanding factors that influence moose (*Alces alces*) calving success and habitat selection are fundamental to the effective conservation and management of the species. The two primary objectives of this study are to evaluate the effects of willow nutrition on calving success of moose and the effect of mountain pine beetle (*Dendroctonus ponderosae*) epidemics on moose habitat selection and movement. Preliminary research by Colorado Parks and Wildlife has identified differences in calving success between two spatially proximate moose populations with similar geographic and biotic features. As moose diet in this geographic area has been well documented and a majority is comprised of willow (*Salix spp.*), we investigate the degree to which differences in willow forage quality explain differences in calving success. Both moose populations in our study are surrounded by forests that have been impacted by mountain pine beetles. These epidemics affect forest structure and the availability of thermal cover; however, the impact on wildlife is poorly understood. Thermal cover is thought to be especially important for moose in Colorado at the southern extent of their range. This suggests that moose will display stronger selection against impacted areas in this geographic region. We present a preliminary analysis of moose habitat use and predictions of habitat selection based on the date of mountain pine beetle impact.

## **\*\* HABITAT SELECTION, SPACE USE, AND DEMOGRAPHY OF GREATER SAGE-GROUSE IN NORTH-CENTRAL, MONTANA (POSTER)**

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The greater sage-grouse is a sentinel species of sagebrush ecosystems and requires large tracts of intact habitat. Despite the 2015 not warranted for listing decision by the U.S. Fish and Wildlife Service, the sage-grouse is still considered a species of conservation concern. Critical to the not warranted decision is the ongoing development of state-level habitat strategies and sage-grouse focused federal land management plans; both of which require the identification of important seasonal habitats. Recently, federal agencies have identified information gaps associated with sage-grouse habitats in the North-central Sagebrush Focal Area, an important sage-grouse core area in Valley County, MT. In 2018, we began a 3-year study of sage-grouse space use and demography in this area to identify important seasonal habitats in the region. Our primary objectives are to 1) identify conditions

influencing seasonal habitat use, 2) evaluate movements and seasonal migration patterns, and 3) evaluate demographic associations with biotic and abiotic habitat conditions and disease risk. During April-May 2018, we captured 45 female sage-grouse and outfitted them with global positioning system (GPS) platform transmitting terminals (PTTs). The transmitters allow us to gather resolute information pertaining to fecundity, female survival, and space use, in relation to seasonal habitat conditions measured both remotely and in the field. We will present preliminary results on demography and space use from our first season.

## **LIMITED PERMIT MULE DEER BUCK HUNTING RESTRICTIONS IN EASTERN MT- HISTORICAL INFORMATION, ANALYSIS AND PUBLIC EXPECTATION OF HUNTING DISTRICT 652**

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Hunting District 652 is a limited permit mule deer buck only area, found along the east side of Fort Peck Lake in FWP Administrative Region 6. The district was initially established in 1987 to meet public desire to produce “more and bigger mule deer bucks”. Population and harvest objectives were established within the Mule Deer Adaptive Harvest Management (2001) guidelines. Mule deer demographics in this district are monitored annually through post-season aerial survey methods. Hunting and harvest metrics are monitored through an annual survey of successful permit applicants via a mailed questionnaire, along with request for a front incisor for cementum age analysis. We reviewed these data to assess whether management objectives set for HD 652 are being met for buck:doe ratios, density of deer and age structure of harvested bucks. These data were compared to similar mule deer buck data from other general hunting season districts collected at the Havre Check Station. During most years since its inception, management objectives set forth for hunting district 652 are met. The general deer season structure is also producing similar metrics during those years. Wildlife managers considering adapting a limited permit mule deer hunting district should have a clear picture of the public's desired outcome for such a season structure, as they relate to measurable management objectives and the likelihood of meeting public expectation.

## **\*\* OPTIMAL USE OF WILDLIFE MONITORING RESOURCES**

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Resources for monitoring wildlife populations are limited and their availability changes over time. The data collected using these resources is critical for making good conservation and management decisions. Determining the optimal way to allocate monitoring resources for data collection based on the amount of information the data provides for conservation and management is a responsible and efficient use of public resources. We develop a method for determining the most optimal scenarios for data collection which simultaneously minimizes cost and maximizes the precision of the abundance estimate. To accomplish this, we developed a new metric which describes the relationship between data collection cost and estimate precision in a single value, the information gain ratio. We used data collected by the Idaho Department of Fish and Game on the statewide mule deer population of Idaho to develop our method for determining the optimal allocation of monitoring resources. Using the information gain ratio, we characterize the relationship between cost and precision relative to the specific attributes of each mule deer population management unit. Our method allowed us to generate a set of data collection scenarios that were adapted to the specific characteristics of each unit, changed with the availability of monitoring resources, and are easily

comparable via the predicted values of the information gain ratio. The collection scenarios detail the type and amount of each data type to collect for the optimal use of monitoring resources. Our optimization method is adaptable across species, scales, data types, and population models.

## **\*\* METHODS TO ESTIMATE RECRUITMENT FOR SOCIAL SPECIES WITH LIMITED DATA**

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Population dynamics for social species depend on hierarchical demography that links local, group-level processes to overall population growth. Many social species cooperatively breed, thus recruitment of offspring is affected by both population- and group-level processes. Traditional methods to estimate recruitment for a species that cooperatively breeds may be insufficient because they do not account for hierarchical demography. Furthermore, for a species that is broad-ranging, rare, or elusive, recruitment data may be too difficult or costly to collect. Our objective was to develop a method to estimate recruitment for a social species that accounts for hierarchical demography and does not rely on recruitment data. We developed an integrated population model (IPM), with both population- and group-level processes, to estimate recruitment in a social species. We were able to estimate recruitment from the IPM without data because changes in abundance are a function of survival and recruitment and we had data for survival. We tested the model using simulated datasets under five scenarios without recruitment data. For all five scenarios we ran models with and without the group-level process to determine if hierarchical demography improved estimation. Simulations demonstrated that the model performed well under most scenarios and provided unbiased estimates of recruitment. We found that explicitly incorporating hierarchical demography was important for estimating recruitment in social species. This model can easily be adjusted to estimate recruitment for any social species. Further, by removing the group-level process this model can be used to estimate recruitment for a non-social species when data are lacking.

## **\*\* RECRUITMENT OF GRAY WOLVES IN MONTANA**

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Recruitment is an important vital rate driving population growth of large mammals. Although large mammals are thought to be regulated by extrinsic factors, cooperative breeding may result in intrinsic factors driving population dynamics, specifically recruitment. The majority of studies evaluating the effects of intrinsic and extrinsic factors on recruitment have not been conducted in a social species that cooperatively breeds, and those that have did not explicitly account for the effects of social structure. We evaluated how intrinsic and extrinsic factors affected variation in recruitment for gray wolves in Montana using an integrated population model. We hypothesized that variation in recruitment was driven by intrinsic factors such as pack size or population size. Alternatively, we hypothesized that extrinsic factors drive variation in recruitment and predicted that winter severity, forest cover, road density, or harvest would explain the most variation in recruitment. We found that the main driver of recruitment in wolves was primarily intrinsic factors, specifically pack size. Mean number of pups recruited per pack appeared to vary little over time despite changes in management practices and decreased survival of yearling and adults following harvest implementation. Although recruitment does not appear to compensate for changes in survival, the population has remained

relatively stable, suggesting that current harvest rates are sustainable. Recruitment in a large bodied, cooperatively breeding species appears to be driven primarily by intrinsic factors.

## **\*\* SHORT-TERM RESPONSE OF SNOWSHOE HARES TO WESTERN LARCH RESTORATION AND SEASONAL NEEDLE DROP**

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Old-growth western larch has been degraded throughout much of its historic range due to extensive timber harvest and fire suppression. We examined the effects of a restoration treatment of western larch on snowshoe hares, a denizen of the boreal forest serving as a focal animal species to indicate the health of the restored ecosystem. In western Montana, we implemented a restoration treatment using “doughnut thinning” to accelerate development of old-growth attributes in larch stands and simultaneously examined the short-term effects on snowshoe hare density, survival and movement. Although typical forest management activities tend to have adverse effects on hares especially in the short-term, we found that the restoration treatment did not affect hare density or survival in the short-term. In addition, despite significant decreases in cover coinciding with the larch needle drop, we found evidence of year-round immigration into larch stands by hares suggesting larch stands are suitable year-round hare habitat. Taken together, our findings suggest that a larch restoration treatment designed to accelerate the development of old-growth attributes can be implemented so as to have no measurable short-term detrimental effects on hares.

## **PROJECT WAFLS: PREDICTING RESPONSES OF SHORT-EARED OWL POPULATION SIZE, DISTRIBUTION, AND HABITAT USE IN A CHANGING CLIMATE**

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The Short-eared Owl is an open-country, ground-nesting species found in marshes, grasslands, shrublands, and tundra across North America and around the world. Evidence suggests that Short-eared Owl populations are experiencing long-term, range-wide, substantial declines in North America, but sufficient monitoring data is lacking to quantify any possible trend. Complicating trend analysis efforts for this species is the expected annual variation in breeding densities, believed to be associated with prey availability. We present evidence from four years of surveys, starting in the Intermountain West, but now encompassing eight western states, confirming annual variation in both density and distribution of Short-eared Owls. Furthermore, we have identified the landscapes features where owls are least susceptible to this variation. Lastly, we present climate-informed projections for the future viability of the species within the region. The results of our work will directly inform the prioritization of actions to help conserve this often neglected species.

## **\*\* PREDICTING HABITAT SUITABILITY FOR DUSKY GROUSE IN MONTANA (POSTER)**

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Claire Gower, Wildlife Division, Montana Fish, Wildlife & Parks, Bozeman, MT  
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Dusky grouse (*Dendragapus obscurus*), are a forest grouse species found throughout western Montana. Despite being a game species, there has been inconsistent monitoring and few surveys in recent years limiting effective management and knowledge of their ecology in Montana. Previous research indicates that dusky grouse use several different habitat types including conifer forest in the winter and shrub/steppe and grassland communities along the edge of coniferous forests during the breeding season. Our objective was to create a state-wide map predicting relative suitability for dusky grouse occurrence that could be used to identify locations for future surveys. We obtained dusky grouse observations collected during April-June, 2009-2018 from the Integrated Monitoring in Bird Conservation (IMBCR) program and extracted habitat information for detected/not-detected locations using remotely-sensed data. We evaluated relative habitat use with resource selection functions calibrated using generalized linear mixed models. Candidate models representing hypothesized relationships among grouse detections/non-detections and habitat conditions (e.g. forest type and coverage, relative elevation, distance to road) were compared using multi-model inference based on information theory. Preliminary results indicate that relative use for dusky grouse was higher in areas with higher proportions of mixed conifer forest, especially areas with higher proportions of douglas fir and that relative use was lower in grasslands and decreased as the distance to the edge of conifer forest increased.

## **\*\* COMPLEMENTING VISUAL SURVEYS WITH WILDLIFE CAMERAS FOR LONG-TERM WETLAND MONITORING**

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Freshwater wetlands support high biodiversity, but are also subject to increased drying under projected climate patterns. Recently, the use of automated tools for monitoring has become more feasible. Using automated tools to complement traditional visual surveys increases observation time at surveyed sites possibly capturing different species, recording within-season dynamics, and expanding our understanding of wetland biodiversity in a changing environment. In 2017 and 2018, we placed wildlife cameras at 6 seasonal and 6 permanent wetlands in Grand Teton National Park for a week each in June and August; we also completed a single visual survey of amphibian species during each of these time intervals. We compared the difference in the number of species detected by each method over the summer to assess temporal changes in wetlands with varying hydrology and evaluate effectiveness of each method for monitoring. Based on preliminary results, changes in species richness over the summer were more related to wetland hydrology than the survey method. Although we found the two methods captured a similar change in richness over time, the species observed were complementary. Cameras added six species from four additional taxa to the four amphibian species detected during visual surveys. Cameras also captured seasonal water-level patterns, which may be used to ground-truth climate-based drying models. Further analysis, including cost/benefit assessments, will help us understand the utility of cameras for monitoring wetlands. Automated surveillance tools allow us to sample cryptic species over large spatial and temporal scales, providing an important contribution to biodiversity monitoring.

## **\*\* TIME-TO-EVENT DENSITY ESTIMATION OF LOW DENSITY SPECIES WITH REMOTE CAMERAS**

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Abundance estimates can inform management policies and are used to address a variety of wildlife research questions, but reliable estimates of abundance can be difficult and expensive to obtain. For low-density, difficult to detect species, such as cougars (*Puma concolor*), the costs and intensive field effort required to estimate abundance can make working at broad spatial and temporal scales impractical. Remote cameras have proven effective in detecting these species, but the widely applied methods of estimating abundance from remote cameras rely on some portion of the population being marked or uniquely identifiable, limiting their utility to populations with naturally occurring marks and populations that have been collared or tagged. Methods to estimate the abundance of unmarked populations with remote cameras have been proposed, but none have been widely adopted. Working with Idaho Department of Fish and Game, we used the time-to-event model (Moeller et al. 2018) to estimate the density of two cougar populations in Idaho. The time-to-event model uses observed encounter rates at randomly or systematically placed cameras to estimate the abundance of unmarked populations. Obtaining reasonable abundance estimates for cougars from the time-to-event model shows that remote cameras may lower the costs of abundance monitoring for low density, difficult to detect species and make monitoring programs using remote camera grids applicable to a broader array of species. Future work will compare estimates of cougar abundance from the time-to-event model to estimates obtained from concurrent genetic spatial capture recapture estimates.

## **\*\* IS HABITAT CONSTRAINING BIGHORN SHEEP DISTRIBUTIONS AND RESTORATION: A CASE STUDY IN THE GREATER YELLOWSTONE ECOSYSTEM**

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Andrea Litt, Ecology Department, Montana State University, Bozeman, MT  
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Carson Butler, Grand Teton National Park, Moose, WY  
Robert Garrott, Ecology Department, Montana State University, Bozeman, MT

We used GPS location data from 65 bighorn sheep (*Ovis canadensis*) in the Madison Mountain Range, located in the northwestern extent of the Greater Yellowstone Ecosystem (GYE), to develop and validate winter and summer resource selection function (RSF) habitat models. Two isolated populations of bighorn sheep occurred within the range, but had demonstrated little expansion into apparent habitat even during years of population growth. We hypothesized that habitat was not the primary factor limiting these populations and that the Madison Range could support a substantially higher abundance and broader distribution of bighorn sheep. We evaluated remotely-sensed landscape covariates expected to influence bighorn sheep resource selection and compared sets of biologically-plausible seasonal models with AICc. We validated our results using temporally- and spatially-independent GPS data and predicted potential habitat throughout the Madison Range. Our results indicate that approximately 82% of winter and 42% of summer habitat was unoccupied. Predicted winter habitat occurred in a non-contiguous distribution primarily along the low-elevation,

southwest-facing aspects within the Madison Valley, and predicted summer habitat was concentrated along the high elevation ridgelines associated with steep slopes and reduced canopy cover. By linking our winter RSF to population estimates for the Taylor-Hilgard, we predicted the Madison Range may be capable of supporting 2 to 4 times the number of bighorn sheep currently estimated within the range. Our results support our hypothesis and suggest that a strategy focused on systematically restoring a metapopulation may greatly enhance the potential for bighorn sheep restoration within the Madison Mountain Range.

## **\*\* USING ECOLOGICAL SITE CONDITION TO EVALUATE HABITAT SELECTION BY SHARP-TAILED GROUSE BROODS (POSTER)**

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Brood survival, an important vital rate affecting population viability of sharp-tailed grouse, is largely determined by the selection of brood-rearing habitats by females. Both the quantity and quality of brood-rearing habitat are influenced by land management decisions, and therefore, improper rangeland management can lead to habitat degradation and have a negative effect on sharp-tail grouse populations. Many land management decisions affecting brood habitats (e.g., livestock stocking rates, prescribed burning) are based on metrics including the type and condition of ecological sites. However, associations between brood habitat use and these common rangeland assessment metrics have not been evaluated. We developed a method of delineating ecological sites and assessing vegetation condition by comparing current vegetation to the climax communities across our study area in eastern Montana and western North Dakota. We then evaluated selection ratios of radio-marked brood hens in relation to ecological sites and their relative condition. Our results should provide useful information on brood habitat selection relative to habitat assessment frameworks used by rangeland managers and have implications for the management of sharp-tailed grouse brood habitats in the northern mixed-grass prairie.

## **INVASIVE AND PEST SPECIES INFORMATION AT THE MONTANA NATURAL HERITAGE PROGRAM (POSTER AND PRESENTATION)**

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Dave Ratz, Montana Natural Heritage Program, University of Montana, Helena  
Andrea Pipp, Montana Natural Heritage Program, University of Montana, Helena  
Dan Bachen, Montana Natural Heritage Program, University of Montana, Helena

The Montana Natural Heritage Program (MTNHP) has centralized information on Montana's native species and habitats since its inception in 1985. In October of 2017, MTNHP started managing information on Aquatic Invasive Species, Noxious Weeds, Forest Pests, Agricultural Pests, other non-native species, and biocontrol species that have been introduced to control invasives. The MTNHP now manages information on over 500,000 observations of more than 700 invasive and pest species and over 50,000 structured survey locations for invasive and pest species and makes that information available on its websites. This presentation will provide an overview of how biologists and resource managers can access information on surveys, observations, predicted habitat suitability models, and descriptive field guide information for invasive and pest species and native species on the MTNHP's Montana Field Guide, Species Snapshot, and Map Viewer websites.

## **\*\* NEW METHODS FOR MONITORING MOUNTAIN GOAT POPULATIONS (POSTER)**

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Estimating the distribution and abundance of wildlife populations is a critical component to the conservation of wild species. Precise estimates of these parameters enable biologists to productively manage and preserve the animal populations they oversee. Methods for monitoring high density species populations are frequently and continuously being improved upon. However, identifying effective methods for monitoring low density species populations (e.g. mountain lions, wolves, mountain goats, and wolverine) has proved challenging due to small population sizes and difficulty of access to low density species habitat. Current approaches for surveying low density species (e.g. aerial surveys, baited camera traps, DNA sampling) often provide insufficient information and application of statistical models to these data can be complex. In this study, and in partnership with Idaho Department of Fish and Game, I will test disparate non-invasive, ground-based methods for monitoring mountain goat (*Oreamnos americanus*) populations in Idaho, USA. This project will compare and contrast findings from three field and analytical methods: camera trapping techniques, single-observer ground surveys, and double-observer ground surveys. Here, I describe the field methods and statistical models being tested and developed in research project. Additionally, I will present findings from the first field season (June-August 2018) of testing these three methods. By improving occupancy and abundance estimates for mountain goat populations, biologists can begin to make smarter conservation decisions around mountain goat management.

## **MONTANA'S SPATIOTEMPORAL MODEL FOR ESTIMATING GAINS AND LOSSES OF GREATER SAGE-GROUSE HABITAT IN A MITIGATION FRAMEWORK: TIME IS OF THE ESSENCE**

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Therese Hartman, Montana Sage Grouse Habitat Conservation Program, Helena, MT  
Graham Neale, Montana Sage Grouse Habitat Conservation Program, Helena, MT  
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Sagebrush-grassland ecosystems support upwards of 300 species, including several charismatic and high-profile big game and upland bird species. For example, habitat conservation for Greater Sage-grouse (*Centrocercus urophasianus*, hereafter GRSG) directly benefits habitat for mule deer and pronghorn. Big game hunting in counties that contain designated GRSG habitat contributes over \$113.5 million annually to Montana's economy. Montana has a deep habitat conservation ethic, which is foundational to maintaining Montana's Outdoor Economy. To address the GRSG conservation needs, Montana and a multi-agency, multi-disciplinary, citizen-based stakeholder group developed a Habitat Quantification Tool (HQT model) to quantify GRSG functional habitat gains and/or losses in a mitigation framework. Montana's HQT model is a geospatial raster model. It differs from other state GRSG HQT models because it incorporates time when estimating changes in available functional habitat caused by development or conservation projects. Using biophysical GBSG habitat attributes, the HQT model first establishes a baseline of existing functional habitat. For individual projects, the HQT model assesses functional acres lost or gained due to development or conservation, respectively, by comparing the baseline to post-project condition. Individual HQT model results are aggregated and summed at regional and statewide scales to determine whether Montana is meeting its goal of no net

loss of GRS habitat. The Sage Grouse Habitat Conservation Program (Program) operates and maintains the HQT model. Using an adaptive management framework, the Program will assess the accuracy of HQT model results. The Program will revise the HQT model through time based on new available science.

### **FREE LUNCH, MAY CONTAIN LEAD: SCAVENGING SHOT SMALL MAMMALS**

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Scavengers are subsidized by hunting remains worldwide. While most studies focus on carcasses of large mammals, shot small mammals likely provide a significant food subsidy as well. Millions of small mammals are shot each year for damage control and recreation, many being left in the field. Despite this high prevalence of carrion, and the potential for scavengers to ingest residual lead from bullet fragments, the fate of these carcasses is largely unknown. We deployed remote cameras to observe which scavengers consumed shot ground squirrels (*Sciuridae spp.*) and black-tailed prairie dogs (*Cynomys ludovicianus*) in 8 locations across Montana, USA. At least 5 species of mammals and 9 species of birds scavenged, including burrowing owls (*Athene cunicularia*). Scavengers fully consumed 67% of carcasses and partially consumed 9%. Carcasses lasted an average of 24.5 hours before the first scavenger arrived. Of carcasses that were scavenged, mammals ate 16% compared to 84% for birds, with corvids and raptors consuming an equal number of carcasses. Common ravens (*Corvus corax*) and black-billed magpies (*Pica hudsonia*) visited the most carcasses and were often the first to arrive. Overall, our results indicate that a diverse scavenger community consumes shot ground squirrels and black-tailed prairie dogs, and consequently, may be exposed to lead from bullet fragments.

### **\*\* EFFECTS OF MOUNTAIN PINE BEETLE ON BAT ACTIVITY IN WESTERN MONTANA (POSTER)**

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Bat activity throughout forests is likely influenced by stand structure, which can be altered by disturbance (e.g., fire, silviculture, and pests). The mountain pine beetle (MPB, *Dendroctonus ponderosae* Hopkins) is a major forest pest in the western United States that has caused tree mortality in millions of hectares of lodgepole (*Pinus contorta*) and ponderosa pine (*Pinus ponderosa*) forests. This disturbance can increase coarse woody debris (CWD) and open canopies through fallen snags. Our objectives were to 1) determine whether CWD can be used as a proxy to characterize severity of the MPB effects, and 2) assess how bat activity changes with MPB severity within lodgepole and ponderosa forests in western Montana. We measured CWD, assessed severity of MPB, and deployed acoustic detectors to evaluate bat activity during the early active season, prior to activity of newly volant pups. Ponderosa-dominated sites had lower average volumes of CWD compared to lodgepole sites. Overall, the amount of CWD did increase with MPB severity. We recorded 8.7 bat passes per night on average (95% CI = 3.2 to 14.2 bat passes/night). However, ponderosa forests (95% CI = 8.4 to 38.6 bat passes/evening) had 20.8 more bat passes per night on average than lodgepole (1.13 to 15.1). Variation in bat activity was not explained by MPB severity alone; future analyses will explore the influence of additional forest characteristics to help us understand how to manage forests in a way that is beneficial for bats.

## **RECENT TRENDS IN UNGULATE FORAGE INFERRED FROM REMOTE SENSING DATASETS**

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Forage quality, quantity, and phenology play a large role in regulating the habitat use and population dynamics of wildlife populations. Assessing how forage has changed over time can help inform management decisions. Using several freely available remotely sensed and climate-based datasets, we calculated forage-related metrics such as the timing and duration of spring greenup on a pixel-by-pixel basis across Montana. We conducted trend analysis from 2000-2014, identifying areas of consistent change within the state and summarizing trends on a more local scale. We also assessed variability and consistency of estimates within and across datasets. In general, mountainous regions and adjacent lower elevations display somewhat opposing trends, highlighting the importance of understanding the changes for conservation of migratory ungulates which rely on greenscape gradients to optimize nutritional gain.

### **\*\* EFFECTS OF FLUSHING ON SHARP-TAILED GROUSE NEST SURVIVAL (POSTER)**

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Intensive demographic studies of prairie grouse provide valuable information to guide management recommendations. However, field techniques are frequently invasive, often necessitating concentrated capture efforts and frequent flushing of females from nests, which could potentially bias estimates of nest survival by altering either bird or predator behavior. Researcher-induced biases in vital rate estimation has serious implications when those estimates are used to inform management. As part of a larger study on the effects of grazing management on sharp-tailed grouse, we monitored 102 radio-marked females in eastern Montana for two years to better understand the effects of flushing on nest survival. A randomly selected subset of radio-marked females were flushed from nests 1-2 times by researchers using standard protocols for game bird nesting studies, while the remainder were never flushed during the nesting season. Daily nest survival was significantly reduced for birds that were flushed from the nest, but the effect was mediated by the amount of precipitation received during the nesting period. A significant negative effect was only observed during periods with little precipitation, with reduced nest survival due almost entirely to predation rather than nest abandonment. Overall, our results suggest that research activities can introduce bias into demographic estimates, but that the effect depends on weather conditions.

### **\*\*EFFECTS OF RANGELAND MANAGEMENT ON THE ECOLOGY OF SHARP-TAILED GROUSE IN MIXED-GRASS PRAIRIES**

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Temperate grasslands, including mixed-grass prairies, suffer from the greatest levels of habitat loss and degradation of any ecosystem, which can have cascading negative effects. Grazing by livestock is the predominant land use across western North America and directly affects the structure, composition, and productivity of native grasslands. While certain grazing regimes can negatively affect wildlife habitat, properly managed grazing can be compatible with wildlife conservation and is preferable to other land uses that destroy or fragment native grasslands. With large home ranges and

differing requirements for nesting and winter habitat, sharp-tailed grouse (*Tympanuchus phasianellus*) require large and complex areas of habitat, making them an ideal indicator species for grassland habitats. Poor range management has been implicated in the decline of sharp-tailed grouse throughout North America, but the effects of specific grazing regimes on grouse populations have not been studied. A better understanding of the ecological impacts of grazing is required to develop effective conservation strategies. We monitored 203 radio-collared sharp-tailed grouse in eastern Montana to assess the effects of grazing management on grouse ecology and evaluate the effectiveness of specific grazing regimes for improving wildlife habitat. In three years of study, we found that choice of grazing system had no effect on space use and important vital rates (nest survival and adult survival) for sharp-tailed grouse. We observed relatively weak effects of stocking rate and stocking density, but overall the performance of the sharp-tailed grouse population at our study area was not affected by grazing system.

### **ELEPHANT FRIENDLY TEA: AN EXAMPLE OF WILDLIFE SCIENCE-BASED COMMERCIALIZATION TO SAVE AN ENDANGERED SPECIES**

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Lisa Mills, Broader Impacts Group, University of Montana, Missoula, MT

In the U.S. alone, >84 billion servings of tea are consumed per year, totaling \$12.5 billion in annual sales. Almost none of these consumers realize that tea is a death crop helping to drive Asian elephants extinct. Building on our applied population ecology research and local outreach in the India-Bhutan region, we have: a) identified tea production practices that drive elephant mortality; b) identified specific actions to reverse those impacts; c) and incentivized those conservation-relevant tea farming practices through a novel “Elephant Friendly Tea” (EFT) Certification. Through our program tea estate owners who implement EFT actions receive a price premium for their tea, which is then sold under a Certified EFT logo; in turn, global tea consumers have a direct opportunity to support science-based elephant conservation with every cup of tea. We expect EFT to be game-changing for arresting the decline of Asian elephants because – unlike traditional conservation approaches – it both implements incentive-based conservation actions on and around the private agricultural lands where most elephants are killed, and it will create profits that we will fully invest into research and conservation actions across the elephant’s range. Critical partners to development of EFT include local villagers and tea professionals, the non-profit certification group Wildlife Friendly Enterprise Network, and University of Montana (who will manage the “EFT Elephant Research and Conservation Fund” created by EFT sales). We believe this model has great potential to address seemingly intractable conservation problems in Montana by developing meaningful win-win wildlife friendly enterprises.

### **A WINTER ENERGETICS MODEL FOR BOBCATS IN A DEEP SNOW ENVIRONMENT**

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Karen Hodges, University of British Columbia Okanagan in Kelowna, BC

Understanding basic energetic requirements of wildlife species is critical to evaluate how individuals persist in their current environments as well as to forecast responses to changed climates or habitats. Indeed, northern range limits are often thought to reflect harsh abiotic conditions that exceed the capacity of individuals to stay in energetic balance. Bobcats (*Lynx rufus*) occur across much of North America; at northern latitudes, they face winter challenges such as deep snows, cold temperatures, and possible food scarcity. We developed an energetics model from field data on movements, body mass, and observed diet of bobcats in mountains of northwest Montana, then evaluated overwinter prey requirements that would enable bobcats to stay in energy balance in this difficult environment.

Our model indicated average daily energy expenditures were  $\sim 1.41 \times$  basal metabolic rate. For 90 days from December-February, a 10.5 kg bobcat consuming prey items in proportion with the observed diet for bobcats in this area would need about 2.1 kg of deer (*Odocoileus spp.*), 7 snowshoe hares (*Lepus americanus*), 155 red squirrels (*Tamiasciurus hudsonicus*), 9 woodrats (*Neotoma cinerea*), and 250 small rodents (Cricetidae). Bobcats have considerable flexibility in diet, movements, and both timing and duration of daily activity to adjust their energetic expenditures in winter.

## **REGIONAL DIFFERENCES IN WINTER DIETS OF BOBCATS IN THEIR NORTHERN RANGE**

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When generalist predators have wide geographic ranges, diets may differ dramatically, largely as a result of differing prey communities. Bobcats (*Lynx rufus*) are widely distributed across southern North America, with their northern range edge occurring in southern Canada and in the northern US states. Within this northern range, bobcats are exposed to cold and snowy winters and a limited number of prey species, conditions that are atypical for most of the range of bobcats. We examined winter diets of bobcats in high elevation and very snowy forests in northwest Montana to determine how these generalist predators managed in these harsh conditions in comparison to elsewhere in the northern range. Bobcats consumed 5 major prey types: red squirrels (*Tamiasciurus hudsonicus*) and Cricetid rodents comprised  $>78\%$  of the dietary biomass, whereas the larger snowshoe hares (*Lepus americanus*), deer (*Odocoileus spp.*), and grouse were consumed much less often. The standardized niche breadth of bobcat diets was 0.29; bobcats from across the northern range also routinely ate multiple prey species, although eastern bobcats appear to consume more lagomorphs than do western bobcats. These results indicate that bobcats remain generalists in difficult winter conditions while preying primarily on small-bodied prey, although bobcats have highly variable diets across their northern range.

## **AN IMPROVED UNDERSTANDING OF POPULATION DYNAMICS USING COUNT DATA: INSIGHTS FROM ELK IN WESTERN MONTANA**

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Understanding the dynamics of ungulate populations is a crucial goal for managers given their ecological and economic importance. In particular, the ability to evaluate the evidence for potential drivers of variation in population trajectories is important for informed management. However, the routine use of age ratio data (e.g., juveniles:100 adult females) to evaluate variation in population dynamics is hindered by a lack of statistical power and difficult interpretation. Here, we show that the use of a population model fueled by count, classification and harvest data can dramatically improve the understanding of population dynamics compared to a model using age ratio data by: 1) increasing the power to assess potential sources of variation in key vital rates, and 2) providing easily interpretable vital rates (e.g., per capita recruitment rates and population growth rates) that are useful to managers. Using a time series of spring count data (2004 to 2016) and fall harvest data from hunting districts in western Montana, we constructed a population model to assess the effects of a series of environmental covariates and indices of predator abundance on the per capita recruitment rates of elk calves. Results from this modeling approach suggest per capita recruitment rates decline in association with wet springs, dry summers and severe winters, and in interactions between

predator communities and the environment. In contrast, the analysis of age ratio data failed to detect these relationships. We recommend using count data and a population modeling approach rather than interpreting estimated age ratio data as a substantial improvement in understanding population dynamics.

## **ESTIMATING CARNIVORE DENSITY USING SPATIAL CAPTURE-RECAPTURE MODELS: SAMPLING DESIGNS AND POTENTIAL PITFALLS**

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Spatial capture-recapture (SCR) models have improved the ability to estimate densities of rare and elusive animals. However, SCR models have seldom been validated even as model formulations diversify to incorporate new sampling methods and/or additional sources of information. The relationship between encounter probabilities, sources of additional information, and the reliability of density estimates, is poorly understood but crucial to assessing reliability of SCR-based estimates. We used a simulation-based approach that incorporated prior empirical work on mountain lions in western Montana to assess the accuracy and precision of density estimates from SCR models using direct search effort. Our simulations focused on understanding the consequences of: 1) variable probabilities of encounter generated from different levels of search effort, and 2) including additional spatial information from collars. Overall, we found that although low search effort resulted in sparse datasets and highly biased and imprecise estimates of density (relative bias, RB = 0.71, coefficient of variation, CV = 1.16), a combination of increased effort and/or additional information generated unbiased and precise density estimates (e.g., moderate effort and 4 collars, RB = -0.004, CV = 0.19). This work suggests that reliable density estimates can be generated by multiple sampling designs such that additional spatial information from collars can be used to supplement direct search effort when resources are limited, or by increasing search effort when collaring is impractical. Using the open-source code for our simulation-based approach, we further offer recommendations on sampling designs for SCR-based density estimation.

## **ADVENTURE SCIENTISTS: IGNITING THE OUTDOOR COMMUNITY TO COLLECT GAME-CHANGING DATA**

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Outdoor adventurers have the skills and inspiration to spend hours, days, and weeks every year in regions that are inaccessible to the rest of the population. While carrying out their already-planned excursions or planning new ones expressly for this purpose, they can collect data and samples of critical importance to scientists and conservationists working to address today's challenges to human health and the environment. Adventure Scientists has gained extensive experience and developed repeatable protocols for designing projects and training these highly-skilled volunteers to collect research-grade data. These data are being used by governments, businesses, and others to shape policies and practices that benefit the environment. Scientists get otherwise unobtainable data while adventurers enrich their experience of the outdoors and increase their knowledge of the challenges facing the natural world. Together they have a greater impact than either could alone. This spring, serving a partnership with the Montana Department of Transportation, Adventure Scientists will begin recruiting volunteer teams of cyclists throughout the state to create a comprehensive year-round portrait of wildlife-vehicle collisions on more than 8,400 miles of state and federal highways. Armed

with the results, decision makers then can identify key migration corridors, uncover road crossing “hot spots,” and design improved road projects such as overpasses and culverts to prevent collisions and allow humans and wildlife to move freely and safely across a shared environment.

## **\*\* ESTIMATING FORAGE QUALITY AND ABUNDANCE TO BETTER UNDERSTAND MULE DEER RESOURCE SELECTION**

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To identify the environmental factors limiting growth of herbivore populations, researchers need to understand how benefits (like forage quality and abundance) and costs (like risk of predation) vary across a population’s range, and how individuals select habitat with respect to those resources. For mule deer (*Odocoileus hemionus*) living in northwest Montana, predicting forage quality and abundance over large extents is difficult, since much of their habitat use occurs within dense conifer forest where remote-sensed metrics (like NDVI) are of limited use. Therefore, we are developing a landscape forage model using field-collected vegetation data to estimate how digestible energy per area varies across 3 mule deer population ranges. Preliminary evidence has shown that forage resource availability varies with landcover-type. With this forage model, and along with previously developed predator resource selection functions (RSFs), we will develop an RSF to assess how mule deer make tradeoffs between nutrition and predation risk. This will allow us to identify the mechanisms driving mule deer resource selection, and will guide more effective management of mule deer populations and habitat in western Montana.

## **GREATER SAGE-GROUSE RESPONSE TO BENTONITE MINING**

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The greater sage-grouse has undergone range contraction and population decline because of anthropogenic land surface disturbances; yet, there is little information on the effects of mining on sage-grouse populations. In the Bighorn Basin of Montana and Wyoming, bentonite mining is a growing source of surface disturbance that contributes to loss of sagebrush habitat. We evaluated the response of sage-grouse to active and reclaimed bentonite mining, relative to nesting, brood-rearing, adult breeding, and adult winter habitat, through resource selection and habitat-specific mortality risk analyses, based on female sage-grouse monitored with telemetry from 2011-2015. A greater proportion of our monitored sample was exposed to mining disturbance during winter (65%) than during other seasons (range = 25%-34%). We observed avoidance of all mining disturbance for selection of nesting habitat, adult breeding habitat, and adult winter habitat. Evidence was inconclusive for avoidance of mining for brood-rearing habitat. We also observed increased adult breeding season mortality risk associated with active mining disturbance but observed no effect on nest success. Evidence was inconclusive for increased mortality risk associated with broods and adults during winter. Stakeholders in the Bighorn Basin should be flexible and proactive to minimize the negative effects of bentonite mining on sage-grouse habitat use and demographic rates. Stakeholders should prioritize the conservation of winter habitats because of the influence on a greater proportion of the population and they should strive to perfect mining reclamation to return disturbed sites back to pre-disturbance conditions to minimize long-term effects.

## INTEGRATED CARNIVORE-UNGULATE MANAGEMENT: A CASE STUDY IN WEST-CENTRAL MONTANA

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In response to poor recruitment and declining ungulate population trends in west-central Montana, wildlife managers implemented an integrated carnivore-ungulate management program designed to reduce carnivore densities via harvest prescriptions in efforts to increase elk recruitment and abundance. However, the ability of wildlife managers to use carnivore harvest management regulations as a tool to reduce carnivore population densities and increase ungulate recruitment is unknown. The management objective in this case was a moderate reduction in carnivore densities that sustained carnivore populations and associated recreational opportunities, while also reducing predation pressure on ungulate populations. We assessed the efficacy of this integrated carnivore-ungulate management program by evaluating: 1) the effects of a harvest management prescription on mountain lion population density using a before-after-control-treatment study design, and 2) patterns in elk juvenile recruitment before and after implementation of the mountain lion harvest treatment. We found that 4-years after the management program was implemented, mountain lion population abundance declined by 26% (90% CI = [0.60, -0.05]) within the harvest treatment area and remained stable within the control area. The per-capita recruitment rate of elk was low and stable in the treatment area prior to the mountain lion harvest prescription (e.g., mean = 0.18, [0.14, 0.22]), increased substantially in the year following the implementation of the harvest prescription (mean = 0.32, [0.24, 0.41]) prior to declining to 0.23 ([0.16, 0.29]) at present, which contrasted with a moderate increase in per capita recruitment rates in the control area. Together these results suggest that the mountain lion harvest treatment moderately reduced mountain lion abundances within the treatment area, as intended, although the effect on elk population dynamics was short-lived. Broadly, this integrated management program achieved carnivore and ungulate population objectives. We recommend wildlife managers applying integrated carnivore-ungulate management programs develop carnivore and ungulate monitoring programs that assess the efficacy of management programs and provide information regarding future management prescriptions designed to achieve carnivore and ungulate population objectives.

## **\*\* ASSESSING HABITAT QUALITY FOR FOUR GRASSLAND SONGBIRD SPECIES OF CONCERN IN NORTHERN MIXED-GRASS PRAIRIE**

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During the past 40 years grassland bird populations have declined faster than any other avian guild in North America. In northern Montana, four species are experiencing severe population declines, Baird's sparrow (*Centronyx bairdii*), chestnut-collared longspur (*Calcarius ornatus*), McCown's longspur (*Rynchophanes mccownii*), and Sprague's pipit (*Anthus spragueii*). In 2017 and 2018, we evaluated abundance and nest density of these species in relation to local vegetative conditions with the goal of identifying important breeding season habitat conditions to inform management. We conducted fixed-radius point-counts at 100 sites to estimate local abundance, rope drag surveys to estimate nest density, and vegetation surveys to estimate vegetation structure and composition across grassland habitats in Phillips County, MT. Point-counts and rope drag surveys were carried out with replicated visits to allow estimation of species-specific detection probabilities. Habitat conditions were measured at the plot level (9 ha) to provide information at scales relevant for land managers. The abundance of Baird's sparrows was positively associated with residual grass cover and litter cover. Chestnut-collared longspur abundance was negatively associated with residual grass and shrub cover and had a quadratic relationship with biomass. Plot-level abundance of McCown's longspurs was negatively associated with both shrub cover and biomass. Sprague's pipit abundance exhibited a quadratic relationship with biomass. Limited sample size only allowed inference of nest density for chestnut-collared longspurs which was negatively associated with plot scale biomass.

## **\*\* APPLICATION OF A NOVEL NEST DENSITY ESTIMATOR: AN EXAMPLE USING SAGEBRUSH-STEPPE SONGBIRDS**

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Studies show nest density is an important demographic rate for shorter-lived species, such as sagebrush-steppe songbirds. A recent analytical approach, temporal nest density estimator (TNDE), was developed to estimate the nest density of waterfowl species using data routinely collected to assess nest success while accounting for detection and availability of nests. To understand the general applicability of TNDE to species in other avian orders, we evaluated the performance of TNDE on a songbird species, Brewer's sparrow (*Spizella breweri*). We assessed the TNDE by comparing estimates of nest detection rate and nest density from TNDE to distance sampling methods for 43 Brewer's sparrow nests monitored in 2015. The TNDE method produced similar but more precise nest detection and density estimates than the distance sampling method. Now that TNDE has been validated, we plan on converting it to a Bayesian framework and using it in conjunction with fine resolution remote sensing data to determine nest-site selection for three sagebrush-steppe songbirds: Brewer's sparrows, McCown's longspurs (*Rynchophanes mccownii*), and vesper sparrows (*Pooecetes gramineus*). These three species are representative of sagebrush specialists, grassland specialists, and generalists that use both, respectively. This study will allow us to explore the capability of TNDE and remote sensing data to assist in habitat selection studies. These methods may allow more accurate nest density estimates on broader scales with less effort, which will aid in identifying priority areas for conservation and management.

## **YOUNG AND RESTLESS: A GUIDE TO GETTING YOUR OWN COLONY AS A JUVENILE BEAVER**

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Interest in using beavers (*Castor spp.*) as an efficient riparian restoration tool has increased dramatically in recent decades. The ultimate goal of most beaver-mediated habitat restoration projects is to establish a self-sustaining population of beavers that can occupy new habitats over time. Therefore, dispersal is a key process to understand when evaluating the potential for project locations to be settled by beavers. We radio-marked juvenile beavers in the Gallatin and Madison River drainages in southwest Montana to investigate dispersal characteristics, survival, and settlement site selection. Our goal was to improve identification of restoration sites with the highest probability of colonization by beavers. The annual probability of dispersal in our study area was low ( $0.26 \pm 0.24$ - $0.29$ ), and distances and timing of dispersal were highly variable. The probability of a beaver dispersing decreased as local colony density increased, suggesting delayed dispersal. Few radio-marked beavers started new colonies in previously unoccupied habitat during our study. Instead, most dispersers settled in stream segments already modified by previous beaver activity. The low number of new settlement sites and evidence of delayed dispersal suggests most of the suitable habitat in our study area was occupied. We recommend land and wildlife managers assess the density and distribution of beaver colonies around proposed restoration sites prior to project design to evaluate the potential for dispersal into the project area. Beaver dispersal is an important factor in the success of riparian restoration projects, and our work highlights aspects of dispersal that may influence beaver settlement in this context.

## **\*\* POPULATION DEMOGRAPHICS, BREEDING ECOLOGY, AND RESPONSES TO GRAZING OF MONTANA SAGEBRUSH STEPPE SONGBIRDS**

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Sagebrush steppe is one of the most threatened ecosystems in North America. Avian adult density estimates are often used to assess conservation actions given the relative ease in collecting data to inform these estimates. However, information on how conservation actions influence life histories such as nest density and nest success are lacking, despite the fact that life histories inform abundance. We investigated songbird adult densities, nest densities, and nest success over multiple breeding seasons in central Montana. Our goal is to understand the relationships among adult abundance, nest density, and nest success, as well as how land management practices, in the form of grazing, influence those patterns. Two grazing systems were compared in our study: a system using a combination of rest and deferment (hereafter rest-rotation) and traditional grazing. For the purposes of our study, we define rest-rotation grazing as changing the timing of grazing in pastures each year, with some pastures alternately rested every few years. Traditional grazing is defined as grazing a pasture at the same annual season each year or all season. Recently, rest-rotation systems have been used as a conservation management tool by the Natural Resource Conservation Service-Sage Grouse Initiative. Their goal is to encourage private landowners to graze their livestock more sustainably to maintain or improve rangeland productivity, while also benefiting habitat for greater sage-grouse (*Centrocercus urophasianus*). We explore the effects of rest-rotation compared to traditional grazing on songbird population demographics during the breeding season.

## **DEMOGRAPHIC FRAGMENTATION OF A PROTECTED WOLVERINE POPULATION BISECTED BY A MAJOR TRANSPORTATION CORRIDOR**

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Roads fragment terrestrial ecosystems around the globe, but the effects of this fragmentation on biodiversity remain poorly understood. Wolverines (*Gulo gulo*) are snow-dependent carnivores that occur at low densities and they exhibit low genetic diversity at the southern extent of their range where they are snow-limited, rare and fragmented by human development. Therefore, understanding the effect of roads on population connectivity is crucial to effective wolverine management in a changing climate. We examined whether the Trans-Canada Highway, Canada's largest east-west transportation corridor, affects wolverine movement and gene flow in the Canadian Rocky Mountains. We used noninvasive genetic sampling methods to collect DNA samples (i.e. hair, scat) from Banff, Kootenay, and Yoho National Parks and provincial lands in British Columbia and then used population and individual-based genetic analyses to quantify genetic structure of the wolverine population across the highway in the national parks complex. We collected 2586 DNA samples between 2010 and 2013 from which we identified 49 unique individuals (29 males, 20 females). We detected equal numbers of males and females that crossed the highway (4 males, 4 females); however, dispersal and gene flow were affected differently in the two sexes by the transportation corridor. We detected weak population structure in males and relatively strong genetic differentiation in females spanning the highway. Our results demonstrate that sex-biased dispersal across a major highway can lead to genetic isolation and demographic fragmentation in a protected carnivore population, highlighting the urgent need to maintain connectivity for wildlife species over an expanding road network.

## **HOW FAR HAVE THEY SLITHERED? GENETIC VARIATION AMONG GARTER SNAKES IN WESTERN MONTANA**

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Snake gene flow across wide geographic regions is poorly understood. Limited sampling opportunities and the challenges posed by microsatellite analysis often prevent researchers from assessing the impact of topographic barriers and the influence of human settlement on the genetics of snake populations. Last year we demonstrated that SNPs significantly improve our understanding of Isolation by Distance for both species of garter snake in Western Montana. Since then we have initially analyzed larger sample sets of Wandering Garters (N=192) and Common Garters (N=160). These samples were obtained at 77 sites during the 2014-2017 seasons. With these samples we hope to initially understand gene flow on both sides of the Continental Divide. Moreover, herpetologists traditionally assumed that the Continental Divide instigated a subspecies barrier for Common Garters. We hope to determine the efficacy of this assumption in the initial analysis of our data.

## **NEST SUCCESS, BEHAVIOR, AND DISTURBANCE OF TWO NIGHTJAR SPECIES IN WESTERN MONTANA (POSTER)**

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The Common Poorwill (*Phalaenoptilus nuttallii*) and Common Nighthawk (*Chordeiles minor*) are two nocturnal species breeding in western Montana. These ground-nesting insectivores deploy similar reproductive strategies, but have unique behavioral adaptations for nest success. From 2015-2018, we used cameras and monitoring to document phenology, disturbance, and success at 20 Common Poorwill and 14 Common Nighthawk nests. Poorwills arrived from mid-April to May, and laid their first eggs in May to early June. Nighthawks arrived a full month later, and initiated nests soon after arrival. Both sexes of poorwills incubate, brood and feed chicks. Poorwills often had two nests per breeding season. In contrast, just female nighthawks performed nesting duties, and their late arrival allowed for only one nest in a season. We documented disturbances from six different intruder types, from insects like grasshoppers, to rodents like chipmunks. We observed nine behavioral responses to intruders, including flushing off the nest, defensive posturing, and standing over or beside the nest. Poorwill and nighthawk nests were disturbed most by humans, unknown intruders, and rodents. Poorwills were most likely to flush off of nests upon disturbance, while nighthawks often defended the nest with aggressive posturing. Of the nests that we could determine fate, we confirmed failure at eight poorwill (40%) and two nighthawk (12.5%) nests. Most poorwill nests failed when nestlings were left unattended by adults. We don't know what caused nighthawk nest failure. Future monitoring may give more understanding of how nest disturbances impact nesting success in both poorwills and nighthawks.

### **\*\* IMPROVING ESTIMATES OF WOLF ABUNDANCE IN MONTANA**

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Estimating wolf (*Canis lupus*) abundance is a key component of wolf management in Montana. Montana Fish, Wildlife and Parks (MFWP) has successfully implemented a Patch Occupancy Model (POM) to estimate area occupied and resulting wolf abundance for the past decade. Estimates of abundance, however, depend on assumptions that territory size is fixed, consistent statewide, and includes minimal overlap; additionally, these assumptions are based on data collected pre-harvest. In reality, territories vary spatiotemporally, and this variability may be even greater under harvest. This variability in turn could affect precision and accuracy of abundance estimates. Furthermore, MFWP requires tools to both keep POM calibrated into the future, and to predict how territorial behavior might change in response to changing environmental conditions or management actions. Critically, these tools must be useful with limited data because intensive monitoring efforts are no longer sustainable. We developed theoretical models of territorial behavior towards accomplishing this goal. Results demonstrate, for example, that territories are expected to be on average smaller where prey are more clumped and abundant, and larger where human influence is greater. Predictions from our models are supported empirically. This provides evidence for how territories will vary based on ungulate populations and human use, which in turn can help guide understanding of the effects of management decisions, e.g., degree of harvest pressure. We are currently parameterizing the models

with field data and developing empirical models to contrast with the theoretical models. Altogether, this work will help keep POM calibrated into the future with limited data.

## **MONTANA’S GREATER SAGE-GROUSE CONSERVATION STRATEGY ALL HANDS BALANCING CONSERVATION AND DEVELOPMENT ACROSS ALL LANDS**

Carolyn Sime\*, Montana Sage Grouse Habitat Conservation Program, Helena, MT  
Therese Hartman, Montana Sage Grouse Habitat Conservation Program, Helena, MT  
Graham Neale, Montana Sage Grouse Habitat Conservation Program, Helena, MT  
Jamie E. McFadden, Montana Sage Grouse Habitat Conservation Program, Helena, MT

The Greater Sage-grouse (*Centrocercus urophasianus* or GRSG) inhabits sagebrush grassland habitats exclusively and shares habitat with up to 300 other species. Montana is a key stronghold among the western states. Montana’s emphasis on habitat conservation on public and private lands is foundational to supporting and growing Montana outdoor economy. The Montana Sage Grouse Conservation Strategy, implemented by the Montana Sage Grouse Habitat Conservation Program (Program), blends voluntary incentives with regulatory oversight through the permitting process and a new requirement to mitigate for impacts to designated habitat. The Program implements the Greater Sage-Grouse Stewardship Act and Executive Order 12-2015. Key pillars include: 1. a consultation process to guide development; 2. grants to maintain, enhance, restore, and expand habitat; and 3. mitigation to offset impacts of development. Taking an “all lands, all hands” approach, the Program works collaboratively with private landowners, state agencies, and federal land management agencies. Since 2015, the Program has reviewed nearly 1500 proposed development projects in designated GRSG habitat on public and private lands. Approximately 43,148 acres have been placed in perpetual conservation easements through Sage Grouse Stewardship Fund grants. With the goal of no net loss-net gain preferred, the mitigation system incorporates market-based incentives and a Habitat Quantification Tool to quantify gains and losses of functional habitat due to conservation or development projects, respectively. Successful conservation depends on proactive stewardship of the remaining intact sagebrush landscape. Montana is well-positioned for the range-wide conservation assessment set for 2020.

## **IDENTIFICATION OF ALTERNATE BAT HIBERNACULA OUTSIDE OF CAVES AND MINES IN EASTERN MONTANA**

Brandi Skone\*, Wildlife Division, Montana Fish, Wildlife & Parks, Miles City, MT  
Heather Harris, Wildlife Division, Montana Fish, Wildlife & Parks, Glasgow, MT  
Lauri Hanauska-Brown, Wildlife Division, Montana Fish, Wildlife & Parks, Helena, MT  
Dan Bachen, Zoology Department, Montana Natural Heritage Program, Helena, MT

*Pseudogymnoascus destructans*, the fungus responsible for White-nose Syndrome (WNS) and millions of bat deaths in North America, was recently detected in Wyoming and South Dakota near the eastern Montana border. Given the nature of the fungus to thrive in cold and humid environments, bats are most vulnerable to infection in their winter hibernacula. Outside of caves and mines, we have limited knowledge of bat hibernacula in Montana. However, from long-term statewide acoustic monitoring stations we know that some bats are wintering in locations where cave and mine features are limited. In anticipation of WNS and its potential impacts, we were interested in identifying hibernacula and associated characteristics. In October 2018, we attempted to capture and transmitter bats to identify alternate roosts in eastern Montana. We targeted 4 sites, captured 12 bats, placed transmitters on 10, and successfully identified 9 different roost sites. We will characterize microsite (i.e. temperature, humidity, etc.) and macrosite (i.e. roost structure, nearby water, etc.) features of each roost and

assess bat use through winter by placing acoustic detectors near roost sites. Although our results are limited, this is the first documentation of alternate winter hibernacula in eastern Montana. Information on specific hibernacula and associated habitats will help inform bat conservation activities. Additionally, findings will assist in site selection for future WNS surveillance efforts and continued efforts will facilitate future exploration of how hibernacula type influences WNS spread and impacts.

## **ASSESSING OCCUPANCY FOR MONTANA SPECIES OF GREATEST INVENTORY NEED**

Hannah Specht\*, Wildlife Biology Program, University of Montana, Missoula, MT  
Josh Millspaugh, Wildlife Biology Program, University of Montana, Missoula, MT  
Allison Begley, Wildlife Division, Montana Fish, Wildlife & Parks, Helena, MT  
Claire Gower, Wildlife Division, Montana Fish, Wildlife & Parks, Bozeman, MT  
Lauri Hanauska-Brown, Wildlife Division, Montana Fish, Wildlife & Parks, Helena, MT  
Chris Hammond, Wildlife Division, Montana Fish, Wildlife & Parks, Kalispell, MT  
Heather Harris, Wildlife Division, Montana Fish, Wildlife & Parks, Glasgow, MT  
Megan O'Reilly, Wildlife Division, Montana Fish, Wildlife & Parks, Billings, MT  
Torrey Ritter, Wildlife Division, Montana Fish, Wildlife & Parks, Missoula, MT  
Brandi Skone, Wildlife Division, Montana Fish, Wildlife & Parks, Miles City, MT  
Kristina Smucker, Wildlife Division, Montana Fish, Wildlife & Parks, Great Falls, MT

Montana non-game species classified as Species of Greatest Inventory Need (SGIN) are not sufficiently monitored by standard ecological monitoring programs, typically because they are locally rare or cryptic, thus evading detection. Yet, these species are often those for which understanding conservation status is most important. We are developing a tool to characterize the survey effort needed to attain estimates of occupied suitable habitat, while accounting for species characteristics and logistical constraints, and incorporating flexible tools recently presented in the scientific literature. Concurrent with tool development, we have used this approach to examine survey designs for assessing suitable habitat occupancy by Great Gray Owls. We identified a survey strategy with sufficient power to estimate occupancy of this inconspicuous species using a combination of automated recording units and ground call-playback surveys that can be employed in the coming years. Understanding effort required to obtain occupancy estimates with acceptable bias and precision can support survey design for species conservation work as well as informing whether existing monitoring datasets have sufficient power to address information needs. We aim for this tool to inform ongoing survey efforts for Species of Greatest Inventory Need and to facilitate survey planning for species without survey protocols underway.

## **LOVE TRIANGLES CAUGHT ON CAMERA! EXPOSING THE INTIMATE RELATIONSHIPS BETWEEN HUNTERS, GUT PILES, AND SCAVENGERS**

Kate Stone\*, Ecology, MPG Ranch, Florence, MT  
Mike Mctee, Environmental Scientist, MPG Ranch, Florence, MT

As big game hunting season draws to a close, hunters celebrate filling their freezers and the satisfaction of time spent outside. While they enjoy venison backstraps fresh off the grill, scavengers are feasting on a gut pile left in the woods. The U.S. Fish and Wildlife Service estimates that hunters leave 1.5 billion pounds of carrion annually in the field. However, little is known about how scavengers consume this carrion and what role this food source may play in scavenger populations. We asked hunters in the Bitterroot and Missoula Valleys to set up game cameras on gut piles after successful harvests of deer, elk, and moose. Scavengers ranging from Golden Eagles to gray wolves

visited the gut piles. Scavengers continued to visit gut pile locations long after obvious food sources were consumed, suggesting the “life” of a harvest goes beyond a matter of weeks. We’ll discuss how this project adds to other citizen-science efforts to understand scavenging species in western Montana, and to our ability as scientists to engage with hunters on tough topics like ammunition choices, carnivore management, and public land issues. The high level of interest in this project suggests that hunters are able and willing to contribute to scientific research. We expect to continue and expand this project during the 2019 hunting season.

## **HABITAT AND LAND-USE EFFECTS ON SCAVENGING RATES AND POTENTIAL BRUCELLOSIS TRANSMISSION IN SOUTHWEST MONTANA (POSTER)**

Kimberly Szcodronski\*, Northern Rocky Mountain Science Center, US Geological Survey, Bozeman, MT  
Paul Cross, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT

Brucellosis, a bacterial disease caused by *Brucella abortus*, is a major concern in the Greater Yellowstone Ecosystem due to potential transmission from elk (*Cervus elaphus*) to livestock. *B. abortus* can lead to abortion in infected animals and is primarily transmitted between elk and livestock when individuals contact infected abortion materials. Therefore, the risk of transmission may be a function of how long abortion materials remain on the landscape. Previous studies suggest the rate of fetus removal by scavengers may vary spatially and that scavengers may play a vital role in the persistence of *B. abortus* on the landscape and the dynamics of brucellosis transmission. To investigate fetus removal in southwest Montana, we placed bovine fetuses and placentas at 266 sites within suitable elk habitat during the brucellosis transmission risk period from February-June 2017 and 2018. We used remote cameras to quantify the scavenging rate of abortion material, as well as the community of scavengers that participate in fetus removal. Preliminary estimates suggest abortion materials were scavenged at an average of 84 hours ( $\pm 8.5$  SE) across all habitat types. When comparing habitat types, fetuses were removed quicker in grasslands (55 hours  $\pm 8.2$  SE) than in sagebrush steppe (102 hours  $\pm 17.0$  SE) and forest (102 hours  $\pm 7.4$  SE). Abortion materials were consumed by a variety of scavengers including magpies, ravens, red-tailed hawks, eagles, turkey vultures, skunks, foxes, coyotes, wolves, mountain lions, and black bears. This research will help identify management options aimed at decreasing the risk of brucellosis transmission from elk to livestock in Montana.

## **BEYOND WORDS: THOUGHT – A VISUAL ATTEMPT TO INSPIRE THOUGHTS ON THE CLIMATE CRISIS (POSTER)**

Mike Thompson \*, Wildlife Division, Montana Fish, Wildlife & Parks, Missoula, MT

The climate crisis presents unprecedented challenges to the wildlife profession, as it does for all of humanity. Does the human animal have the capacity to wrap its mind around it? This poster is an attempt to convey and inspire individual thoughts about the climate crisis where words in scientific or popular literature may fail us, and from individual thoughts may arise actions and initiative beyond our experience. For actions beyond our experience are required of those who strive to make a difference, and of others who would hope to support, rather than impede, their efforts. So, we hope that the visual image of this poster will speak to someone for whom words are not as impactful.

## **\*\* EFFECTS OF CONTAMINATION FROM OIL EXTRACTION ON AMPHIBIAN ABUNDANCE, SURVIVAL, AND SIZE**

Brian Tornabene\*, Wildlife Biology Program, University of Montana, Missoula, MT

Creagh Breuner, Dept of Organismal Biology, Ecology, and Evolution, University of Montana, Missoula, MT

Saline wastewaters (brine) that contain sodium-chloride salts (NaCl) and heavy metals are a common byproduct of oil extraction. Wetlands and streams are commonly contaminated by brines, but there is sparse information on its effects on freshwater vertebrates. Amphibians are especially sensitive to increased salinity because of their porous skin and primarily-aquatic lifecycle. Therefore, we investigated the influence of brines and pure NaCl on three widespread amphibian species (barred tiger salamanders *Ambystoma mavortium*, leopard frogs *Rana pipiens*, and boreal chorus frogs *Pseudacris maculata*) in the Prairie Pothole Region of Montana and North Dakota. We determined abundance of larvae in 33 wetlands that spanned a gradient of contamination. We also used lethal concentration 50 experiments to determine the influences of brine and pure NaCl contamination on survival and size. Abundance and survival of chorus frog larvae declined most rapidly in response to increased concentration of brines and NaCl, followed by leopard frogs and tiger salamander larvae. However, survival of larvae was lower when exposed to brine compared to pure NaCl. For larvae that survived experimental exposures, mass and length were lower for larvae exposed to higher concentrations of brine and NaCl. Our results suggest that brine contamination has reduced survival and abundance of larvae, brine is more toxic to larvae than pure NaCl, and that sublethal concentrations of brine and NaCl negatively influence growth of larvae. The persistence and negative influence of salts in freshwater ecosystems underscores the critical need for tools to restore landscapes affected by brine and NaCl contamination.

## **DECODING AVIAN MIGRATION: COLD FRONTS AND THEIR INFLUENCE ON NOCTURNAL FLIGHT CALLS (POSTER)**

Carrie Voss\*, Avian Science, MPG Ranch, Florence, MT

Debbie Leick, Avian Science, MPG Ranch, Florence, MT

Kate Stone, Avian Science, MPG Ranch, Florence, MT

Passerines respond to a variety of environmental cues during migration. Some research suggests that passerine migration may be influenced by weather variables such as the passage of cold fronts. During fall 2017, we used acoustic recorders at 23 stations to document the nocturnal flight calls (NFCs) of migrating passerines in the Bitterroot Valley. We looked at correlations between the number of NFCs and the daily change of two weather variables that may indicate an oncoming cold front: temperature and barometric pressure. Cold fronts tend to correlate with migration waves and an increase in nocturnal flights calls. In the future, we intend to include other environmental variables including light pollution, cloud cover, wind direction and precipitation.

## **KEEPING THE CROWN OF THE CONTINENT CONNECTED: A REPORT ON HIGHWAY 2 NEAR GLACIER NATIONAL PARK (POSTER)**

John Waller\*, Science and Resources Management, Glacier National Park, West Glacier, MT

Tabitha Graves, Glacier Field Station, US Geological Survey, West Glacier, MT

The US Highway 2 corridor separates Glacier National Park from the Bob Marshall Wilderness complex to the south. With increasing vehicle traffic, recreation, and high train traffic, resource managers in the region are concerned that Highway 2 is slowly becoming a barrier to north-south wildlife movement in the Crown of the Continent Ecosystem, and thus, this corridor has been identified as a

priority for wildlife connectivity planning. While there have been a number of efforts to understand wildlife connectivity across this corridor, they have tended to be narrowly focused and temporally disjointed. Over the last year, an interagency group of local researchers and managers met in two workshops to evaluate existing research and data sources, identify knowledge gaps, and establish a research framework to increase understanding of wildlife use of the US2 corridor. The long-term goal is to identify explicit management options for preserving trans-highway movements, seasonal migrations, and dispersal movements of animals, plants, and ecological processes. This report builds on previous efforts to understand and plan for terrestrial wildlife connectivity across this inter-jurisdictional corridor by beginning a multi-agency conversation for collaborative research and management.

## **\*\* INFLUENCE OF PRE-BREEDING BODY CONDITION ON REPRODUCTIVE METRICS OF GREATER SAGE-GROUSE**

James A. Waxe\*, Ecology Department, Montana State University, Bozeman, MT  
Andrea R. Litt, Ecology Department, Montana State University, Bozeman, MT  
Kyle A. Cutting, Red Rock Lakes NWR, U.S. Fish and Wildlife Service, Lakeview, MT  
Bok Sowell, Animal and Range Sciences Department, Montana State University, Bozeman, MT

Many species are subject to carry-over effects, where habitat quality experienced long before breeding may influence subsequent performance and overall fitness of an individual. Pre-breeding body condition has been shown to affect reproductive metrics including: breeding propensity, timing of nest initiation, clutch size, and offspring quality. Although the effects of pre-breeding body condition on reproduction have been well-studied in waterfowl, we know little about carry-over effects for gallinaceous birds. During on-going research in the Centennial Valley in southwestern Montana, we tracked 237 female Sage-grouse for 5 years and monitored nesting activity and broods until 30 days of age. Based on preliminary regression analyses, we did not detect an influence of pre-breeding body condition on breeding propensity, given that most individuals nested (91%, 187/206) if they survived long enough to breed. We did not observe differences in timing of nest initiation based on variation in pre-breeding body condition, but this timing differed substantially among years. We found pre-breeding body condition positively influenced clutch size and offspring weight, however there was substantial unexplained variation. Although we did not find pre-breeding body condition strongly influenced reproduction in this population, other metrics, such as habitat characteristics and the previous season's weather events, may provide insights about the role of carry-over effects in sage-grouse. We are currently investigating other drivers to understand the importance of winter habitat quality on reproduction and subsequently help guide management decisions.

## **ESTIMATING OCCUPANCY AND ACTIVITY OF MONTANA BAT SPECIES PRIOR TO THE ARRIVAL OF WHITE-NOSE SYNDROME**

Wilson Wright\*, Ecology Department, Montana State University, Bozeman, MT  
Kathryn Irvine, Northern Rocky Mountain Science Center, U.S. Geological Survey, Bozeman, MT  
Andrea Litt, Ecology Department, Montana State University, Bozeman, MT  
Emily Almberg, Wildlife Division, Montana Fish, Wildlife, & Parks, Bozeman, MT

The spread of white-nose syndrome (WNS) across the eastern United States has raised conservation concerns for bats and provided motivation for monitoring efforts. Currently, WNS has not been detected in Montana and understanding the impacts of WNS on bats in western states requires accurate baseline population assessments and continued monitoring after the disease arrives. Within an occupancy model framework, we analyzed mist netting and acoustic records for eight bat species

in Montana to estimate baseline distributions prior to the arrival of WNS. We created distribution maps from this model that explain the heterogeneity in occupancy for each species using covariates for forest cover, elevation, ruggedness, and average degree days. We also developed a model for overall bat activity using additional acoustic data. Even after accounting for nightly weather conditions, patterns in overall activity were highly variable across years and detector locations. These analyses can help inform future surveillance efforts for early detection of WNS and future bat monitoring efforts in Montana. We developed tools to help visualize estimates from both analyses when selecting locations for WNS surveillance so managers can focus efforts on locations with high estimated probabilities of occupancy for susceptible species and consistent bat activity. Based on the model estimates, we also provided recommendations for future acoustic monitoring aimed at identifying how bat species are impacted by WNS when it arrives in Montana.

## **\*\* PRECIPITATION AND REPRODUCTIVE EFFORT ALTER SURVIVAL OF TURKEY HENS IN THE NORTHERN BLACK HILLS, SD**

Michael J. Yarnall\*, Ecology Department, Montana State University, Bozeman, MT

Andrea R. Litt, Ecology Department, Montana State University, Bozeman, MT

Chad P. Lehman, Wildlife Division, South Dakota Game, Fish, and Parks, Custer, SD

Tradeoffs between survival and reproduction are predicted by life history theory. Understanding how reproductive tradeoffs act in concert with abiotic elements to impact survival is crucial for effective management and conservation of wildlife populations, particularly for at-risk or harvested species. During 2016 - 2018, we radio-tracked and collected survival data on 140 Merriam's wild turkey (*M. g. merriami*) hens in the northern Black Hills, South Dakota. We evaluated associations between hen survival and nest incubation, brood rearing, and precipitation. Consistent with life-history theory and the moisture-facilitated nest-depredation hypothesis, increased time spent incubating and daily precipitation amount were associated with reduced hen survival, but the magnitude of the precipitation association depended on incubation status. Seasonal survival was lowest during spring and winter, highest during summer, and intermediate during fall. A hen that did not incubate a nest was predicted to have a higher rate of annual survival (0.54, 95% CI = 0.46 - 0.61) than a hen that incubated a single nest (0.44, 95% CI = 0.33- 0.55); this prediction is based on precipitation data collected in 2017 and assumes the hen began incubation on the median date. We estimated that annual survival for both nesting and non-nesting hens was lower in the northern Black Hills compared to previous estimates from the southern Black Hills. Management options to improve hen survival are limited, but we recommend actions that would reduce hunter-induced hen mortality of this important game species in the northern Black Hills.

## **THE U.S. FISH AND WILDLIFE PROPOSAL TO DELIST THE CANADA LYNX**

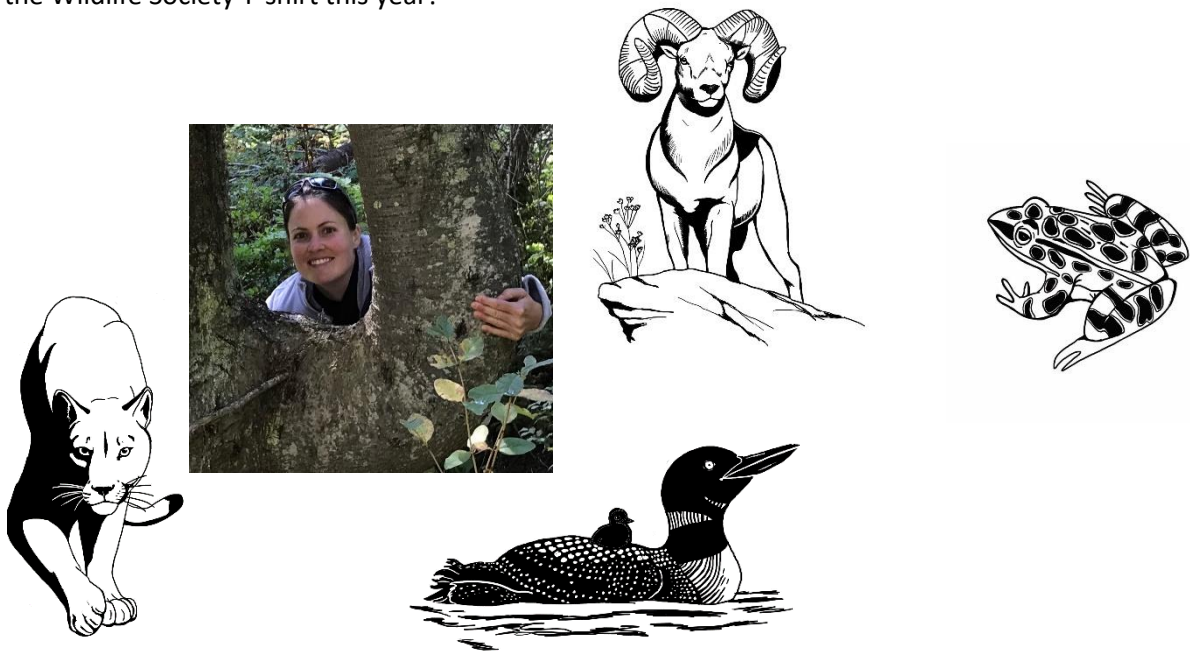
Jim Zelenak\*, U.S. Fish and Wildlife Service, Montana Ecological Services Field Office, Helena, MT

In 2000, the U.S. Fish and Wildlife Service listed the contiguous U.S. distinct population segment (DPS) of the Canada lynx (*Lynx canadensis*) as threatened under the Endangered Species Act (ESA) because of the inadequacy, at that time, of regulatory mechanisms in federal management plans. Since then, federal agencies have formally amended most management plans in the DPS's range to adopt science based conservation measures for lynx or continued to implement conservation agreements in collaboration with the Service. State and Tribal agencies have also worked to conserve lynx populations and important habitats. Research and monitoring conducted since the DPS was listed suggest that resident lynx are naturally rarer and populations smaller in much of the west than previously thought, but they are more abundant in Minnesota and Maine. The 1999-2006 release of

lynx into southwestern Colorado has established a resident population there. The Service recently completed a peer reviewed species status assessment (SSA) for the DPS that evaluated the available scientific information and incorporated the opinions of recognized lynx experts to assess the status and viability of DPS populations. Although the threat for which the DPS was listed has been addressed by improved regulatory mechanisms, the SSA recognized that continued climate warming is likely to reduce lynx populations and distribution in the Lower 48 over the long term. However, the Service concluded that the DPS is not at risk of extirpation in the reasonably foreseeable future and is therefore proposing to delist the DPS.

## 2019 CONFERENCE T-SHIRT DESIGNS

Montana FWP's Rebecca Mowry is the artist behind the T-shirts that are available at this year's conference. We would like to thank Rebecca for sharing her artistic talents with us, and we hope you all enjoy a Montana Chapter of the Wildlife Society T-shirt this year!



# THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY IS HERE TO SERVE YOU AS WILDLIFE PROFESSIONALS

In order to be effective and to influence circumstances for Montana's wildlife resources, we must have an active and committed membership. Please consider volunteering and becoming an active member of any of the following committees or ad hoc committees. Your participation is always appreciated and needed. Refer to Bylaws for duties and composition of standing committees (Article VIII).

## STANDING COMMITTEES 2019-2020

### NOMINATING AND ELECTIONS

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

**Committee Chair:** current MT TWS President (Liz Bradley, [mttws.president@gmail.com](mailto:mttws.president@gmail.com))

### MEMBERSHIP

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

**Committee Chair:** current MT TWS Treasurer (Lorelle Berkeley, [mttws.treasurer@gmail.com](mailto:mttws.treasurer@gmail.com))

### PROGRAMS

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

**Committee Chair:** current President-Elect (To-be-determined, [mttws.preselect@gmail.com](mailto:mttws.preselect@gmail.com))

### FINANCIAL MANAGEMENT

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

**Committee Chair:** current MT TWS Treasurer (Lorelle Berkeley, [mttws.treasurer@gmail.com](mailto:mttws.treasurer@gmail.com))

## EDUCATION AND INFORMATION

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

**Committee Chair:** Brent Lonner ([blonner@mt.gov](mailto:blonner@mt.gov))

## RESOLUTIONS AND PUBLIC STATEMENTS

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

**Committee:** Executive Board - Find email addresses: <https://mttws.org/>

## SCHOLARSHIPS

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

**Committee Co-Chairs:** Bob Garrott (MSU) [rgarrott@montana.edu](mailto:rgarrott@montana.edu)  
Chad Bishop (UM) [chad.bishop@umontana.edu](mailto:chad.bishop@umontana.edu)

## AWARDS

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

## YEARLY AWARDS NOMINATIONS

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

1. The ***Distinguished Service Award*** is presented annually for cumulative, past, current and/or continuing achievements in wildlife conservation.
2. The ***Biologist of the Year Award*** is presented annually for significant achievements in wildlife conservation anytime during the five years immediately preceding the award presentation.
3. The ***Bob Watts Communication Award*** is presented for significant communication in media such as professional publications, popular wildlife articles, books, movies or videos that have a relatively wide audience.
4. The ***Wildlife Conservation Award*** is given to an individual or non-governmental organization for past, present or ongoing efforts that enhance wildlife conservation in Montana.

**Committee Chair:** Brendan Moynahan ([brendan\\_moynahan@nps.gov](mailto:brendan_moynahan@nps.gov), or [moynahanb@gmail.com](mailto:moynahanb@gmail.com))

# AD HOC COMMITTEES

## CONSERVATION ACTION

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

**Committee Chair:** Open (please contact MTTWS Executive Board if you are interested)

## GRANTS

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

**Committee Chair:** Claire Gower ([cgower@mt.gov](mailto:cgower@mt.gov))

## EFFECTS ON RECREATION

This ad hoc committee oversees distribution and updates of the Montana Chapter report entitled, Effects of Recreation on Rocky Mountain Wildlife - A Review for Montana. See Recreation in Wildlife Habitat: <http://joomla.wildlife.org/Montana>

**Committee Chair:** Dan Bachen ([dbachen@mt.gov](mailto:dbachen@mt.gov))

## SPECIES OF CONCERN

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

1. Development of a status paper which summarizes all relevant information on the biology and status of the species in Montana, and
2. Completion of the NatureServe status model which evaluates population size, range extent or area of occupancy, short and long-term population trends, intrinsic vulnerability, environmental specificity, and scope, severity, and immediacy of threats.

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

**Committee Chair:** Dan Bachen ([dbachen@mt.gov](mailto:dbachen@mt.gov))

# MEMBERSHIP IN THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY

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

## Membership Benefits

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

1. Close association with a group dedicated to wise use of our state's wildlife resources. Members come from universities, colleges, high schools, environmental consulting firms, state and federal agencies, private organizations, and business.
2. Reduced registration fee for participation in the Annual Conference, where timely resource topics are explored.
3. Workshops that permit exploration of selected wildlife topics and management activities.
4. The Newsletters, containing reports on items of interest to wildlife professionals in Montana.
5. The opportunity to influence state and federal policy through an organization capable of providing a unified professional opinion on Montana's wildlife issues.
6. Providing support for the Intermountain Journal of Sciences.

## Information Updates

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

## Peer Network

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

## Continuing Education

Gain in-depth exposures to timely wildlife management concerns by attending chapter meetings. National membership also allows you to demonstrate your dedication to professional development by achieving and maintaining the status of a Certified Wildlife Biologist®.

## Professional Growth

Students can obtain leadership skills and enhance their professional growth by serving as an officer, on a committee, or giving a presentation at a chapter meeting. We welcome you to join the Montana Chapter of The Wildlife Society. There is a role in the Chapter for the wildlife biologist, manager, technician, conservation officer, educator, naturalist, and any individual concerned about the welfare and future of Montana's wildlife resources.

## Becoming a Montana Chapter Member

To become a member log onto <https://mttws.org/membership/>



## Now Available on the Internet

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### **What is IJS?**

- *The Intermountain Journal of Sciences (IJS) offers a regional peer-reviewed journal for scientists, educators and students to submit original research, management applications, or viewpoints concerning the sciences.*
- *IJS has been published since 1995 to enhance the educational outreach goals of the sponsoring organizations.*

### **What is Published in IJS?**

- *Any regional submissions of manuscripts dealing with the sciences are welcome.*
- *Abstracts from presentations at annual meetings of the co-sponsoring organizations appear in the last issue of each volume if submitted by the sponsoring organization(s).*

### **What is Available Online?**

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