THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY
60TH ANNUAL CONFERENCE

FOSTERING DIVERSITY IN SPECIES, PEOPLE, AND PERSPECTIVES

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THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY

60TH ANNUAL CONFERENCE, 2022

"Fostering Diversity in Species, People, and Perspectives"

February 22 - 24, 2022

MT TWS Goes Virtual (Again!)
(Because we are in the future, well really the present, which feels maybe like purgatory…well, wherever we are, we are virtually together again!)

Contents

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 principal 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.

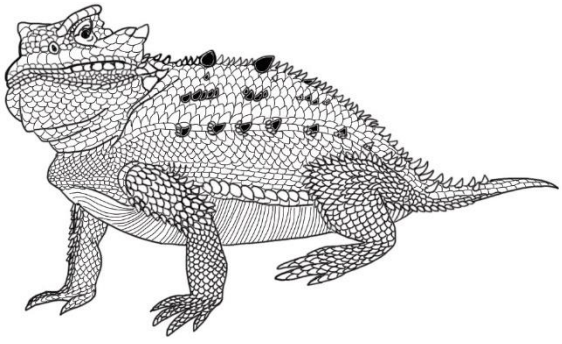
The Montana Chapter of The Wildlife Society was chartered in 1962 and formally organized with the election of its first officers in 1963. Adoption of chapter bylaws occurred in 1964. The mission of the Montana Chapter of The Wildlife Society is to encourage and support effective wildlife management in 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 only as strong as our members and participation. We have numerous committees that need active participation from members. We encourage member nominations to fill our elected positions, and presentations from researchers, managers, and students are always needed to continue communication among 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 is the official publication for the printed proceedings of our annual meetings and submission of multidisciplinary scientific manuscripts for review and publication.



2021 - 2022 MONTANA TWS CHAPTER OFFICERS

President: Andrew Jakes (Smithsonian Conservation Biology Institute)
Past-President: Brett Dorak (Montana Fish, Wildlife & Parks)
President-Elect: Andrea Litt (Montana State University)
Secretary: Rebecca Mowry (Montana Fish, Wildlife & Parks)
Treasurer: Heather Brower (Pheasants Forever)
Montana State University Student Chapter President: Emma Heydenberk
University of Montana Student Chapter President: Wyatt Nielsen

2021 - 2022 MONTANA TWS COMMITTEE CHAIRS

Programs: Andrea Litt
Awards: Megan O'Reilly
Education/Information: Brent Lonner
Financial Management: Heather Brower
Membership: Heather Brower
Nominating and Elections: Andrew Jakes
Conservation Affairs: Sonja Andersen, Lance McNew, MT TWS Past President
Scholarships: Dave Willey – MSU
Paul Lukacs – UM
Species of Concern Committee (Ad hoc): Dan Bachen
Effects of Recreation (Ad hoc): Bryce Maxell, Liz Bradley
Grants (Ad hoc): Claire Gower
Intermountain Journal of Sciences (Ad Hoc): Terry Lonner and Rick Douglass

THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY
PROFESSIONAL CONDUCT DISCLAIMER
2022

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 60TH ANNUAL CONFERENCE OF THE MONTANA CHAPTER OF THE WILDLIFE SOCIETY

"Fostering Diversity in Species, People, and Perspectives"

Greetings and welcome to the 60th Annual MT TWS Conference!

Thank you for being part of our annual meeting! Although we really had hoped to be together again this year, we've put together yet another virtual conference. Thankfully (?!), we've learned some things over the past year and hope you will find great value in the insights and connections you make this week (and beyond). I have greatly enjoyed serving as President-elect this year – developing the ideas for the theme and plenary session, making new connections, working with the Executive Board, and learning so much about this chapter and the incredibly dedicated wildlife professionals in Montana. I hope we'll all be able to connect in-person again soon.

Fostering diversity in species, people, and perspectives

As a profession, we've long recognized the value of diversity in the species and ecosystems where we work. Many organizations, including The Wildlife Society, are having important, but often challenging, conversations about the value of diversity, equity, and inclusion (DEI) with regards to people. Several studies have supported the idea that diverse perspectives lead to increased productivity and innovation, enhanced problem-solving, as well as outcomes that are more relevant to society. In many cases, these conversations have led to developing policies and initiatives that reduce barriers to participation, support recruitment and retention, and better ensure that diverse voices are heard. This year's conference theme engages us in these conversation and focuses on one of the MT TWS chapter's goals: developing a diversity of perspectives, backgrounds, and individuals unified behind our core mission.

The plenary session features panelists from diverse backgrounds, with diverse personal and professional experiences. They will share their diverse perspectives and challenges they (or others) have faced, but also propose suggestions for reducing barriers to participation and potential ways we can all help foster diversity in our profession. I'm excited about what can emerge from these conversations.

Workshops

We have three workshops this year; these will all be live sessions on Tuesday. One workshop aims to provide participants with background information to prepare wildlife habitat-focused grazing plans when working with private ranchers and ranch managers. We also have a workshop that will share tips, examples, and strategies for creating and refining effective resumes, including how to navigate the challenges of USAJobs. The final workshop should be a fun one – focused on different ways to prepare your hunting harvest, from sous vide to charcuterie! Enjoy!

Posters and Presentations

We are grateful to have so many papers and posters being presented during our conference. These contributions represent many diverse agencies and universities, including both undergraduate and graduate students. Thank you for sharing your work!

Acknowledgements

The MT TWS annual conference is the product of the efforts of many people, over an entire year. It takes time and dedication from the Executive Board, members, volunteers, sponsors, and everyone involved to work diligently to produce such a great event, especially finding ways to make a virtual conference the best it can be! Throughout the year, so many people stepped in to help. I will do my best to mention and thank everyone, but I do realize that there is a

chance I may miss some individuals. So, to everyone, I want to say THANK YOU! Please know that your time, energy, and dedication to the MT Chapter and the conference is greatly appreciated.

First, to the members of The Wildlife Society (state and national), thank you for being a part of such a great organization and helping to "To inspire, empower, and enable wildlife professionals to sustain wildlife populations and habitats through science-based management and conservation."

To the Executive Board: Andrew Jakes, Brett Dorak, Heather Brower, and Rebecca Mowry – I have enjoyed working with you and greatly appreciate your hard work and dedication. Thanks for sharing your knowledge about navigating planning a virtual conference and for your patience as I learned the ropes.

A huge thank you to the amazing, efficient, and fun team from the next great event: Kerrell Dunsmore, Tricia Fry, and Jen Sharpe. I really enjoyed working with you. Thanks also to X-CD for your virtual platform and expertise. Without your assistance, commitment, and willingness to share the lessons you have learned about virtual conferences, I would have been lost.

To all the attendees that submitted abstracts to share your research and experiences through presentations and posters, thank you. These presentations are the centerpiece of our conference every year.

To the plenary session presenters: Gayle Joslin, Kqyn Kuka, Erim Gomez, Chad Bishop, Janene Lichtenberg, Brett Stevenson, and Serra Hoagland – I am very grateful for your willingness to participate – you helped my idea come to life. Thank you for sharing your diverse perspectives with me and the entire chapter, to help us learn, grow, and improve as a profession.

Thanks to Dave Willey, Bob Garrott, Dan Tyers, Tom Healy, Steve Riley, Catherine Wightman, Kami Kilwine, Rick Northrup, Hunter Van Donsel, Kelvin Johnson, Aaron Clausen, Marisa Sather, Martin Townsend, Stacey Barta, and Kelsey Molloy, who shared their time and expertise to offer workshops this year. These very diverse offerings helped participants prepare resumes, grazing plans, AND their hunting harvest! We are grateful for your thoughtful preparation, especially with delivering engaging workshops in a virtual format.

To the chairs and members of all of the committees – we are extremely appreciative of all of your efforts to share the workload that this conference and the chapter requires. Special thanks to Megan O'Reilly and Claire Gower for managing all of the awards and small grants.

Many thanks to the chairs and participants in the working groups – thank you for your efforts and dedication to the conference and all the work associated with such incredible commitments. Special recognition to Dan Bachen, Allison Begley, Lisa Bate, and Chris Hammond.

Thank you to Kristina Smucker and her fabulous team of judges for the student presentations! Our students benefit from your feedback, engagement, and commitment to honor their hard work.

A big thanks to all the volunteers that helped throughout the conference by moderating, interacting in the networking lounges, and filling in wherever we needed you! Thank you to Jeremy Anderson, Dan Bachen, Chad Bishop, Mike Borgreen, Leah Breidinger, Heather Brower, Jo Ann Dullum, Erim Gomez, Tabitha Graves, Heather Harris, Andrew Jakes, Will Janousek, Kelvin Johnson, Elise Loggers, Lance McNew, Dave Messmer, Rebecca Mowry, Andy Oestreich, Ken Plourde, Carly Segal, Art Soukkala, Noah Starling, James Waxe, Dave Willey, and anyone else that I missed inadvertently!

Thanks to John Kuntz – for creating a beautiful flicker image that graces our MT TWS t-shirts this year. I am sure it was challenging to choose just one species, but we'll certainly be coming back to request more of your designs in the future!

To Carly Segal – thank you for using your talents and love of the biodiversity in Montana to create the conference logo that wonderfully represents the conference theme!

A big thanks to my graduate students, who endured the challenges associated with their advisor taking on this service role with MT TWS – I greatly appreciate your support and understanding.

And finally, a giant THANKS to all of you for participating from wherever you are – it wouldn't be a conference without you.

Welcome to the 60th Annual Conference of the Montana Chapter of The Wildlife Society!

Andrea Litt

President-Elect, MT TWS

2021-2022

Memoriam: Dr. John Paul Weigand, PhD, CWB®

John Weigand passed away on December 24, 2020, with his wife, Judy, eldest daughter, Cathy, and son-in-law, Jim, at his side. John was born in Milwaukee, Wisconsin on July 23, 1936. Fishing and hunting in Wisconsin sparked his interest in wildlife biology and he completed his B.S with a double major in biology and general conservation at Central State College, now University of Wisconsin, Stevens Point in June 1958. Shortly thereafter he married his high school sweetheart and lifelong love, Judy Plenke. They then moved to Michigan State University where John completed his M.S. in fish and wildlife management with a botany minor.

John's professional career began as a game management biologist in southeast Montana (1959-61), district game supervisor in North Platte, NE (1962-66), game management and then research biologist in Great Falls/Choteau, MT (1966-74). In 1977 he completed his Ph.D. in wildlife management at Montana State University. His doctoral thesis and Journal of Wildlife Management Monograph *Ecology of the Hungarian Partridge in North-Central Montana* earned him a national Wildlife Society award. He retired in 1994 as the Chief of Research for Montana Fish, Wildlife & Parks.

After retirement, John continued to dabble in wildlife habitat management through a variety of consulting projects but recreation and travel with Judy, his children and grandchildren became the cornerstone of his daily activities. He was the "news hub" for the entire family and was sure to keep everyone connected and informed. He had an immense talent for being the center of the universe for every beloved family dog, whether mutt or purebred, lap dog or hunting dog, 10 pounds or 60 pounds. Sneaking treats to them under the table during dinner was highly suspected.

John was an avid outdoorsman and enjoyed angling for trout, walleye, bluegill and nearly anything that would bite on a slow day. He enjoyed pursuing pronghorn on the wide-open sage prairie among gumbo buttes and filling the freezer with Montana's abundant mule deer, white-tailed deer and wily wapiti. Upland birds and waterfowl were his greatest hunting passion. His time in hot pursuit of a flush from tall grass or a wing-set over decoys, with his double barrel shotgun in hand, was always a special time for John. He instilled his passion for hunting and wildlife by mentoring his five children and numerous grandchildren in hunting, fair chase, and firearms safety, and influenced hundreds of new hunters as a long-time hunter education instructor. Decades of philosophical ponderings with his children and grandchildren unwaveringly resonated with science-based habitat management and wildlife conservation, the Public Trust Doctrine of Wildlife Management, and public ownership of wildlife.

John was an active member in the Montana Chapter of the Wildlife Society, serving as Vice President (1972), President-Elect (1978) and President (1979). He presented the prophetic "Are the Threats to Hunting in Montana Real?" at the Chapter's 1980 annual meeting.

John also offered his energy, expertise and knowledge by actively participating in the Weapon's Collector Society of Montana as a Founding Member, and local chapters of Ducks Unlimited and Pheasants Forever.

Although he considered himself a mere a youngster when speaking of his predecessors' accomplishments in establishing Montana's wildlife legacy, those who knew John grant him similar mention and honors with fervor. Through John, and those he considered his mentors, we "youngsters" have been provided a great inheritance to shoulder, carry into the future, and provide to those that follow.

"**If I have seen further, it is by standing on the shoulders of Giants**." (Isaac Newton, 1675)

2022 NOMINEES FOR EXECUTIVE BOARD OFFICERS

PRESIDENT-ELECT CANDIDATES

Chad Bishop

It would be an honor to serve as your next President-Elect of the Montana Chapter of The Wildlife Society. I am the Director and Professor of the Wildlife Biology Program at University of Montana. I have been a member of the Montana Chapter for six years now and have been thoroughly impressed with how the Chapter operates. I especially value and appreciate the collegiality among members and the Chapter's focus on student engagement and professional development at annual conferences. I would be excited to work with Andrea Litt and the Executive Board to continue the impressive work of the MT Chapter and to help advance strategic priorities of the Chapter. I am running for President-Elect as a way to give back to the Chapter. I just completed service as Past President of the National Association of University Fisheries and Wildlife Programs and now have the capacity to step in to this role with the Montana Chapter should I be elected.

Previously, I served five years on the Executive Board of the Colorado Chapter of The Wildlife Society and as President in 2004. During my time in Colorado, I organized three annual meetings and two workshops. I also served as the Student Awards/Scholarships Chair for the Colorado Chapter during 2005-2012. I have been a member of The Wildlife Society since 1996 and am presently a member of the Biometrics, Native People's Wildlife Management, and Nutritional Ecology Working Groups.

Prior to my work at UM, I worked for Colorado Parks and Wildlife as the Assistant Director of Wildlife and Natural Resources (2012-2015), Mammals Research Leader (2009-2012), and Wildlife Researcher (1999-2009). I earned degrees in wildlife biology from Montana State University (BS, 1995), University of Idaho (MS, 1998), and Colorado State University (PhD, 2007).

Mike Borgreen

Mike Borgreen is a Wildlife Biologist for the Bureau of Land Management in the Glasgow Field Office. Mike was born and raised in Lewistown, MT and received his B.S. in Ecology (2003) and an M.S. in Animal and Range Sciences (2010) focusing on bison reproduction from Montana State University.

Mike started his federal career with the U.S. Fish and Wildlife Service. In 2004, he joined the Regional Wildlife Health Office in Bozeman, MT working on a wide array of wildlife health and disease issues throughout the Mountain-Prairie region. In 2012, Mike became the Refuge Biologist at Medicine Lake National Wildlife Refuge in Medicine Lake, MT. There, his research focused on investigating the effects of prescribed fire and grazing on mixed grass prairies, wetland management, and the effects of oil and gas development on USFWS fee-title lands.

In 2018, he transitioned into his current position as the Wildlife Biologist for the BLM in Glasgow, MT. Current research projects include crested wheatgrass reconstructions and the role soils play in success of native seedings, habitat selection by greater sage-grouse hens, and roost site selection of 2 bat species, among others. Mike works closely with numerous state, federal, university, non-profit and NGO partners to leverage funding and capacity to maximize conservation efforts. His achievements in this area were recently recognized when Mike was awarded the 2021 BLM Director's Excellence in Stewardship Award.

If elected, Mike would seek to bring his diverse and unique background and passion for mentorship to the President's position to further research interests in addressing land management challenges.

Katie Benzel

Katie Benzel is a wildlife biologist for the BLM Dillon Field Office (DFO). Growing up in Dillon, she spent her free time in the mountains where she cultivated respect and appreciation for the outdoors and wildlife. Since the age of eleven, she couldn't think of any other occupation she'd like to pursue other than becoming a wildlife biologist. She attended Colorado State University for 2 ½ years before transferring to the University of Montana and graduating with a B.S. in wildlife biology in 2004. To diversify her knowledge of range management and wildlife habitat, she completed a M.S. in Range Science from Montana State University in 2008. Throughout college she worked as a seasonal wildlife technician for the Forest Service and BLM in Dillon. Under the Student Career Experience Program (SCEP) with the BLM Missoula Field Office, she continued to work as a wildlife technician through grad school. The stars aligned around the time she was graduating, and one of her mentors and supervisors at the DFO was retiring and through the SCEP she was offered her current position. Public lands are vitally essential, and she is grateful to work on the landscape that is deeply important to her. As a wildlife biologist for the BLM, she advocates for wildlife and habitat while navigating the complexities of managing multiple use public lands. Communication and willingness to hear all perspectives is required. She continues to spend her free time in the mountains hiking, skiing, running, hunting, camping, and backpacking.

SECRETARY CANDIDATES

Brandi Skone

Originally from western Pennsylvania, Brandi received her Bachelors in Zoology from Ohio Wesleyan University (2004). She worked for the next six years as a technician and crew lead with multiple organizations including U.S. Geological Survey, Kentucky Department of Fish & Wildlife, Virginia Tech, and Science Applications International, moving her way west with each job, before earning her M.S. in Biological Sciences from Montana State University (2014). Since 2014, she has worked for Montana Fish, Wildlife & Parks as a nongame biologist in southeast Montana where she resides with her husband and ever-growing farm of animals. Brandi has always enjoyed participating in the Montana Chapter of The Wildlife Society. She is running for secretary to take a more invested role, learn how things work behind the scenes, and give back to such a great organization.

Shannon Hilty

Shannon is a wildlife biologist and bat specialist with over 14 years of research and management experience related to nongame species. She received her B.A. in Ecology and Organismal Biology from University of Montana, Missoula and her M.S. in Fish and Wildlife Management from Montana State University, Bozeman. Between schooling, Shannon worked for the Montana Natural Heritage Program for many years where she studied a variety of taxa, including bats, small terrestrial mammals, amphibians, reptiles, songbirds, raptors, invertebrates, and special status plant species. After graduate school she dabbled in environmental consulting before becoming the Nongame Wildlife Biologist for Montana Fish, Wildlife & Parks Region 4.

Shannon has been a board member of the Western Bat Working Group since 2016 and has several years of secretarial experience. She is passionate about Montana and the wildlife that reside here and welcomes the opportunity to work with the Montana Chapter of The Wildlife Society.

In her free time, Shannon loves to backpack in the mountains, cross country ski, birdwatch and see new places while traveling with her family, Haendel, Bridger, Rice, and Bean.

GENERAL CONFERENCE SCHEDULE

All Times MST	Tuesday, Feb 22			Wednesday, Feb 23		Thursday, Feb 24	
9:00	Beginning Friday, Feb. 18 - Poster and Oral Presenatations Available On-Demand	Workshop: Grazing Planning for the Wildlife Manager	Bird Conservation Partnership Working Group	Poster and Oral Presenatations Available On-Demand	Welcome and Plenary: Fostering Diversity in Species, People, and Perspectives	Poster and Oral Presenatations Available On-Demand	
9:30							
10:00							MTTWS Business Meeting
10:30							
11:00							
11:30							
12:00					Brown Bag Lunch - Student/Mentor Networking		Brown Bag Lunch - Student/Mentor Networking
12:30							
13:00		Workshop: Strategies to Create a Student Resume and Navigate	Montana Bat Working Group		Oral Presentation Live Panel Q&A		Oral Presentation Live Panel Q&A
13:30							
14:00							
14:30							
15:00		From Birds to Bid Game - Up Your Game on Butchering, Brining, Charcuterie and Sous Vide	Harlequin Duck Working Group				
15:30							
16:00							
16:30					Award Ceremony followed by Happy Hour - BYOB		MT TWS Board Wrap Up
17:00							
17:30							
18:00							
18:30							
19:00							

2022 CONFERENCE DAILY SCHEDULE

Tuesday, February 22

- **Pre-recorded Montana TWS Conference Presentations Available On-Demand (X-CD Main Platform)**
- **Working Group Meetings**
  - **Montana Bird Conservation Partnership Working Group:** 9:00am – 11:00am
  - **Montana Bat Working Group:** 1:00pm – 3:00pm
  - **Harlequin Duck Working Group:** 3:00pm – 5:00pm
- **Workshops**
  - **Grazing Planning for the Wildlife Manager:** 9:00am – 12:00pm
  - **Strategies to Create a Student Resume and Navigate USAJobs.com:** 1:00pm – 2:00pm
  - **From Birds to Big Game – Up Your Game on Butchering, Brining, Charcuteries and Sous Vide:** 3:00pn – 5:00pm

Wednesday, February 23

- **Pre-recorded Montana TWS Conference Presentations Available On-Demand (X-CD Main Platform)**
- **Welcome & Plenary Session (X-CD Live Channel):** 9:00am – 11:30am
  - **Welcome & State of the Chapter Address (**MT Chapter President Andrew Jakes)
  - **Plenary Session & Panel Discussion:** "***Fostering Diversity in Species, People, and Perspectives***" **(**Introduction by MT Chapter President-Elect Andrea Litt)
  - **Panelists:**
    - Gayle Joslin – Retired Area Biologist (Montana Fish, Wildlife & Parks)
    - Kqyn Kuka – Montana Fish, Wildlife & Parks (Tribal Relations Liaison/Diversity Coordinator)
    - Dr. Erim Gomez – University of Montana (Assistant Professor)
    - Dr. Chad Bishop – University of Montana (Director, Wildlife Biology Program)
    - Janene Lichtenberg – Salish Kootenai College (Department Head, Wildlife and Fisheries)
    - Brett Stevenson – Salish Kootenai College (Alumnus)
    - Dr. Serra Hoagland – US Forest Service (Biologist/Liaison Officer)
- **Brown Bag (Networking Rooms):** 12:00pm – 1:00pm
    - State Agency
    - Federal Agency
    - University/Academy
    - NGO/Non-Profit
    - Tribal

- **Oral/Poster Presentations Live Panel Q&A**
  - **Birds I:** 1:00pm – 2:00pm
  - **Biodiversity:** 2:00pm – 3:00pm
  - **Ungulates I:** 3:00pm – 4:00pm
- **Awards Ceremony followed by Happy Hour!!!**
  - **Awards:** 4:30pm – 6:30pm

Thursday, February 24

- **Pre-recorded Montana TWS Conference Presentations Available On-Demand (X-CD Main Platform)**
- **MT TWS Business Meeting:** 10:00am – 12:00pm
- **Brown Bag (Networking Rooms):** 12:00pm – 1:00pm
  - State Agency
  - Federal Agency
  - University/Academy
  - NGO/Non-Profit
- **Oral/Poster Presentations Live Panel Q&A**
  - **Birds II:** 1:00pm – 2:00pm
  - **Methods and Technology:** 1:00pm – 2:00pm
  - **Mammals:** 2:00pm – 3:00pm
  - **Ungulates II:** 3:00pm – 4:00pm
- **MT TWS Board Wrap Up!!!!:** 4:30pm – 5:00pm

CONFERENCE LOGO ARTIST

AND WINNER OF THE 2022 STUDENT ARTWORK CONTEST

Carly Segal

MONTANA STATE UNIVERSITY

Carly Segal has worked in Yellowstone National Park for a number of biological and ecological studies, although the majority of that time has been spent as a technician for the Yellowstone Bison Ecology and Management Office. She is now a masters student at Montana State University in the Ecology Department working on a study of arthropod diversity in relation to vegetation characteristics and bison grazing. Prior to living in Montana, she spent a number of years working in mostly states that border Canada, with a few states bordering Mexico thrown in as well. She is an avid trail runner, backcountry tripper (paddling or backpacking), and gardener. Though she loves the mountains, ocean, and desert, Montana feels like home at the moment. Carly finds it important to incorporate art into her life because it helps her stop and really take note of what's going on around her, she rarely heads into the backcountry without a sketch book and enjoys oil painting in her front country life. She aspires to become a biologist and hopes to be able to continue to incorporate backcountry work into her future studies.

About the cover

"Montana is a state that hosts a tremendous amount of biological diversity with studies on most taxa, often connected in surprising ways. In thinking about the theme this year of "Fostering Diversity in People, Species, and Perspectives", I was a little overwhelmed in thinking about how to show it all. I decided to try and represent an iconic Montana species from most kingdoms as a reminder that we are very good at justifying the importance of conservation across these taxa that make Montana, Montana, and that it is equally important to put that energy into fostering a diversity of people who carry out this work." - Carly

PROFESSIONAL DEVELOPMENT WORKSHOPS

Grazing Planning for the Wildlife Manager

Instructors: Steve Riley (Northern Great Plains Joint Venture) and many other partners.
Date and Location: Tuesday, February 22, 9:00am – 12:00pm (Zoom)
Cost and participant limits: Free, 48 participants

This workshop will provide participants with background information to prepare wildlife habitat focused grazing plans when working with private ranchers and ranch managers.

Strategies to Create a Student Resume' and Navigate USAJobs.com

Instructor: Drs. Bob Garrott (MSU). Dave Willey (MSU), and Dan Tyers (USFS)
Date and Location: Tuesday, February 22, 1:00pm – 2:00pm (Zoom)
Cost and participant limits: Free, NA

This workshop will include tips, examples, and strategies for creating and refining an effective resume for students, including navigating USAJobs.com

From Birds to Big Game – Up Your Game on Butchering, Brining, Charcuterie and Sous Vide

Instructors: Tom Healy
Date and Location: Tuesday, February 22, 3:00pm – 5:00pm (Zoom)
Cost and participant limits: Free, NA

Learn all about different ways to prepare your hunting harvest!

PLENARY SESSION

Fostering diversity in species, people, and perspectives

Earlier in the history of the wildlife profession, we focused our more of our efforts on game species. But, over time, we've recognized that there are many reasons to value, conserve, and manage for diversity in the species and ecosystems where we work. In 1973, the Montana legislature clarified that Montana Fish, Wildlife, and Parks was responsible for managing all wildlife species, from mammals and birds to reptiles, amphibians, and more. Wildlife professionals from many organizations expend tremendous effort to manage and protect the wide diversity of species that call Montana home.

Similarly, we as a society and as a wildlife profession have increasingly recognized that diversity in people – their backgrounds, experiences, perspectives – contribute great value to workplaces, collaborations, and our personal lives. Researchers have documented evidence that diverse teams bring a wider range of skills, life experiences, and cultural insights, and are more productive, creative, and engaged. But, just like with biodiversity of species in the places we work, we have to devote concerted effort to increase and maintain diversity in the people in our profession.

To this end, more and more organizations have developed policies and initiatives that reduce barriers to participation, support recruitment and retention, and better ensure that diverse voices are brought to the table and heard. The national chapter of The Wildlife Society has been part of these efforts, establishing a Standing Position on Workforce Diversity, developing several working groups focused on diverse groups, creating awards, workshops, professional development programs, and many other resources to increase and support diverse perspectives.

Today, for our 60th conference of the Montana Chapter of The Wildlife Society, our panelists will share their diverse stories about diversity, equity, and inclusion – the challenges they have experience or observed, the concerted efforts they have been part of, as well as some ideas for how we all might help to strengthen our profession, as we move into the next 60 years!

PLENARY SESSION SPEAKERS

Gayle Joslin

Gayle retired from Montana Fish, Wildlife and Parks after a 32 year career with the state. In 1969, despite unwelcoming professors, she entered the Wildlife Management curriculum at Montana State University, as the only female. Upon graduation from MSU in 1975, she became a research biologist with the University of Montana, trapping and monitoring grizzly bears as they were being listed under the Endangered Species Act. Her supervisor at the time was unusually progressive in his willingness to hire her, and then several other women. She went on to work on projects ranging from mountain goats and elk to urban wildlife and public land development impacts upon wildlife. Navigating human psychology turned out to be the most challenging aspect of the job.

In retirement, Gayle spends much of her time advocating for and litigating on behalf of public land wildlife habitat. She has two children and 3 grandchildren who love to go camping and exploring with their grandma.

Kqyn Kuka

Kqyn Kuka was hired as a field game warden in 2007, at the time there were only two female game wardens within the Montana Fish, Wildlife and Parks enforcement department. As a result, she understands the dynamics of gender equality, inclusion, and diversity. She empowers women by teaching conflict resolution through understanding prejudices and the common resistance to change when working in predominately male fields. She empowers everyone to lower their barriers to differences by teaching communication skills and open-minded techniques.

After 12 years with the enforcement division, Kqyn Kuka became the first female sergeant in the history of Montana's Fish, Wildlife, and Parks. Currently, she holds the position as Tribal Liaison and Diversity coordinator, the first and only to hold this position as well. Kqyn brings a unique perspective to the professional associations between state and other agencies. She manages interactions with Montana's tribal governments to facilitate the working relationship between the tribes and the state of Montana.

Kqyn's actions help provide the opportunity for the Tribe's voices to be heard at the same table as the state government. This action is both meaningful and historic for the state and tribal governments. Working with colleagues from the Tribes and the state has further opened Kqyn's mind and heart to managing our natural resources. Kqyn continues to advocate and ally for our Tribal nations and diverse populations as we face challenges, and she will continue spreading knowledge of Montana's Indian people.

Dr. Erim Gomez

Dr. Erim Gómez is an assistant professor of wildlife biology at the University of Montana. Gómez holds a Bachelor of Science in Environmental Studies from Southern Oregon University and Masters and Ph.D. in Natural Resource Sciences from Washington State University. Gómez considers himself a conservation biologist. His more recent research work aims to understand the habitat occupancy of charismatic mini-fauna; from crayfish and amphibians to butterflies and birds.

Gómez is a first-generation American and is proud of his parent's farm working and immigrant roots. He spent a decade as advisor to the largest Latinx college student organization in Washington, MEChA de WSU. He is devoted to encouraging students from under-represented groups to pursue higher education, sciences, and the conservation profession. In service of this goal, he teaches Careers in Wildlife Biology at UM, and nationally gives workshops, keynotes, serves panels on the DEI in STEMS and conservation profession. Gómez is founding Advisor of UM's Chapter of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (largest STEM Diversity organization in the country).

Dr. Chad Bishop

Chad Bishop is Director of the Wildlife Biology Program and Professor in the Department of Ecosystem and Conservation Sciences at University of Montana (2015 – present). As Director, Chad is responsible for a wide array of functions tied to running the wildlife program, with an emphasis on faculty and student support and program outreach and development. He also teaches courses and leads multiple research projects focused primarily on ungulate ecology. Prior to University of Montana, he spent nearly 16 years working for Colorado Parks and Wildlife, initially as an ungulate researcher and later as an administrator. He received his B.S. degree from Montana State University, M.S. from University of Idaho, and Ph.D. from Colorado State University.

Chad began explicitly integrating DEI into his work as the Wildlife Biology Program Director several years ago by expanding graduate education opportunities for Native American students at UM. As part of those efforts, he led the wildlife biology faculty through a process of evaluating use of GRE scores in graduate admissions. In spring 2021, the Wildlife Biology Program at UM formally dropped GRE scores as an admission requirement and is in the process of adopting a holistic, more equitable graduate admissions procedure.

Janene Lichtenberg

Janene Lichtenberg is the chair of the Wildlife and Fisheries Department at Salish Kootenai College (SKC). She enjoys teaching and learning from students pursuing education, research, and future careers in wildlife

conservation and ecology. Prior to working at SKC, she spent 12 years as a wildlife biologist for the Confederated Salish and Kootenai Tribes where she worked on a variety of projects including species reintroductions, wildlife monitoring, and habitat restoration projects. She has also worked as an ecologist with the U.S. Geological Survey as well as a variety of wildlife-related seasonal positions and research internships. She grew up in Utah and received her B.S. degree in Wildlife Management from Utah State University, then completed her M.S. degree from University of Arkansas where she conducted research on trophic interactions among birds, insects, and oaks. She is a long-term member of The Wildlife Society, a board member for TWS Native Peoples' Wildlife Management Working Group, and faculty advisor of the SKC chapter of the Ecological Society of America SEEDS (Strategies in Ecological Education, Diversity, and Sustainability) club. She enjoys spending her free time skiing, hiking, hunting, birding, kayaking, fishing, biking and relaxing with her husband and three teenage sons.

Janene will be joined by Brett Stevenson who is an alumni of the Salish Kootenai College.

Dr. Serra Hoagland

Dr. Serra Hoagland (Laguna Pueblo) serves as the Liaison Officer/Biologist for the USDA Rocky Mountain Research Station Missoula Fire Sciences Lab to Salish Kootenai College. She focuses on building local, regional and national partnerships with tribes and intertribal organizations, mentoring students in natural resources, and conducting research that is relevant to Native communities.

PRESENTATION AND POSTER ABSTRACTS

Alphabetical by Presenter's Name

*Indicates Presenter
**Indicates Student Presentation

Assessing the Presence and Impacts of White-nose Syndrome on Montana's Bat Populations through Disease Surveillance and Long-term Acoustic Monitoring

Emily Almberg***,** Montana Fish, Wildlife and Parks
Kristina Smucker, Montana Fish, Wildlife and Parks
Dan Bachen, Montana Natural Heritage Program
Kathi Irvine, US Geological Survey
Christian Stratton, Montana State University
Justin Gude, Montana Fish, Wildlife and Parks
Jennifer Ramsey, Montana Fish, Wildlife & Parks

Abstract: In 2019, Montana Fish, Wildlife and Parks, the U.S. Geological Survey, and the Montana Natural Heritage Program designed a plan to assess how the invasion and spread of the fungus *Pseudogymnoascus destructans* (Pd), which causes the disease White-Nose Syndrome (WNS), might impact bats across Montana. The resulting project involves annual, statewide surveillance for Pd and WNS to estimate the arrival and distribution of the disease, and long-term acoustic monitoring to assess bat occupancy and activity. Pd was first detected in Montana in 2020. In 2021, we surveyed 35 sites across the state, 9 of which were Pd-positive. WNS was first confirmed in 2021 among little brown bats (*Myotis lucifugus*) in Fallon, Carter, and Phillips Counties. As of 2021, Pd and WNS detections remain restricted to the eastern half of the state. During the summer of 2021, volunteers and staff from state, federal, and non-profit organizations deployed acoustic detectors at 87 North American Bat Program grid cells. We will use a Bayesian hierarchical model to estimate both occupancy and relative activity before versus after the arrival of WNS. Understanding the impacts of WNS on Montana's bats will inform decisions about how Montana pursues bat management and conservation strategies—whether it be treatments specific to WNS or ecological approaches toward offsetting the costs of disease. Wildlife and land management agency staff in Montana are currently engaged in a structured decision-making process to understand how best to respond to WNS while trying to maximize the abundance and distribution of bats across the state.

Glacier's ghosts: estimating Canada lynx occupancy and density in Glacier National Park with a passive camera array during summer **

Alissa Anderson*****, Washington State University
Dan Thornton, Washington State University
John Waller, National Park Service

Abstract: Glacier National Park (GNP) is a large, protected area within the northern Rockies Canada lynx (*Lynx canadensis*) recovery unit, however knowledge of lynx distribution within the park is limited. Traditional means of monitoring lynx are not easily achieved in GNP due to difficulty in access during wintertime. Therefore, our intent was to complete the first park-wide occupancy survey of lynx using an array of passive camera traps during summer, a method recently found to be successful in other southern range edge populations. Within a smaller area of the park, we also tested the possibility of identifying individuals from subtle markings on the inside of the front leg to estimate density via spatially explicit capture-recapture. Finally, we linked park-wide predictions of occupancy with local density to estimate lynx population size across GNP. We found lynx distributed across much of the park and in the density study area we were able to successfully identify ~75% of lynx captures to individual based on coat markings. We estimated average park-wide lynx density at 1.2/100km^2 (95% CI: 0.7 – 2.2) resulting in an estimated population of 52.4 (95% CI: 29.9 - 91.8) lynx during summer. Our findings suggest that much of GNP is highly suitable habitat for lynx in the summer, with habitat mostly at or above the current elevational and climatic limits used by lynx. Based on our results, we propose that GNP should be considered as a potentially important area for lynx habitat refugia in a warming climate.

Climatic conditions and migration distance drive timing of autumn migration in mule deer

Colby Anton***,** Montana Cooperative Wildlife Research Unit
Nick DeCesare, Montana Fish, Wildlife & Parks
Collin Peterson, Montana Fish, Wildlife, & Parks

Abstract: Seasonal migration is a behavioral strategy that animals have evolved to exploit seasonally changing resources. A predictable pattern for many ungulates in northern temperate landscapes is to seasonally migrate from low-elevation winter ranges to higher-elevation summer ranges, allowing individuals to exploit a diversity of forage resources during summer while avoiding extreme winter conditions. In Montana, ungulate migrations often cross multiple hunting districts, and the timing of autumn migration often coincides with hunting seasons. Here, we utilize GPS collar data during 2017-2019 from 68 female mule deer (*Odocoileus hemionus*) spanning three distinct study areas in northwest Montana to evaluate the spatial and temporal patterns behind autumn migration. We first conducted descriptive summaries of the timing of autumn migrations with respect to hunting district boundaries and found that deer spanned multiple (up to 8) hunting districts across all 3 study areas. While many deer returned to winter

range during archery season, some remained in wilderness until after the general rifle season concluded. Next, we related the timing of autumn migration to environmental variables like precipitation, snow depth, temperature, plant phenology (NDVI), migration distance, and estimates of relative hunting intensity. In addition, we summarized climatic and hunting variables across multiple temporal scales (2-day, 1 week, and 2 week) to identify possible lagged or cumulative effects of environmental conditions on mule deer behavior. We found that plunging minimum temperatures provided a strong cue for mule deer to begin their migration back to winter range.

Assessment of Species Diversity and Habitat for Bats in the Limestone Hills of Central Montana

Dan Bachen***,** Montana Natural Heritage Program
Alexis McEwan, Montana Natural Heritage Program

Abstract: Bat species use a diversity features as day roosts including man-made structures, caves, trees, and rock outcrops which provide crevices and cavities to shelter in during the day. While roosts such as caves and mines are relatively will studied, roosts in rocks are poorly described. In July and August 2021 we conducted visual encounter surveys of rock outcrops within the Limestone Hills Training Area east of Townsend, Montana to detect roosting bats. Surveyors traversed small cliffs and talus examining cracks and crevices for roosting animals and guano. Across 10 surveys we detected three species of bat: Western Small-footed Myotis (*Myotis ciliolabrum*), Long-eared Myotis (*M. volans*), and Little Brown Myotis (*M. lucifigus*). Roosts were typically in horizontal or vertical crevices between 1 and 3 cm in width with good solar exposure. We found roosts occupied by single individuals as well as females and pups. We also use mist net deployed over water sources and acoustic detector/ recorders placed across the landscape to assess species diversity, allowing the opportunity to compare effectiveness of these methods. The same three species were detected with both roost surveys and mist nets. Using acoustic methods we recorded six species across five sites. While acoustic methods were more effective for assessing diversity than the other methods, detection of bats at rock outcrops and water sources allow assessment of the importance of the features for roosting and drinking respectively, important information for managing these species and the landscapes they inhabit.

Testing New Technology for Wildlife-Livestock Conflict Mitigation: An Evaluation of AI Enabled Camera Traps **

Taylor Bayne***,** Montana State University
Jared Beaver, Montana State University
Jeffrey Mosley, Montana State University
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Wildlife-livestock conflicts, including depredation, disease transmission, and resource competition, challenge the economic sustainability of ranches and farms that provide important

wildlife habitat. It is therefore important to explore and develop ways to mitigate wildlife-livestock conflicts. Camera trap technology that uses artificial intelligence (AI) has the potential to provide real-time information on the presence, distribution, and spatiotemporal interactions between livestock and wildlife while limiting the amount of useless images resulting from false positive triggers. Our objectives are to evaluate the performance of an edge AI-enabled ("smart") camera trap and assess applications for wildlife monitoring and wildlife-livestock conflict mitigation. We will assess the performance of the AI-enabled passive infrared (PIR) sensor of the smart camera and its ability to reduce false positive images by comparing it with two traditional game cameras. The maximum detection distance and the probability of detection for all three cameras were tested in a controlled environment in January 2022. Cameras will be deployed for a field test in March 2022. In an additional field test in spring 2023, we will assess the smart camera's ability to remotely classify wildlife images by species and remotely notify ranchers and wildlife managers of wildlife presence via cellular data connection. Timely and accurate information of wildlife presence would allow for the strategic application of conflict mitigation measures and help sustain critical wildlife habitat on working lands throughout Montana and the western United States.

Greater sage-grouse chick survival as a function of grazing management, morphometric, and habitat variables in central Montana.

Lorelle Berkeley*****, Montana Fish, Wildlife & Parks
Mark Szczypinski, Montana Fish, Wildlife and Parks
Victoria Dreitz, University of Montana
Jenny Helm, University of Montana
Justin Gude, Montana Fish, Wildlife and Parks

Abstract: Chick survival is the lowest and most variable vital rate for grouse, but it is important because surviving individuals contribute to the breeding population each year. We estimated the effects of grazing, morphometric, and habitat variables on chick survival in a greater sage-grouse population in central Montana where the Natural Resources Conservation Service and landowners implemented Sage-Grouse Initiative (SGI) rotational grazing systems during 2011-2019. We used a Kaplan-Meier survival function with staggered entry and right-censoring to evaluate chick survival, log-rank models to test for differences among categorical variables, and Cox proportional hazards models to evaluate chick mortality risk as function of time-dependent and continuous variables. Annual survival estimates for 521 chicks were highly variable (range: 0.19-0.60) and differed significantly among years. Median survival time was 42 d (95% CI=33-59 d, all years pooled). Male chicks had substantially higher survival risk than females, and there was some evidence for a higher mortality risk associated with use of SGI pastures during and post enrollment, though we had low sample sizes in pre-SGI categories. Our results suggest SGI grazing management did not benefit chick survival, and that annual effects and sex of chicks were important. Managers might expect female-biased survival and fewer males displaying on leks in the spring following a year with disturbances that affect chick survival.

Bison restoration to temperate grasslands is associated with similar biodiversity outcomes in upland habitats but strong positive effects in riparian areas in comparison to seasonal cattle grazing

Andy Boyce***,** Smithsonian Conservation Biology Institute
Hila Shannon, Smithsonian Conservation Biology Institute
Kyran Kunkel, Conservation Science Collaborative, Inc.
William McShea, Smithsonian Conservation Biology Institute

Abstract: Temperate grassland biomes are globally imperiled, and species that rely on them are in precipitous decline as a result. The majority of North America's grasslands are designated as rangelands and are occupied by domestic cattle, but reintroductions of bison to restore evolutionary grazing patterns are increasingly common. Grassland landscapes in western North America have undergone drastic changes since millions of bison occupied this landscape, and the biodiversity effects of bison on modern rangelands remain poorly understood. Here, we test the biodiversity effects of native versus non-native grazers in the context of a highly diverse grassland ecosystem on the Northern Great Plains of North America. We compared the effects of 2 different grazing treatments common across the region on avian diversity: seasonally grazed and manually rotated domestic cattle, and year-round, free-moving bison. We used a variety of techniques including point counts, camera-trapping and time-series remotely sensed vegetation sampling to evaluate the effects of these two treatments on grassland biodiversity in upland and riparian habitats. We found roughly equivalent bird diversity and species-specific abundance in upland habitats, at sites occupied year-round by bison and seasonally by cattle. In riparian zones, we found that woody vegetation, and native grasses/forbs increased more rapidly over time in bison pastures, and that these changes in vegetation structure were associated with increased bird diversity and cervid occupancy. Our results suggest that both native and non-native grazers can create habitat for a highly diverse assemblage of grassland birds in uplands, but year-round bison grazing has strong positive biodiversity effects on riparian habitats compared with seasonal cattle grazing.

Identification of Bumblebee Species from Photographs Taken in the Field: Quantifying Effectiveness and Best Practices.

Anne Colgan*, USGS, Northern Rocky Mountain Science Center
Tabitha Graves, U.S. Geological Survey
Wendy Velman, Bureau of Land Management, Montana/Dakotas

Abstract: With many bumblebee (*Bombus*) species in decline across North America, there is an urgent need to collect data on the status of bumblebees in Montana; however, bumblebee identification requires specialized expertise and can be difficult in the field. Traditionally, bumblebee specimens have been collected and pinned for experts to view and identify. However, storing and managing specimens presents logistical challenges. In addition, three bumblebee species in Montana are under consideration for listing which may lead to restrictions on lethal

sampling. Taking photographs of bumblebees in the field offers a non-lethal alternative that may be more cost-effective, appropriate for species of concern, or suitable for engaging community scientists. We seek to evaluate the effectiveness of identifying bumblebee species in Montana from photographs. In collaboration with BLM Montana/Dakotas, we took photographs and collected specimens of >565 bumblebees between 2018 and 2021. The species of each bumblebee was determined separately from specimens by Montana bumblebee expert Amy Dolan and from photographs by bumblebee expert Rich Hatfield. We will use these data to answer: (1) How frequently were species identified from photographs of bumblebees, and how frequently did these identifications agree with specimen identifications? (2) What methods and practices contribute to successful bumblebee identification from photographs? (3) Are there specific species or castes that cannot be reliably identified to species level from photos? Our goal is to inform viable and efficient methods for sampling and identifying bumblebee species, including species of concern, across Montana and beyond.

Pronghorn in the Madison Valley: research-informed management actions and community-based conservation.

Julie Cunningham*****, Montana Fish, Wildlife and Parks
Kelly Proffitt, Montana Fish, Wildlife and Parks
Jesse DeVoe, Montana Cooperative Wildlife Research Unit

Abstract: Secretarial Order 3362 to improve habitat quality, winter range, and migration corridors for big game provided an opportunity to foster collaboration between Montana Fish, Wildlife and Parks (MTFWP) and private landowners using the best available science to manage habitat. Pronghorn may exhibit long distance migrations while being sensitive to anthropogenic barriers like fences, highlighting the need for data to inform pronghorn habitat management. From 2018 to 2021, 82 female pronghorn were fitted with GPS collars in the Madison Valley. Findings have been applied in many ways to follow the Secretarial Order. First, collar data defined a previously-unknown herd structure involving migratory and non-migratory herds. This information will refine how survey and inventory data will be collected and how harvest may be applied. Second, collar data defined corridors and natural and anthropogenic barriers. Problematic and non-problematic barriers were defined. Third, community-based enthusiasm for pronghorn grew into a collaboration between several non-governmental organizations to work together with private landowners to bring labor and resources to repair and remove fences. Fourth, agencies such as Montana Department of Transportation and Bureau of Land Management worked with MTFWP and private landowners to promote and enhance permeability of pronghorn fence crossings. Finally, findings from this research are beginning to be applied with the Madison County Planners to highlight the importance of development planning in the pronghorn migratory corridor. The numerous ways in which research data have been applied to improve management, develop communication, and facilitate collaboration among stakeholders in the Madison Valley will be discussed.

Comparing ancient and contemporary bighorn sheep populations using bones recovered from ice patches in the Greater Yellowstone Area

Elizabeth Flesch***,** Montana State University
Craig Lee, Institute of Arctic and Alpine Research
Beth Shapiro, University of California, Santa Cruz
Jennifer Thomson, Montana State University
Robert Garrott, Montana State University/Ecology Department

Abstract: Bighorn sheep have inhabited the Greater Yellowstone Area (GYA) for thousands of years and remain one of the ecosystem's significant large herbivores. Following the arrival of Europeans and domestic sheep grazing, exotic respiratory diseases introduced into the GYA undoubtedly resulted in catastrophic die-offs of bighorn sheep and strong selection for individuals that could mount successful immune defenses. Archaeologists studying receding ice patches in alpine areas of the GYA, e.g., Absaroka-Beartooth Mountains, have identified numerous ancient bighorn sheep skulls, fragments (e.g., horn cores and sheathes), and post-cranial bones, exposed by melting ice. Representative samples radiocarbon date to between 781 and 6311 calendar years before present. We hypothesized the genomes of the pre-contact bighorn sheep recovered from the melting ice would represent the historic condition of native sheep populations when they were more numerous and free of the diseases introduced by domestic sheep. We compared 26 mitochondrial DNA genomes from contemporary bighorn sheep in the Absaroka-Beartooth Mountains with six ancient samples by constructing a phylogenetic tree. Using this information, we evaluated how market hunting and domestic sheep diseases may have influenced the bighorn sheep population. Because mitochondrial DNA is only inherited from the mother, and because bighorn sheep groups of mothers and daughters tend to maintain similar seasonal ranges over multiple generations, we also evaluated if the regional spatial structure of bighorn sheep changed after Euro-American settlement. We believe this study will help determine how the bighorn sheep populations inhabiting the Absaroka-Beartooth Mountains has changed over several thousand years.

Motus wildlife tracking: real-world case studies and partnership building

Megan Fylling***,** University of Montana Bird Ecology Lab (UMBEL)
Maggie Blake, University of Montana Bird Ecology Lab
Joely DeSimone, University of Montana
William Blake, MPG Ranch
Kate Stone, MPG Ranch

Abstract: The Motus Wildlife Tracking System (Motus) is an international collaborative research network that uses coordinated automated radio telemetry to facilitate research and education on the ecology and conservation of migratory animals. The UM Bird Ecology Lab has deployed Motus tags on several species, including Swainson's Thrushes, Gray Catbirds, Lazuli Buntings, and Pine Siskins. We plan to deploy tags on two grasslands species, Western

Meadowlark and Grasshopper Sparrow, this coming summer of 2022. We discuss the results and research directions of tracking wild birds using Motus, as well as the partnership-building opportunities that arise from working with migratory species.

Evaluating the Effects of Electric Cables on Urban Howler Monkeys with Local Knowledge and Naturalistic Observation **

Olivia Gervacio Jakabosky*, Montana State University - The Wildlife Habitat Ecology Lab
Rebecca Smith, Montana State University - Wildlife Habitat Ecology Lab
Para La Tierra; Montana State University - Wildlife Habitat Ecology Lab
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Black-and-gold howler monkeys commonly inhabit urbanized areas of South America often using anthropogenic structures, such as electric cables, to travel across urban environments, which can result in increased rates of mortality. The urban howler monkey troops in Pilar, Paraguay, offer a unique opportunity to understand the dynamic between humans, wildlife, and complex urban habitats. With very little research existing on the howler monkey populations in Paraguay, this study aims to provide initial understanding of the relationship between urban howler monkeys and human populations through an interdisciplinary research approach. During summer 2021, we studied the two most-at-risk monkey troops in Pilar to evaluate whether proximity to electric cables is influencing monkey behavior. We grouped proximity to electric cables into 3 groups, 15 ft, and we grouped behavior into 7 classes: resting, feeding, traveling, playing, mating, grooming, and other. We found evidence that the behavior of the monkey troops had a significant behavior difference across 3 levels of proximity to electric cables ($\chi^2 = 225.8$, df = 12, $P < 0.001$). Next, we will fit a multinomial model to further assess the effect of electric cable proximity on behavior. We also explored the human dimension aspect of the monkey-cable issue by interviewing 104 community members, where views ranged from being concerned for the monkeys to viewing populations as pests. In the future, the results of this study will provide valuable sociological and ecological tools to further assess the nuances and complexities of social-ecological issues in Paraguay.

Assessing the Effectiveness of Autonomous Recording Unit Surveys for Detection of Great Gray Owls in Western Montana**

Justin Griggs*, University of Montana
Hannah Specht, University of Montana
Torrey Ritter, Montana Fish, Wildlife and Parks
Kristina Smucker, Montana Fish, Wildlife and Parks
Claire Gower, Montana Fish, Wildlife, and Parks
Allison Begley, Montana Fish, Wildlife & Parks

Abstract: Montana has classified the Great Gray Owl as a Species of Greatest Conservation Need (SGCN3) and a Species of Greatest Inventory Need (SGIN). Montana non-game species

listed as SGIN are not sufficiently monitored by standard ecological monitoring programs, typically because they are cryptic and difficult to detect. We have completed three years of surveys in high quality habitat utilizing Autonomous Recording Units (ARU) and traditional Callback Surveys to assess occupancy of this elusive species. A total of 101 cells in western Montana have been surveyed with ARU detectors, including 30 sites with two detectors deployed simultaneously. Great Gray Owls were detected in 8 of the 101 survey cells. We'll present findings on the effectiveness of ARU surveys for the detection of cryptic owl species, as well as information about the detection of non-target species of information need, and best practices for ARU surveys of owls.

Camera Trap Density Estimators: Methods Old and New

Guen Grosklos*

Abstract: Camera traps are a cost-effective and non-invasive method for collecting data on wildlife species. Recently, camera trap data has been used to estimate abundances in unmarked animal populations. In this talk, I summarize some of the different camera trap density estimators already in existence and introduce a novel method that uses dynamic processes to estimate landscape-scale abundances. I show how dynamic models may be used to incorporate movement across a landscape and how they may be applied to camera trap data. I compare this new model with four previously developed density estimators by fitting them to individual-based simulations using Bayesian methods. Note that these results are preliminary and future work will show where each of these methods are appropriate given the type of data available.

Associations Between Public Lands Cattle Grazing and Long-term Trends in Vegetation

Christopher Hansen*, University of Montana

Abstract: Cattle grazing is a common practice on public lands in the western United States; however, it is largely unknown how cattle grazing on public lands has affected rangelands. Thus, our primary objective was to identify whether grazing practices were associated with changes in herbaceous vegetation productivity on public lands. To address this objective, we acquired billed Animal Unit Month (AUM) data and above-ground herbaceous biomass data for 12,628 Bureau of Land Management BLM grazing allotments for the past 36 years. We fit linear mixed effects models with annual change and 36-year trends in vegetation biomass as response variables, and grazing intensity (AUM/ha), precipitation, and temperature as predictor variables. Trends in precipitation and temperature had the strongest effects on trends in perennial and annual herbaceous biomass, with allotments that got warmer and drier over time having the largest decreases in biomass. Grazing intensity had weak to no associations with trends in herbaceous biomass. Our results suggest that current cattle grazing practices on BLM allotments were not

strongly associated with vegetation productivity for the past 36 years, when considering allotment-scale effects across the range.

Behavior-Season Mapping of Sage-Grouse Use Intensity to Define Habitat **

Trapper Haynam*, Montana State University
Michael Borgreen, Bureau of Land Management
John Carlson, U.S. Fish and Wildlife Service
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: The greater sage-grouse (*Centrocercus urophasianus*) is a focal species in the effort to conserve imperiled sagebrush ecosystems and associated organisms. As sage-grouse numbers decline and populations become more isolated, populations in different regions must cope with unique combinations of stressors and are less likely to be replenished by surrounding populations. Therefore, it is critical that we understand and delineate local habitat to inform management decisions. Wildlife-habitat responses are typically inferred from seasonal population-level resource selection models without regard for detailed individual-level phenologies and behaviors. A more comprehensive suite of inferences and predictions may be gained by linking landscape-condition responses with specific behavior-seasons derived from movement data and expert knowledge. Our primary goal was to quantify sage-grouse landscape-condition responses relevant to management and map use-intensity for 7 distinct behavior-seasons. We attached a 22-g solar powered GPS satellite transmitter to 86 female sage-grouse in north-central Montana and have collected 188,786 geographic coordinates during 2018-04-24 – 2021-12-28. We monitored females, analyzed movement behaviors, and mapped use-intensity using a combination of field observations, nonlinear-regression movement models, a time-local convex hull approach, and generalized additive models. The relationship and magnitude of associations among sage-grouse use-intensity and landscape conditions varied among the 7 behavior-seasons which indicates that behavioral and temporal context is important for understanding habitat physiognomy and use for sage-grouse.

A preliminary look at the effects of livestock grazing on greater sage-grouse nest success and hen survival in central Montana **

Jenny Helm*, University of Montana
Lorelle Berkeley, Montana Fish, Wildlife & Parks
Mark Szczypinski, Montana Fish, Wildlife & Parks
Victoria Dreitz, University of Montana

Abstract: Livestock grazing is a dominant land use in sagebrush habitat, leading to ongoing questions about the relationships between grazing and coexisting wildlife populations. We investigated the effects of livestock grazing on greater sage-grouse demographic rates. This work is based on a decade-long collaboration among multiple agencies and private landowners in central Montana. We evaluated whether rotational grazing systems implemented through the

Sage Grouse Initiative (SGI) in central Montana can be used to effectively manage sage-grouse habitat to support different vital rates. We collected data on livestock grazing and sage-grouse demographic rates from 2011-2020. First, we synthesized grazing data in several different ways to investigate both short- and long-term effects of SGI grazing systems on demographic rates. Second, we explored the influence of the different grazing systems on sage-grouse nest success and hen survival. Preliminary results suggest that inter-annual variation has a stronger effect on both demographic rates than grazing management. In our ongoing work, we will expand our current preliminary models by adding additional habitat and weather variables. Ultimately, our findings will help inform grazing management to support sage-grouse in central Montana.

Effects of climate on Western bumble bee declines in North America now and in the future.

William Janousek*, U.S. Geological Survey
Tabitha Graves, U.S. Geological Survey

Abstract: The Western bumble bee (*Bombus occidentalis*), once common throughout Western North America is under consideration for listing by the U.S. Fish and Wildlife Service (USFWS). To support the USFWS Species Status Assessment of the Western bumble bee we assessed the relative influence of climate, land cover, and pesticides on the trends in occupancy for the Western bumble bee across its range in the conterminous United States. We used a Bayesian hierarchal occupancy model leveraging 14,457 surveys conducted over 23 years (1998-2020). We found strong support for a negative relationship between occupancy and two climate components: temperature during the warmest quarter and cumulative years of drought. We also found a complex relationship between the presence of Western bumble bee and land cover types with the species being more common in areas of increased forest and shrub cover. These relationships are non-linear and suggest forest/non-forest edge is an important habitat characteristic. We found variable declines in ecoregions across the species range from moderate declines in the Greater Yellowstone Ecosystem (-15%) to much steeper declines in the Cascades-Sierra Nevada-Coastal forests of the western US (-62% to -83%). In Montana, predicted declines are largest in the semi-arid prairies of the Eastern portion of the state (-53%) but still evident in the mountainous Western portion (-37%). We also discuss methods for future scenario planning by incorporating climate and land cover projections.

Effects of Survey Conditions on Dusky Grouse Counts in Montana **

Kellan Karch*, Montana State University
Elizabeth Leipold, Montana State University - Wildlife Habitat Ecology Lab
Claire Gower, Montana Fish, Wildlife, and Parks
Lorelle Berkeley, Montana Fish, Wildlife & Parks
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Dusky grouse (*Dendragapus obscurus*) are a species of upland game bird for which monitoring methods are still being developed. Understanding factors that influence the detections of grouse is crucial for developing survey protocols that maximize observability of grouse and provide unbiased estimates of population size and trends. Our objective was to explore

relationships between grouse counts and survey conditions to inform future statewide survey protocols. We conducted multiple 4-minute point counts during the spring mating season from late April–early June 2020. We explored the effect of wind speed, temperature, cloud cover, precipitation, minutes since sunrise, and date on the maximum number of dusky grouse counted at each site using generalized linear models and information theory. The number of grouse observed declined with wind speed (? = -0.06 ± 0.04SE), and increased with ambient temperature (? = 0.02 ± 0.01SE). The number of grouse counted for date and minutes since sunrise had a positive quadratic relationship, with peak counts occurring from May 5th – May 20th, and between 100- 150 minutes post sunrise. Higher counts were observed when cloud cover was low, and snow had the strongest negative impact compared to other forms of precipitation. These results provide valuable insight for identifying favorable conditions for surveying dusky grouse, which could lead to effective management decisions for this species.

Predicting Potential Dusky Grouse Habitat in Montana **

Elizabeth Leipold*, Montana State University - Wildlife Habitat Ecology Lab
Claire Gower, Montana Fish, Wildlife, and Parks
Lorelle Berkeley, Montana Fish, Wildlife & Parks
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Effective population monitoring protocols are needed for dusky grouse (*Dendragapus obscurus*). As a first step towards developing a method for unbiased population monitoring, we developed a habitat model to determine appropriate sampling sites. Our objectives were: 1) explore relationships between habitat characteristics and relative probability of use by dusky grouse, and 2) develop a state-wide habitat model for Montana using multiple modeling techniques. We used dusky grouse observations collected during the Integrated Monitoring in Bird Conservation's (IMBCR) spring (April-June) point count surveys from 2009–2020 and extracted habitat information using geospatial datasets for detected (used)/not-detected locations (pseudo-absent). We compared habitat characteristics at used and pseudo-absent locations using resource selection functions and random forests. We evaluated both model techniques using Area Under the Curve/ Receiver Operating Characteristics (AUC/ROC) and with an independent dataset. We averaged the predictions from both models to create a final habitat model for predicting dusky grouse habitat. Overall, we found a number of landscape level metrics to be important for predicting dusky grouse habitat, including tree height, tree canopy, elevation, slope, and several conifer forest vegetation communities. In the future, our model will assist in determining sampling sites for population monitoring.

Estimating variable pronghorn survival across their northern populations**

Molly McDevitt*, University of Montana
Paul Lukacs, University of Montana

Abstract: Estimating demographic parameters (i.e., survival and recruitment) is critical for tracking and predicting trends in wildlife populations. Learning how demographic parameters change in response to dynamic landscape and climatic conditions can provide ecologists with insight into how wildlife populations might respond to future environmental changes. Further, identifying how demographic rates vary across populations can guide management actions to maximize conservation. In this project, we study how pronghorn population survival rates vary across a range of landscapes throughout their northern distributions. Leveraging GPS location and survival data from nearly 1,000 GPS collared pronghorn across Montana and South Dakota, we estimate annual survival from over 10 populations. South Dakota Game, Fish and Parks (SDGFP) and the University of Montana have partnered with Montana Fish, Wildlife and Parks to collar over 500 juvenile male and female and adult, female pronghorn in northwestern South Dakota, central South Dakota as well as an additional 500 adult female pronghorn across eastern, central, and southwestern Montana. We used a hierarchical Bayesian survival model to estimate annual survival rates and variability across populations. By gaining more insight into how pronghorn survival rates vary across populations, we can begin to ask more probing questions about the mechanisms driving survival across space and time, and adapt conservation actions to best meet management objectives in a changing landscape.

Spatial and Temporal Patterns of Elk Aggregation on Fossil Butte National Monument

Olivia Miller*, U.S. Geological Survey
Tabitha Graves, U.S. Geological Survey

Abstract: As wildlife managers strive to limit disease transmission among their herds, information about when and where animals are congregating is crucial for making effective management decisions. We investigated the density of an elk herd that winters on Fossil Butte National Monument, WY over a five-year period from 2005 to 2010 using GPS collar data from 68 female elk to assess the spatial and temporal patterns of disease transmission risk. Using a daily proximity index and kernel density estimates, we determined that contact rates between the elk in each year were highest during the fall and winter months while the elk herd was predominately located on the Monument. This suggests that management actions taken on the Monument may have an important impact on disease transmission risk for the herd across the year, although the herd migrates to a different range in the summer. This information is particularly relevant to the Monument given the Monument's proximity to other locations with Chronic Wasting Disease (CWD). We plan to compare these results with density metrics for an elk herd that winters on the Cokeville Meadows Wildlife Refuge, WY. We anticipate that similar information across additional populations will be useful for untangling the interactions of density, population size, and environmental transmission on disease transmission dynamics.

Post-release movement by swift foxes translocated to the Fort Belknap Reservation, MT **

Dana Nelson*, Clemson University, Smithsonian Conservation Biology Institute
Hila Shamon, Smithsonian Conservation Biology Institute
William McShea, Smithsonian Conservation Biology Institute
Melissa Songer, Smithsonian Conservation Biology Institute
Nucharin Songsasen, Smithsonian Conservation Biology Institute
Harold Main, Fort Belknap Fish and Wildlife Department
Timothy Vosburgh, Fort Belknap Fish and Wildlife Department
David Jachowski, Clemson University

Abstract: In species reintroductions, monitoring post-release movement of translocated individuals can provide valuable insight into the factors influencing survival, site fidelity, and ultimately, reintroduction success. Swift fox (*Vulpes velox*) populations in Montana are primarily the result of multiple reintroduction efforts onto tribal lands in northern Montana and Canada, yet despite those actions occurring >20 years ago, an approximately 350 kilometer range gap remains between the restored population in northern Montana and southern populations near the borders of Wyoming and South Dakota. The Fort Belknap Indian Community and partners are translocating swift foxes both to promote connectivity in this range gap and to return an extirpated species to Nakoda and Aaniiih sovereign lands. To date, we have translocated and fitted 75 swift foxes with GPS collars to monitor post-release movement and measure progress towards ecological and cultural goals. In addition to an overview of the translocation process and early progress toward reintroduction benchmarks, we present preliminary results on the effects of origin, individual factors, and release strategy on distance travelled in the first two weeks post-release. We discuss the implications of findings from the first two years of translocations in terms of adaptive management of the ongoing reintroduction and for future conservation actions to promote this sensitive species.

Ongoing work to quantify livestock grazing in the sagebrush steppe using remote sensing data **

Kaitlyn Reintsma*, University of Montana
Mark Szczypinski, Montana Fish, Wildlife And Parks
Victoria Dreitz, University of Montana

Abstract: Domestic livestock grazing is the primary land use worldwide, but the influence of grazing on rangeland productivity is difficult to quantify due to its dependence on many environmental and management factors. This study examines the effect of livestock grazing on rangeland gross primary production (GPP) while accounting for effects of environmental variables. Specifically, we use Bayesian generalized linear models (GLMs) to regress field-based grazing intensity data on remotely sensed GPP and environmental covariates. Our preliminary results suggest that the grazing levels in our study area minimally influence short-term rangeland

productivity when compared to other environmental variables. Our ongoing work will consider other measures of rangeland productivity (e.g., NPP, NDVI), alternate models, and simulations to improve our predictions. Our findings will provide insight into the relationship between grazing and rangeland productivity for use in grazing management.

Aquatic Invasive Species Management In Western Montana: American Bullfrog and Common Snapping Turtle

Torrey Ritter*, Montana Fish, Wildlife and Parks
Grace Spella, AmeriCorps
Clo Smytheman, AmeriCorps
Jackie Becker, AmeriCorps
Ethan Weisgerber, AmeriCorps
Nick Goelkel, AmeriCorps

Abstract: Invasive herptiles can negatively impact native aquatic species through competition for resources, predation, and introduction of pathogens. In response to public reports and the need for updated surveys on invasive herptile infestations west of the Continental Divide in Montana, we undertook a project to survey for and control common snapping turtles (*Chelydra serpentina*) and American bullfrogs (*Lithobates catesbeianus*). We used a GIS to map potential habitat for the focal species to prioritize efforts. We used targeted outreach to collect sightings and educate the public about invasive species. Once we had compiled relevant data, we conducted surveys to estimate the extent of current infestations. Concurrently, we conducted control operations to eliminate snapping turtles and bullfrogs from key areas. During June - September of 2021, we set 78 snapping turtle traps in 40 different water bodies for a total of 593 trap-nights. Trapping success was low, resulting in the removal of 11 snapping turtles and one nest containing 73 eggs. We conducted 110 nighttime calling surveys for bullfrogs and spent 11 nights removing bullfrogs from seven wetlands. Results suggest there is not a well-established breeding population of snapping turtles in west-central Montana, but a breeding population exists in northwest Montana. Bullfrogs in west-central Montana have not significantly expanded their range since the early 2000s, whereas bullfrogs have spread past a key dispersal pinch-point in northwest Montana and are expanding towards Ninepipes Reservoir and associated wetland complexes. We suggest specific, ongoing monitoring and removal efforts to address these invasive herptiles in key areas.

Integrating Three Scales of Analysis to Compare Spiny Softshell Turtle Nesting Habitat in Dammed Versus Undammed Rivers **

Larissa Saarel*, Rocky Mountain College

Abstract: Riverine turtles' life cycles are highly adapted to the dynamic river systems in which they live. *Apalone spinifera* (spiny softshell), for example, rely on complex habitat produced through spring-flood pulse flows and minimal anthropogenic modifications for their life

processes. The extent and quality of this sort of habitat appears to be increasingly limited by the effects of dams on river systems such as on the Bighorn River, located in south-eastern Montana. In comparison, the Yellowstone River is a relatively undammed river which experiences natural flood pulses. Little research has been done that focuses on how anthropogenic modifications, especially dams, affect spiny softshells' habitats and population structure. Three scales of data were utilized (ground observations of turtle nesting sites; high-resolution (~2cm) unmanned aerial system (UAS) imagery; and medium resolution (10m) Sentinel 2 imagery, to generate a viable estimate of the amount of available spiny softshell nesting habitat in 32.2 km study areas along both the Yellowstone and Bighorn rivers in Montana. Using a smaller study area of 15-hectares within the full 32.2km study as a model for differences in nesting habitat availability between UAS imagery and Sentinel imagery resulted in about 54% nesting habitat in common on the Yellowstone and almost 86% in common for the Bighorn. These percentages were used to create a corrected full study nesting habitat estimation. When run, the Yellowstone River had almost nine times more APSP nesting habitat than that of the Bighorn. From an ecological and conservation perspective, this is important to consider.

Real-time drone data collection for improved wildlife management using a combination of radio-telemetry and thermal sensor technology.

Debbie Saunders*, Wildlife Drones, Australia

Abstract: Drones are quickly becoming a popular and valuable tool for wildlife researchers across the United States and globally. With an increasingly wide range of drone platforms and onboard sensors readily available, wildlife managers can now collect data on multiple individuals simultaneously and in real-time to directly inform actions or management decisions on the ground. This includes both radio-telemetry sensors and thermal cameras. These complementary sensors provide unique combinations of data to enable more time and effort to be directed towards managing target animals across broad landscapes, rather than searching for them inefficiently from on the ground. Such tools provide wildlife biologists with valuable real-time data for preventative measures in human-wildlife conflict areas, conservation action for endangered species as well as improving the effectiveness of invasive species control. Here we provide examples of wildlife management projects in the United States and Australia that have successfully used these sensors to provide unique insights into wildlife movements and enhance management.

A state-wide look at Montana's diverse avian datasets

Amy Seaman*, Montana Audubon
Boaz Crees, Montana Natural Heritage Program
Dan Bachen, Montana Natural Heritage Program
Bryce Maxell, Montana Natural Heritage Program

Abstract: Since the online platform eBird.org launched in 2002, millions of bird observations have been collected by citizen scientists and amateur bird observers. Today, 10's of thousands of bird observation lists are uploaded each day and the data building up is incredible. Over 391 thousand lists have been submitted by over 13 thousand observers in Montana, with 431 species having been observed. Along with trusted long-term and large-scale bird data series, like the Breeding Bird Survey or the Integrated Monitoring in Bird Conservation Regions effort, and species-specific efforts like annual fall hawk counts, a truly immense body of bird observation data has been amassed. Though the diversity of survey efforts and individual birders' contributions to data collection efforts are crucial to understanding the state's 442 bird species, they are complicated to utilize in their respective silos. Now after a multi-year partnership effort between the Montana Natural Heritage Program (MTHNP) and Montana Audubon millions of bird data records have been reviewed for final acceptance and incorporation into the MTNHP zoological database. The huge effort will directly contribute to improved range analysis tools and updated range extents for dozens of species, in addition to supporting trend analysis for Montana's birds; one of the few groups of species where enough data exists for trend analysis. In some cases, as with the Lesser Goldfinch, and Gray Flycatcher, the data may help MTNHP assess a status for the first time, and in all cases the updates will be seen immediately through the MTNHP tracker and project

Grizzly Bear Habitat Selection and Predicted Movement Corridors in Western Montana

Sarah Sells*, Wildlife Biology Program, University of Montana
Cecily Costello, Montana Fish, Wildlife & Parks
Paul Lukacs, University of Montana
Lori Roberts, MT Fish Wildlife and Parks
Milan Vinks, Montana Fish, Wildlife & Parks

Abstract: Once-contiguous grizzly bear populations remain largely isolated, and connectivity among federal recovery areas is a key concern for conservation efforts. Research has been needed to assess potential corridors that could promote genetic and demographic connectivity for males and females among recovery ecosystems. Our objective was to model grizzly bear habitat use, movement, and population connectivity. We employed GPS data from male and female grizzly bears in the Northern Continental Divide Ecosystem (NCDE) and an integrated step selection function approach to test hypotheses of habitat selection and simulate movements. Results demonstrate highly individualistic behaviors, with some individuals avoiding and others preferring various features like forest edge, riparian areas, etc. Such individualism supports the need for an individual-based modeling approach to understand and predict grizzly bear behavior.

We accordingly first used each individual's model to simulate movements within and near the NCDE using correlated random walks. We then used each model to simulate pathways from the NCDE to nearby recovery areas using randomized shortest paths. Our work is ongoing; however, preliminary results highlight potential pathways that could be targeted for proactive conservation efforts such as habitat conservation, conflict mitigation, and transportation planning.

Searching for the horny toad: Trials and tribulations to document greater short-horned lizards in Montana

Brandi Skone*, Montana Fish, Wildlife & Parks
Heather Harris, Montana Fish, Wildlife & Parks
Shannon Hilty, Montana Fish, Wildlife & Parks
Nicole Hussey, Montana Fish, Wildlife & Parks
Megan O'Reilly, Montana Fish Wildlife and Parks
Kristina Smucker, Montana Fish, Wildlife and Parks
Hannah Specht, University of Montana

Abstract: Greater short-horned lizards (GSHL) are a fascinating and cryptic lizard that are poorly documented in Montana. In the State Wildlife Action Plan, they are identified as a Species of Greatest Conservation Need (SGCN3) and a Species of Greatest Inventory Need (SGIN). With recent declines in reptile populations globally, it is important to establish baseline information about occurrence and a way to monitor population trends in the state. We developed a model to identify suitable habitat based on previous studies, existing observations, and expert opinion. We used standard methods for amphibian and reptile visual encounter surveys (ARVES) with sites randomly sampled within suitable habitat across the GSHL range as defined by the Montana Natural Heritage Program. We sampled 70 sites and observed 18 GSHL from 2016 to 2019 at 6 sites. Our efforts did not produce enough detections to support site occupancy analyses nor examination of variables that affect occupancy or detection probability. We are currently refining our habitat model and adapting our survey protocol based on recent studies and conversations with herpetology specialists to increase detections. In addition to standardized surveys, we also used outreach to request incidental observations from the public. These efforts produced more than 100 additional observations and have proven quite valuable in understanding range and habitat used by GSHL. We will continue to solicit help from the public and ask that if YOU encounter a GSHL, please help us out and let us know!

Using drones and radio telemetry to monitor wildlife in Montana

Ty Smucker*, Montana Fish, Wildlife & Parks
Thomas Brinkoetter

Abstract: We summarize work evaluating the potential use of radio telemetry equipment mounted on a small Unoccupied Aerial System (sUAS), a DJI Matrice 600 Pro drone, to support

locating wolf radio collar signals and aerial photography. A Communications Specialist R1000 receiver and Advanced Telemetry Systems 3 element yagi antenna were used to listen for signals from radio collared wolves from the ground. The Matrice 600 landing gear was modified to provide a platform for mounting the receiver electronics, the three element Yagi antenna, and a wireless transmitter/receiver system. A DJI Zenmuse Z30 30x zoom camera was mounted under the drone. Radio frequency noise from the drone controller and motor electronics initially masked weak signals from the collars. Mounting the antenna 1-2 feet above the drone significantly reduced the noise interference. Using the drone to lift the antenna 100 feet up into the air and getting above the treeline resulted in a 20 dB signal improvement over the signal strength from the ground. We plan further testing using a spectrum analyzer in place of the receiver, and a higher gain 5 element antenna to improve direction finding. Additionally, we review how drones have been used to facilitate data collection for wolves and other wildlife in Montana and beyond, and the potential for drones to facilitate more efficient, effective, and precise monitoring and management of wildlife.

Wildfire extends the shelf-life of elk nutritional resources regardless of fire severity **

Lauren Snobl*, University of Montana
Kelly Proffitt, Montana Fish, Wildlife and Parks
Joshua J. Millspaugh, University of Montana

Abstract: Large-scale, high severity wildfires are increasingly frequent across the western United States. Fire severity affects the amount of vegetation removed and helps dictate what, where, and how many plants can regenerate postfire, potentially altering the available habitat and nutritional landscape for wildlife including elk (*Cervus canadensis*). To evaluate the effects of fire severity on the Blackfoot-Clearwater elk population's summer nutritional resources, we collected field data and remotely sensed information in years two and three after the Rice Ridge wildfire to compare forage quality across multiple forest types and fire severities and developed spatiotemporal predictive landscape nutrition models. We used these models to predict forage quality across the landscape and compared the observed landscape of nutrition to an unburned landscape to assess nutritional consequence of the Rice Ridge wildfire. Wildfire increased summer forage quality in both mesic and dry mixed conifer forests regardless of fire severity. Based on our predictive models, we found that wildfire extended the duration in which elk can access high quality forage in the summer. Therefore, shortly after a large-scale wildfire, elk may be better able to meet their requirements which may positively impact elk body condition, reproductive performance, and survival. Fire has frequently been shown to increase summer nutritional resources for elk, however, to our knowledge, this is the first study to analyze the immediate impacts of fire severity on elk nutritional resources.

Movements and Habitat Use of Northern Saw-whet Owls (Aegolius acadicus) During Fall Migration

Kate Stone*, MPG Ranch
William Blake, MPG Ranch
Mat Seidensticker, Northern Rockies Research and Educational Services

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Abstract: We used radio telemetry to track the movements and habitat use of close to 100 Northern Saw-whet Owls as they traveled through the Bitterroot Valley during fall migration in 2014 and 2015. We hypothesized that owls would travel south through the Bitterroot River floodplain. Instead, we failed to detect a signal from 19 owls the day after release, suggesting they traveled a minimum of six miles to the east or west into either the Sapphire or Bitterroot Mountains, out of range of our telemetry search. Most of the other owls traveled along the valley periphery, using forested foothills. Most owls exhibited stopover behavior, staying in the same general area for several days between movements. Our greatest nightly distance moved was 40 miles and our greatest distance tracked was 60 miles from the release site. Most owls tracked on the Bitterroot River floodplain roosted high in tall ponderosa pines, in areas with a low density of small trees but a high density of medium-large trees, saplings, and shrubs. We documented one communal roost containing at least three individuals. We only saw half of the owls tracked to an individual tree or shrub; the remaining were too well hidden to detect visually. We did not find pellets and rarely observed whitewash below roosts. These results suggest that methods relying on passive observation to detect owls and/or roost sites likely miss most roost sites, at least during migration.

Fatal attraction for an imperiled songbird: Is cropland in the Northern Great Plains an ecological trap for breeding thick-billed longspur? **

Amber Swicegood*, Montana State University
Kevin Ellison, American Bird Conservancy
Marisa Sather, US Fish and Wildlife Service
Scott Somershoe, US Fish and Wildlife Service
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Population declines of thick-billed longspurs (*Rhynchophanes mccownii*) (-4% annually) are among the most severe of all grassland birds. This species has a unique habitat preference for recently disturbed or sparsely vegetated areas within mixed grass prairie and is known to occur in crop fields during the breeding season in northeastern Montana. Maladaptive selection may result in crop fields operating as ecological traps, but information on use and demography are lacking. We hypothesized crop fields provide visual cues necessary for territory selection, but frequent human disturbance and increased exposure to weather and predators should result in reduced reproductive success. To address this hypothesis, we 1) used dynamic occupancy models to compare arrival times of territorial male longspurs using data collected with autonomous acoustic recorders, 2) used open population distance sampling models to compare longspur densities and evaluate whether densities changed differentially over the

breeding season, 3) compared indices of nest density, and 4) used nest survival models to compare survival rates of nests between crop and native sites. Arrival times of territorial males were similar in both site types. Bird and nest densities responded negatively to growing vegetation and differences between crop and native sites were mediated by drought. Nest survival was similar in crop and native sites (n=240 nests). The data did not support our ecological trap hypothesis: longspurs did not exhibit a clear preference and reproductive output was not significantly reduced in crop fields.

Use of autonomous recording units (ARUs) in assessing arrival phenology of a migratory bird in the Northern Great Plains **

Amber Swicegood*, Montana State University
Kevin Ellison, American Bird Conservancy
Marisa Sather, US Fish and Wildlife Service
Scott Somershoe, US Fish and Wildlife Service
Lance McNew, Montana State University - Wildlife Habitat Ecology Lab

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Abstract: Autonomous recording units (ARUs) are increasingly used in avian research to monitor bird populations in place of human observers. ARUs are particularly useful in remote locations and allow researchers to collect continuous and systematic temporal sampling with reduced field effort. As part of a larger study assessing whether crop fields operate as ecological traps for breeding thick-billed longspurs (*Rhynchophanes mccownii*), we used ARUs to compare arrival phenologies of longspurs in crop and native sites (n=20) at the core of their breeding range in northeast Montana. Secondary spillover from native sites into crop fields may indicate preference for native prairie habitats while earlier occupancy of crop sites may indicate preference of crop habitats. We used ARUs to document daily bird occupancy during the month of April in northern Valley County, Montana. We used dynamic occupancy models to estimate initial occupancy in crop and native sites and to derive estimates of latent occupancy across the 24-day survey period. We found no evidence that crop sites were occupied earlier than native sites. Site occupancy increased from 0.56 (0.12 SE) on April 7 to 0.99 (0.01 SE) on April 30 and was similar between crop and native sites. Our results demonstrate that ARUs may be a useful tool for assessing migration phenologies of vocal avian species, particularly once machine learning software is able to accelerate processing times of high-volume recording files.

Intact rangelands outcompete focal species as a more efficient surrogate for conservation in the Northern Great Plains.

Jason Tack*, US Fish and Wildlife Service
Andrew Jakes, Smithsonian Conservation Biology Institute
Paul Jones, Alberta Conservation Association
Mark Hebblewhite, University of Montana, Wildlife Biology Program
Dave Naugle, University of Montana
Marisa Sather, US Fish and Wildlife Service
Kevin Doherty, US Fish and Wildlife Service
Brian Martin, The Nature Conservancy
Ronald Pritchert, US Fish and Wildlife Service

Abstract: Maps of species-habitat relationships often underlie our strategies to identify and prioritize areas for conservation. Often a single surrogate species drives conservation design, with the assumption that conservation actions for a well selected species will confer benefits to a broader community. Recent advances in systematic conservation planning coupled with increasingly available spatial data have helped planners incorporate requirements of multiple species. Yet, multispecies prioritization algorithms are still challenged by how to objectively 'weight' varying attributes, which has tremendous impacts on resulting area-based prioritizations. We developed an approach to quantify 'strength of surrogacy' among species, by building individual models and measuring their ability to encompass a broader wildlife community. We applied our approach to a suite of species models used for conservation targeting in the imperiled grasslands and sagebrush steppe of the Northern Great Plains, where prioritization can help stem the loss of private grazing lands to cultivation. This approach allowed us to measure the relative efficacy of different species as surrogates, and provided a metric to weight models among multispecies algorithms. In this test, we also considered a simple surrogate of intact rangelands, fully agnostic to species data, representing a null model for conservation targeting. Prioritization outputs weighted by species strength of surrogacy among intact parcels give practitioners a roadmap for future investments to maintain these already functioning landscapes for conservation. Furthermore, our measure of intactness vastly outperformed any species model as a surrogate for conservation, highlighting the efficacy of strategies that target large and intact cores for wildlife conservation.

Montana Chronic Wasting Disease Surveillance and Monitoring- 2021 Season Review

Austin Wieseler*, Montana Fish, Wildlife and Parks
Sam Treece, Montana Fish, Wildlife and Parks
Matt Becker, Montana Fish, Wildlife and Parks
Jennifer Ramsey, Montana Fish, Wildlife & Parks
Emily Almberg, Montana Fish, Wildlife and Parks

Abstract: Montana, Fish, Wildlife, and Parks (FWP) has been conducting surveillance for Chronic Wasting Disease (CWD) since 1998, and first detected CWD in wild deer in 2017. In 2021, FWP prioritized sampling in northwestern, southwestern, south central, and east central Montana. Additionally, FWP continued to target sampling in the Libby CWD Management Zone and conducted a Southwest Montana CWD Management Hunt for a 2nd consecutive year. Surveillance and management efforts focused on maximizing the detection of CWD in new areas, limiting the spread of CWD, maintaining or reducing prevalence of CWD in endemic areas, improving CWD communication and outreach with the public, and providing hunters the opportunity to have their harvested animal tested for CWD. During the 2021 season, FWP tested 8,525 samples from mule deer (n=3,532), white-tailed deer (n=3,991), elk (n=951), and moose (n=51). Of these, 323 animals tested positive and CWD was detected in 4 new hunting districts (317, 330, 340, and 700). Among positive hunting districts, prevalence estimates between 2017-2021 ranged from Between 2017–2021, CWD prevalence was 6% (95%.CI:.5-7%) in white-tailed deer within the Libby CWD Management Zone and 21% (95% CI:19-23) in white-tailed deer within the Southwest Montana CWD Management Hunt Area. For 2022, FWP will continue to promote proper carcass disposal and transport regulations and advocate sample collection by hunters. Additionally, CWD management actions will be evaluated for addressing high CWD prevalence areas across the state.

Responses of Elk to Changes in Travel and Access Management**

Peter Mumford*, USGS Montana Cooperative Wildlife Research Unit

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Abstract: Rifle-hunting on land accessible to the public is the main tool wildlife managers use to manage the abundance of elk (*Cervus canadensis*) in the western United States. Elk are increasingly located on land inaccessible to hunters during rifle season in the western United States, decreasing the ability of managers to reduce the abundance of elk and harvest opportunity for hunters. Management actions are used to balance hunting risk across landscapes and assumed to influence the behavior of elk, but evidence is limited. We evaluated how restricting hunter access and motorized routes influenced the behavior of elk during rifle season in the northern Sapphire Mountains, Montana, USA. We used locations of female and male elk during the rifle season during 2014-2015 prior to restrictions and again in 2019-2020 following restrictions to evaluate elk responses. We hypothesized restrictions would influence the behavior of elk more

strongly than other factors since elk have been shown to respond strongly to changes in hunting risk. Additionally, we evaluated how access of elk to hunters during rifle season changed over time to understand patterns in the location of elk. We found no support that elk responded to restrictions. Preexisting use of adjacent land by elk and restrictions mainly to motorcycles likely decreased efficacy of restrictions. Further, access of elk to hunters was low, and decreased over time for male elk.

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 2021-2022

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 (Andrew Jakes, 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 (Heather Brower, 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.

Committee Chair: current President-Elect (Andrea Litt, 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 (Heather Brower, 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)

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/**

CONSERVATION AFFAIRS

This committee shall: review legislative proposals, administrative regulations, environmental assessments and impact statements, and other subjects or issues affecting wildlife or wildlife habitat within the organizational area of the Montana Chapter and make recommendations to the Executive Board for any action that should be taken by the Montana Chapter; Prepare white papers on critical wildlife issues, and other issues affecting wildlife or wildlife habitat within the organizational area of the Montana Chapter; Receive proposed position statement, resolutions, and public statements from two or more members at any time, and shall prepare, submit, and recommend action on such items to the Executive Board in accordance with Article VII, Section 4; Communication with The Wildlife Society's Director of Government Affairs to elevate local or regional issues that may have national or international significance or precedent setting.

Committee Co-Chairs: Sonja Andersen (SAndersen@mt.gov)
Lance McNew (lance.mcnew@montana.edu)
Past MT TWS President (mttws.pastpres@gmail.com)

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: Dave Willey (MSU) willey@exchange.montana.edu
Chad Bishop (UM) chad.bishop@umontana.edu

There is a new scholarship for 2022 that will be presented to a student from a small college within Montana. The name of the award and finalized selection process for future years will be voted on during the Business Meeting and once finalized will be added to the website and Bylaws.

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 five 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.
5. The ***Rising Professional Award*** (new in 2020) recognizes emerging professionals and rising leaders in the wildlife field who are drivers of professional progress in Montana.

   Committee Chair: Megan O'Reilly (moreilly@mt.gov)

AD HOC COMMITTEES

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)

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 Co-Chairs: Bryce Maxell (bmaxell@mt.gov)
Liz Bradley (LBradley@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)

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/

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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?

- IJS has a world-wide presence through its website, Montana State University's Open Journal Systems (archival home of IJS) & Search Engines.
- All published manuscripts or written presentations and poster abstracts from the sponsoring organizations can be found as individual PDFs as conversion for internet access progresses.

As of 2020 - Volume 16, 2010 - Volume 24, 2018 are on-line!

- All contents are "OPEN ACCESS", ensuring maximum availability without costs and press ready PDFs can be downloaded, saved or printed immediately.

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