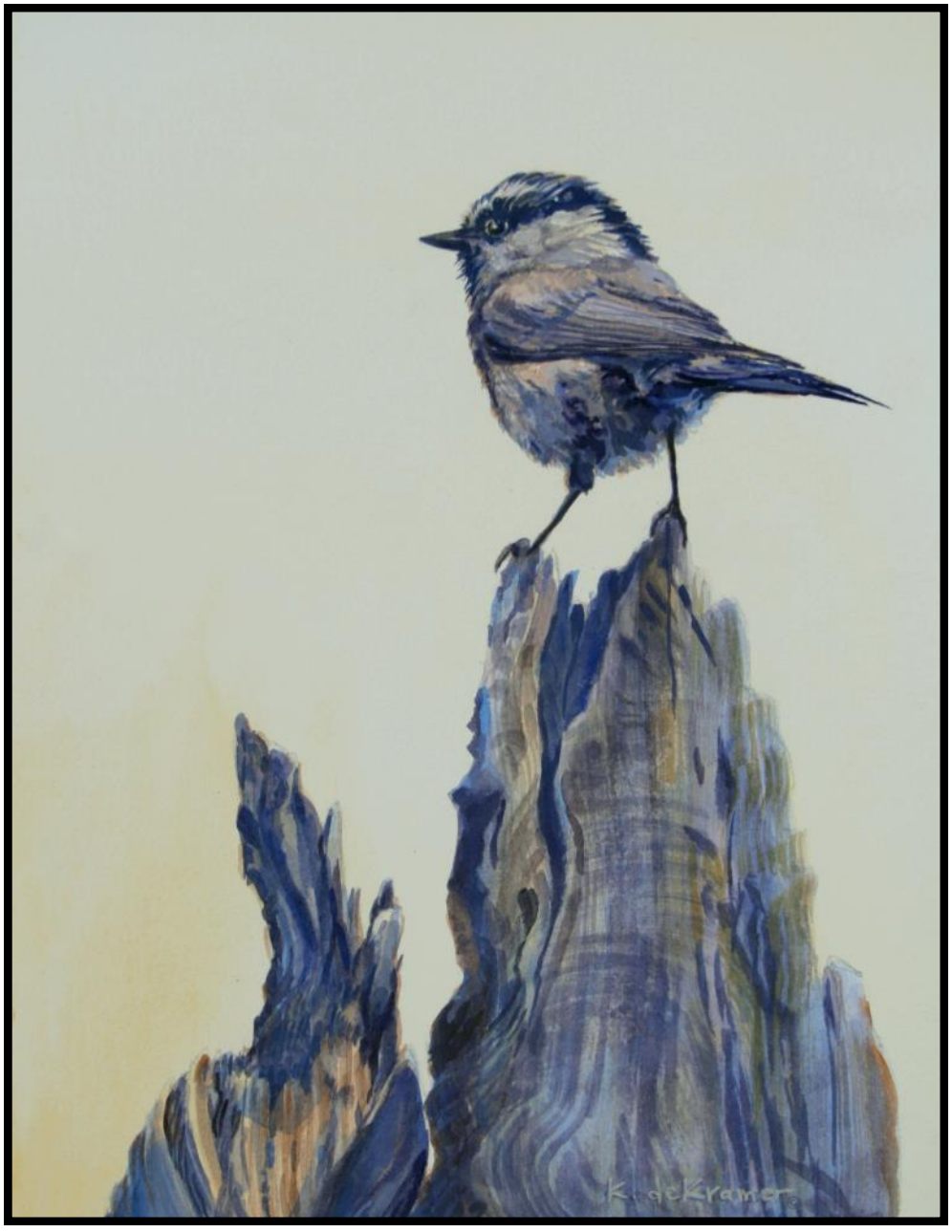
2016 Joint Partner Wildlife Conference "Common Resources, Challenges, and Solutions"

22-26 February 2016
Coeur d'Alene Resort
Coeur d'Alene, Idaho



Program

2016 Joint Partners

Idaho Chapter TWS

The Society for Northwestern Vertebrate Biology

THE WILDLIFE SOCIETY
WASHINGTON CHAPTER

NORTHWEST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

2016 Associated Meetings

- Idaho Bat Working Group
- Idaho Bird Conservation Partnership
- Idaho Partners in Amphibian and Reptile Conservation

Cover Art Contest Winner

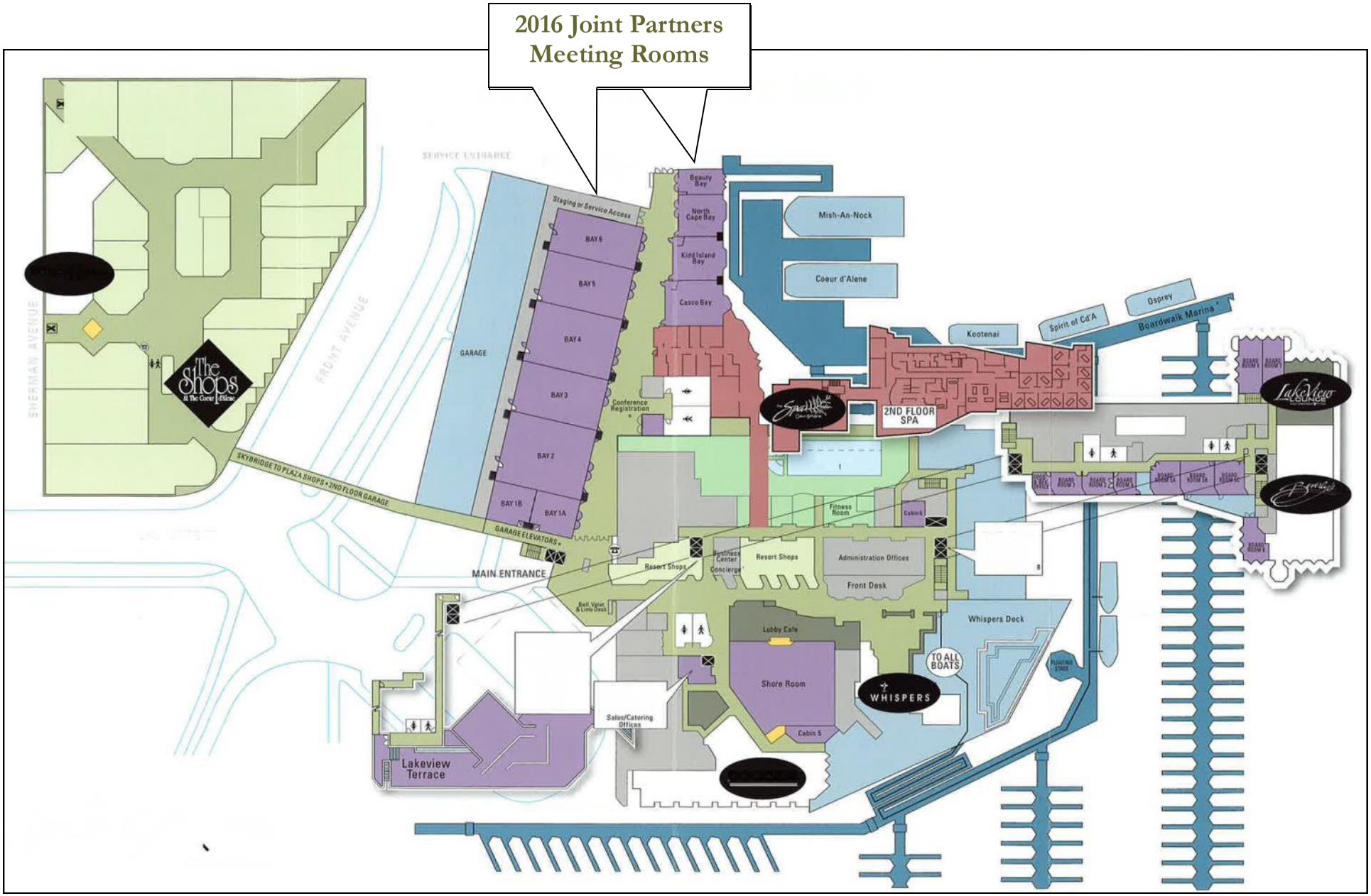
The winning entry is titled "Little Package, Big Attitude" by Karyn deKramer, Wildlife Water-color Artist. Congratulations Karyn!

Karyn deKramer
www.dekramerart.com
karyn@dekramerart.com
www.facebook.com/dekramerart/

In Memoriam

Randall "Randy" Smith
1952-2016

Randy Smith, long time ICTWS member and recipient of the Charles E. Harris Award (2010), died February 4, 2016. Randy retired from the Idaho Department of Fish and Game in 2014 after a 30 year career, most of which as the wildlife population manager in the Magic Valley Region of Idaho. Randy was instrumental in starting new populations of bighorn sheep, wild turkey, Columbian sharp-tailed grouse, and ruffed grouse. He was recognized by FNAWS (2001 & 2004)for his work in bighorn sheep restoration at Jim Sage Mountain and Cache Peak. His influence spanned across state borders so much so he was awarded the Robert L. Patterson Award from the Western Association of Fish and Wildlife Agencies Technical Committee (2010) and the Northwest Section TWS Outstanding Administrator Award (2014). He was recognized multiple times by the IDFG for his excellent wildlife work including Outstanding Achievement Award – Wildlife Population Management (1993-1994), Employee of the Year – Senior Resource Management (2001 & 2007), and the Wildlife Mentor Award (2013). Randy received numerous letters and comments of commendation from the public for his helpfulness and professionalism in serving them. He was a champion for the wildlife cause, a well-respected colleague, caring mentor, loyal friend, dedicated public servant, and a loving husband and father.



Coeur d'Alene Resort Floor Plan

Table of Contents

Meeting Introduction and Host City

Meeting Introduction

The Joint Partners Conference of the Idaho and Washington Chapters of The Wildlife Society, The Society for Northwestern Vertebrate Biology and Northwest Partners for Amphibian and Reptile Conservation is 22-26 February 2016 in Coeur d'Alene, Idaho. This year's conference offers a diverse scientific program with a plenary session, special workshops, symposium, contributed oral and poster presentations, social, banquet, student activities and the annual business meetings of the joint partners.

Host City — Coeur d'Alene, Idaho

Welcome to Coeur d'Alene! With about 44,000 residents, Coeur d'Alene (pronounced KORR də-LAYN), is the largest city and county seat of Kootenai County, Idaho. The city is located about 30 mile (48 km) east of the larger Spokane, Washington, with a resulting metropolitan area population of just under 600,000. The city is located at an elevation of 2,180 ft (660 m) above sea level, and on the shore of 25 mile (40 km) long Lake Coeur d'Alene.

The city is named after the Coeur d'Alene People, a tribe of Native Americans who lived along the rivers and lakes of the region and were first encountered by French fur traders in the late 18th and early 19th century. Translated from French, Cœur d'Alène literally means "heart of the awl" which might mean "sharp-hearted" or "shrewd", perhaps reflecting the trappers admiration for how this tribe conducted business.

A few things to do while here:

Hike Tubbs Hill—Tubbs Hill consists of over 120 acres and is bordered by Lake Coeur d'Alene on the west, south and east sides. There are several miles of hiking trails on the hill that provide spectacular scenery for everyone to enjoy. The trail head on the west side of Tubbs Hill is located at the southern end of 3rd Street in the parking lot. The east side trail head is located at the south end of 10th Street. A 2.2 mile interpretive trail follows the perimeter of Tubbs Hill.

Silver Mountain Ski Resort—for avid skiers and snowboarders, Silver Mountain is an opportunity to enjoy north Idaho winter recreation. Located 35 miles from Coeur d'Alene, take I90 east from the city to Kellog. Take the Bunker Rd exit and go south 1/4 mile.

Public Art and Art Galleries—Public art is found throughout the city. Specific information on art and locations is available at *http://www.cdaid.org/190/committees/arts-commission/public-art-collection*. Indulge your passion for western and wildlife fine art at any of several galleries located within a short distance of the meeting site. Galleries include the Coeur d'Alene Galleries and Painters Chair Fine Art Gallery, both on Sherman Avenue.

Take a drive along CDA Lake—This is a nice evening drive. Go east on Sherman, but turn right on the old highway just before you get to I90. The old I90 ran along the shoreline, but was redesigned by Dick Schwartz (former IDFG Commissioner) as a bike/running path with an adjacent 2-lane road for wanderers. During December, many folks park at the dead end to watch up to 200 eagles feeding on spawning kokanee.

Additional information on recreational, cultural, educational and shopping opportunities is available online for Coeur d'Alene and the surrounding area at *http://www.cdaid.org*., and at *http://www.coeurdalene.org, and http://www.cdadowntown.com.*

Conference Venue

All conference activities will take place at the Coeur d'Alene Resort (115 S. Second St, Coeur d'Alene, ID; Phone— toll free (855) 999-7998; *www.cdaresort.com*).

Registration and Logistics

Registration fees includes admission to all oral sessions, poster session, coffee breaks, social activities, a copy of the program and a complimentary meeting gift. Registration and fees for the NW PARC symposium on Thursday are separate.

Registration Fees:

$150/$175	Full registration (includes social and meeting gift)/after February 1
$75/$100	Retiree & new professional registration (includes social and meeting gift (while supplies last))/after February 1
Free/$25	Idaho Chapter student member registration (includes social, and meeting gift (while supplies last))/after February 1
$25/$50	Student registration (non-Idaho Chapter member) (includes social and meeting gift (while supplies last))/after February 1
$60/$85	One day registration/after February 1
$50	Regular banquet ticket
$20	Student banquet ticket
$75/$45	NW PARC symposium regular/student registration (includes snacks and lunch)

Separate Registration Required:

Free	Introduction to R Workshop (Workshop is full)
Free	Yellow Billed Cuckoo Workshop
$ 30	Terrestrial Mollusks Workshop ** book required

The registration desk will be open at the following times:

Monday	22 Feb	4-6 pm
Tuesday	23 Feb	7-8:30 am, 10-11 am, 3-4 pm, 5-6 pm
Wednesday	24 Feb	7-8:30 am, 10-11 am, 3-4 pm
Thursday	25 Feb	7-8:30 am, 10-11 am

Messages and volunteer opportunities
A message board will be available near the registration desk.

Conference Contact (Co-Chairs)
Aren Eddingsaas - (ICTWS) aeddingsaas.sbtribes@gmail.com; 208-521-3868
Betsy Howell - (NW PARC) blhowell@fs.fed.us; 360-821-8135
Danielle Munzing - (WCTWS) danielle.munzing@dnr.wa.gov; 509-637-6737
Teal Waterstrat - (SNVB) teal_waterstrat@gmail.com; 360-789-8504

Executive Boards & Conference Organizing Committee:

Idaho Chapter

Quinn Shurtliff	President
Aren Eddingsaas	President-Elect
Anna Owsiak	Vice-President
Lisa Nutt	Secretary
Laura Wolf	Treasurer
Shane Roberts	Past-President

Washington Chapter

Tony Fuchs	President
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Mike Hall	Secretary
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Board Members

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Eric Lund	Webmaster
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Chelsea Waddell	Murreletter Editor
Robert Weaver	Northwest Fauna Editor

Northwest Partners for Amphibian and Reptile Conservation

Kris Kendell	Co-chair
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Valorie Titus	Social Media Coordinator
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Elke Wind	Membership

Steering Committee Members:

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Purnima Govindarajulu
Lisa Hallock
Janene Lichtenberg
Bryce Maxell
Chuck Peterson
David Pilliod
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Meeting Sponsorship

2016 Joint Partner Conference Sponsors

We wish to thank the following organizations and businesses for sponsoring the 2016 Joint Partner Conference.

Platinum Sponsors ($2,400+):

Gold Sponsors ($1,800-$2,399):

Silver Sponsors ($1,200-$1,799):

Bronze Sponsors ($500-$1,199):

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NEZ PERCE TRIBE TREATY OF 1855
© 1995 Nez Perce Tribe

The Nature Conservancy
Idaho

Auction and Raffle Item Donors

We wish to thank the following individuals, businesses and organizations that supported the 2016 Joint Conference with auction and raffle item donations:

Angie Schmidt
Anna Owsiak
Anser Charter School
Backyard Bird Shop,Vancouver, Wa
Bass Pro Shop
Beth Waterbury
Betsy Howell
Birds & Beans LLC.
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Washington Trust Bank
Wayne Melquist
Wearboise.com
Wildbirds Unlimited
Worley-Bugger Fly Co

Some donor names were not available by the time this program went to print. We extend a sincere thank you to those of you whose names are not listed above, your generous support of this conference and of our organizations is sincerely appreciated!

2016 Joint Conference Contributors

We extend a special thank-you to the many session chairs, the conference volunteers who helped with AV and other logistics, and the silent auction and raffle volunteers who help ensure fundraising success for all the organizations. Your efforts have helped ensure the success of this year's meeting and are greatly appreciated.

We would like to thank the following organizing committee members for making this conference possible.

- Steering Committee (Aren Eddingsaas, Tony Fuchs, Erim Gomez, Paul Hendricks, Blake Hossack, Betsy Howell, Kris Kendell, Danielle Munzing, Anna Owsiak, Bruce Thompson, Teal Waterstrat, Laura Wolf)
- Program Committee (Jeff Kozma, Anna Owsiak, Bill Vogel)
- Fund-Raising Committee (Deniz Aygen, Leif Hansen, Danielle Munzing)
- Sponsorship Committee (Tony Fuchs, Gregg Servheen, Bruce Thompson)
- Paper/poster judging coordinator (Duston Cureton) and all of the paper/poster judges
- Student Activities (Wendy Arjo, Cathy Flick, Sara Hansen, Katey Huggler, Blake Murden, Quinn Shurtliff, Bruce Thompson, Chelsea Waddell)

Program At a Glance

Monday 22 February

Time	**Workshops**
08:00-12:00	Idaho Bat Working Group Meeting **(Room-Kid Island Bay)**
09:00-12:00	Introduction to "R" **(Room—North Cape Bay**)
13:30-17:30	Idaho Partners in Amphibian and Reptile Conservation Meeting **(Room-Kid Island Bay)**
13:30-17:30	Introduction to "R" **(Room-North Cape Bay)**
13:30-17:30	Yellow-billed Cuckoo **(Room-Bay 6)**
13:30-17:30	Terrestrial Mollusks **(Room-1A/1B)**
Registration Desk Open: 16:00-18:00	

Tuesday 23 February

Registration Desk Open: 07:00-08:30; 10:00-11:00, 15:00-16:00; 17:00-18:00			
Time	**Room—Bay 4-5**	*Vendor Displays all day in **Lobby**	
08:00-08:30	**Welcome** - ICTWS President: Quinn Shurtliff; WCTWS President: Tony Fuchs; SNVB President Teal Waterstrat; NW PARC Kris Kendell		
08:30-11:20	**Plenary Session—*"Common Resources, Challenges and Solutions"* (Room—Bay 4-5)**		
11:20-12:00	Panel Discussion		
12:00-13:30	Idaho Chapter of The Wildlife Society Business Lunch **(Room—Casco Bay/Kid Island Bay)**		
	Room—Bay 3	**Room—Bay 1A/1B**	**Room—Bay 6**
13:30-17:30	Carnivores	Ignite!	Sage & Sharp-Tailed Grouse
17:30-18:30	**Student Mentoring (Room—Bay 4-5)**		
18:30-21:00	**Social, Poster Session, Silent Auction, and Raffle (Room—Bay 4-5)**		
21:00-22:00	**Student Quiz Bowl (Room—Bay 4-5)**		

Wednesday 24 February

Registration Desk Open: 07:00-08:30; 10:00-11:00, 15:00-16:00			
Time		*Vendor Displays all day in **Lobby**	
07:00-08:00	Business Breakfast Washington Chapter of The Wildlife Society **(Room Casco Bay/Kid Island Bay)**		
	Room-Bay 4	**Room-Bay 5**	**Room-Bay 6**
08:00-12:00	Big Game	Field Techniques	Dry Forests
10:00-13:00	Resume Review Booth		
12:00-13:30	The Society for Northwestern Vertebrate Biology Business Lunch (**Room—Casco Bay/Kid Island Bay)**		

(Wednesday afternoon continues on next page)

Program At a Glance

Wednesday 24 February (Continued)

Time

	Room—Bay 4	**Room—Bay 6**	**Room-Bay 5**
13:30-17:30	Amphibians	Manuscript Preparation Workshop *(Pre-registration Required-workshop is full)*	Arid Ecosystems
17:30-18:00	**Break**		
18:00-20:00	**Social Hour, Banquet, Awards, Silent Auction and Raffle (Room—Bay 1-2)**		

Thursday 25 February

Registration Open: 07:00-08:30; 10:00-11:00

Time	**Room-Note Locations**	
07:00-08:00	Breakfast with a Wildlifer **(Location—Dockside Restaurant in the Resort)**	
08:00-17:30	Northwest PARC Symposium: "Conservation Across Borders" (**Room—Bay 5)**	
08:00-17:30	Chemical Immobilization and Handling **(Room—Bay 1A/1B)** ***(Pre-registration & fee required)***	
	Room—Bay 3	**Room—Bay 6**
8:00-12:00	Wildlife Diseases	Freshwater Mussels
12:00-13:30	**Lunch**	
14:00-17:30	Idaho Bird Conservation Partnership (**Room—Bay 3**)	

Friday 26 February

Time	**Location-IDFG Regional Office, 2885 Kathleen Avenue, Coeur d'Alene**
08:00-17:30	Chemical Immobilization and Handling **(Roosevelt Room in the Hunter Education Wing)** ***(Pre-registration & fee required)***
08:00-12:00	Idaho Bird Conservation Partnership **(Leopold Room in the Hunter Education Wing)**

Attendee and Presenter Information

Locations
All conference activities will be held in the following Rooms: Bays 1A, 1B, 3, 4, 5, 6, of the Coeur d'Alene Resort. Associated workshops and meetings will be held in Kid Island Bay and Casco Bay and North Cape Bay. See pages 12-13, "Program at a Glance" for room location of specific events.

Oral Presenters
Please take note of your presentation date and time. Please note that all **general session** talks should be limited to 20 minutes total (including 5 minutes for questions), whereas **IGNITE!** session talks are limited to a 5 minute presentation with several minutes afterwards for questions. Respect other speakers and your audience by staying within your scheduled time. It is extremely important that we maintain this schedule, so that attendees can move amongst sessions. Take the time to practice so your delivery fits into the scheduled interval. Check with your session chair well in advance of the start of your session to make sure that you know where the tools are that you need for your talk (e.g., remote control, laser pointer) and how to use them. This is also the time to check and see if your PowerPoint presentation (ideally saved in Microsoft Office PowerPoint Show [.pps] format) runs properly on the projector and projection computer. Presentations should be uploaded no later than the break preceding your talk.

Posters
The poster session will be held during the conference Social on Tuesday, 23 February, in the Bay 4-5. Poster displays should be set up after the afternoon session of contributed papers. Tacks to secure posters to the wall will be provided, however, please bring some if you have them just in case. All authors should be at their posters and prepared to discuss their work from 18:30 to 20:00 on Tuesday evening. Posters must be removed after the social.

Résumé Review
A résumé review station will be available to provide students an opportunity to receive feedback on their résumé, ask questions and seek advice from wildlife professionals from across different fields working in the private or public sector. The station will be open **Wednesday, February 24, from 10 am—1 pm.** Location will be near the vendor tables.

<u>Notice to all attendees</u>: As a courtesy to all presenters, we request that you turn off your cellular phones while attending sessions and meetings.

Special Awards—Presented at the Banquet Wednesday Evening

Idaho Chapter of The Wildlife Society Awards

Charles E. Harris Professional Wildlifer Award
This award honors professionals in wildlife management. It is given to demonstrate outstanding contributions to Idaho's wildlife resources as appreciated by one's peers. The award is meant to recognize outstanding professional contribution and promote public understanding of significant wildlife management accomplishments in Idaho.

Special Recognition Award
This award honors any person or group who has made an outstanding contribution within the state of Idaho to wildlife conservation, management, science, conservation education, the wildlife profession or to an area of endeavor species, community, ecosystem or region. Any person or group who has made such a contribution in the last 3 years is eligible for this award.

Washington Chapter of The Wildlife Society Awards

Conservation Award
This award recognizes an outstanding accomplishment (program or project) by a person or organization for significant contributions to wildlife conservation, including efforts involving outstanding initiative, innovation, and personal risk of failure.

Partnership Award
This award recognizes an outstanding accomplishment by a person or organization for working with and establishing partnerships that otherwise would not have existed or functioned as well without their initiative, and which has resulted in significant advancement of wildlife conservation.

Foresight Award
This award recognizes an outstanding contribution by a person or organization for outstanding foresight and efforts to address conservation of species and/or habitat in a timely manner. For instance, endangered or threatened species listing decisions and conservation can be aided by information collected and efforts initiated prior to the when the urgency is well understood or publicized. This includes initiating monitoring, research, or enhancement projects prior to a species reaching levels or legal status where such actions are necessary.

Chapter Award
This award honors individuals or organizations that have made significant contributions to the support and growth of the Washington Chapter of The Wildlife Society.

The Society for Northwestern Vertebrate Biology Awards

Mentorship Award
This award recognizes a current member whom has served as a mentor to students, SNVB members and/or developing professionals. This SNVB member has distinguished him/herself as a mentor by going above and beyond the expectations of the individual(s) that nominate them. Mentors can be a faculty member or professionals. Previous awardees have included both professional and faculty mentors.

Lifetime Achievement Award
This award recognizes a member that has contributed to the development of SNVB and/or the field of Vertebrate Biology in the Northwest. This member has had an overall positive impact as a professional and/or they have contributed to SNVB's mission.

President's Award
This award recognizes an individual(s) the current President of SNVB has determined to go above and beyond the requirement of their roles to further the mission or exemplify the mission and values of SNVB. The award's recipients may be nominated by others for the Presidents consideration.

Photography Contest
The 2016 Joint Partners Conference photo contest (open to all meeting registrants) takes place during the banquet and is in digital format this year. Volunteer judges will select up to three finalists in each category prior to the banquet and these images will be projected on the big screen leading up to dinner. Paper ballots will be available on all tables and all attendees are encouraged to vote for the winner of each category. The votes will be tallied during dinner and the winners will be announced before the conclusion of the banquet during our awards ceremony.

Monday Morning & Afteroon

Workshops

08:00-12:00	Idaho Bat Working Group Meeting **(Room-Kid Island Bay)**
09:00-12:00	Introduction to "R" **(Room—North Cape Bay) (Pre-registration Required/Workshop is full)**
12:00-14:00	**Lunch**
13:30-17:30	Introduction to "R" **(Room-North Cape Bay) (Pre-registration Required/Workshop is full)**
13:30-17:30	Idaho Partners in Amphibian and Reptile Conservation Meeting **(Room-Kid Island Bay)**
13:30-17:30	Yellow-billed Cuckoo **(Room-Bay 6) (Pre-registration Required)**
13:30-17:30	Terrestrial Mollusks **(Room-1A/1B) (Pre-registration Required)**

Idaho Bat Working Group Annual Meeting—Agenda

Meeting objective: Share information and collaborate to conserve Idaho's bats.
Attendees: Idaho Bat Working Group members and interested parties

8:00 AM	Welcome and introductions (Rita Dixon and Bill Doering, Cochairs) (5 min)
8:05 AM	Partner updates (45 min)
8:50 AM	North American Bat Conservation Alliance (NABCA) update (10 min)
9:00 AM	WNS surveillance efforts including this winter's hibernacula surveys /NWHC bat swabbing projects (30 min)
9:30 AM	NABat planning for 2016 summer field season (30 min)
10:00 AM	Break (10 min)
10:10 AM	Wind energy—fatality estimation, actions to minimize mortality, research questions, policy (30 min)
10: 40 AM	AML monitoring of existing bat gates (10 min)
10:50 AM	SWAP implementation of bat conservation actions in 2016 and discussion of collaboration among IBWG partners (55 min)
11:45 AM	Wrap-up (15 min)
12:00 PM	Adjourn

Tuesday Morning Plenary

Plenary Session Invited Speaker Biographies

Virgil Moore - has served as Director of the Idaho Department of Fish and Game since 2011. He has 39 years of professional experience in fish and wildlife management and has served in many positions for Idaho Fish and Game including, Deputy Director for field operations, Fisheries Bureau Chief, Information and Education Bureau Chief, Fisheries Research Manager and various other field management positions as a fisheries scientist. He has served on numerous fish and wildlife teams including: Co-Chair, Idaho Wolf Depredation Control Board; Co-Chair, Gov. Otter's Sage Grouse Task Force; Chair, Executive Committee, Association of Fish and Wildlife Agencies; Past Chair, Fisheries Water Policy Committee, Association of Fish and Wildlife Agencies; Chair, Western Bird Conservation Committee, Member of Lesser Prairie Chicken Initiative Council, and Chair, Sage Grouse Executive Oversight Committee, Western Association of Fish & Wildlife Agencies (WAFWA); and both the Stanley Basin Sockeye Salmon and Kootenai River Sturgeon Recovery Teams. In his free time, he and his wife Becky enjoys outdoor activities with their two daughters and five grandchildren.

Jim Unsworth, Ph.D - became director of the Washington Department of Fish and Wildlife (WDFW) in February of 2015. Prior to becoming the head of WDFW, he spent more than 30 years in wildlife management with the Idaho Department of Fish and Game (IDFG). He held several management positions for IDFG, including Deputy Director, State Big Game Manager and Wildlife Bureau Chief. He holds a Bachelor's degree in wildlife management from the University of Idaho, a Master's degree in fish and wildlife management from Montana State University, and a Doctorate in forestry, wildlife and range sciences from the University of Idaho. Jim and his wife Michelle have four adult children. He is an avid hunter and fisherman.

Bill Gaines, Ph.D. - is a Wildlife Ecologist and Director of the Washington Conservation Science Institute. He has been involved in wildlife research and forest management for the past three decades, including 27-years as a wildlife biologist with the US Forest Service. He has conducted a number of research projects on bears and other large carnivores in the North Cascades Ecosystem, and has been involved in the grizzly bear recovery efforts in the North Cascades for the past 25 years. He has published over 50 peer-reviewed articles on a wide-range of wildlife species and conservation topics.

Richy J. Harrod, Ph.D - is the Deputy Fire Management Officer for Fuels and Fire Ecology on the Okanogan -Wenatchee National Forest. He has a B.S. in biology and terrestrial ecology and a M.S. in biology with an emphasis in botany, both degrees received from Western Washington University. He received his Ph.D. in ecosystem sciences from the University of Washington. Richy started his career on the Okanogan National Forest in 1990 as a seasonal botanist and served as the District Plant Ecologist on the Leavenworth Ranger District, Wenatchee National Forest until summer 2000. In 2000, he moved to the fire program in Okanogan-Wenatchee National Forest Headquarters where he presently resides. Richy has been involved in forest and fire restoration planning and research for 25 years. He has been the primary author or co-author of over 40 published research papers and technical reports on various fire and forestry topics including forest restoration, fire effects on rare plants, biodiversity, and noxious weed management. Richy has been a guest lecturer at several colleges and universities, has taught college level courses at Wenatchee Valley College and continuing education courses through the North Cascade Institute. He has given over 50 presentations at scientific and management conferences.

Frances Cassirer, Ph.D - has served as project coordinator for the Hells Canyon bighorn sheep restoration project since its formal inception in 1997. She received a B.S. in Wildlife Biology from University of Montana, an M.S. in Wildlife Resources from the University of Idaho, and a Ph.D. in Zoology from the University of British Columbia. Frances has worked on a broad range of topics as a wildlife research biologist for the Idaho Department of Fish and Game.

Plenary Session Invited Speaker Biographies

Mark Penninger - a certified wildlife biologist and the Forest Wildlife Biologist for the Wallowa-Whitman NF in Oregon, and the National Bighorn Sheep Biologist for the US Forest Service. His 27 year career has been with the US Forest Service in Region 6. He has been a TWS member since getting involved in the student chapter at NC State University in 1988. He has served on the board, and as VP and President for the Oregon Chapter of TWS. Mark's professional interests include: 1) integrating principles of conservation biology into forest restoration; 2) effects of motorized access and travel management on wildlife and habitat; and 3) bighorn sheep and mountain goat restoration and conservation.

Paul Wik - is the District Wildlife Biologist for the Blue Mountains District for the Washington Department of Fish and Wildlife. He received a B.S. in Biology from Central Washington University and a M.S. in Wildlife Resources from the University of Idaho. Paul works on management and research issues for game and diversity species in southeast Washington.

Wayne Wakkinen - was born in Idaho and raised in the west. He spent several of his early years in the navy and traveling before finding his life's calling. He has a Bachelor's degree in biology from Boise State University and a Master's in Wildlife Resources from the University of Idaho, where he studied sage grouse under the watchful eyes of Kerry Reese and Jack Connelly. After a short stint in Idaho Falls as a HIP technician, he moved to Bonners Ferry as a research biologist, and spent the next 24 years studying grizzly bears, woodland caribou and handling regional management duties. After 24 years in Bonners Ferry, he moved south to Coeur d'Alene and became the Regional Wildlife Manager in the IDFG Panhandle Region.

Scott Becker - has been the statewide wolf specialist for the Washington Department of Fish and Wildlife for the past 3.5 years where he coordinates and directs field activities related to wolf recovery and management in Washington. He received his MS degree from the University of Wyoming where he evaluated factors limiting population growth of the north Jackson moose herd in Wyoming. Scott has been involved with large carnivore (grizzly bear, black bear, mountain lion, and wolves) management and monitoring activities since 2000 when he began working as a Large Carnivore Biologist for the Wyoming Game and Fish Department (WGFD). He switched to strictly wolf management in 2008 working for both WGFD and the U.S. Fish and Wildlife Service where he coordinated and directed activities related to wolf recovery in Wyoming.

Tuesday Morning—Bay 4-5

Plenary Session (Chaired jointly by partner organization presidents)

08:00-08:30 **Welcome** by Joint Partnership Leadership: Quinn Shurtliff (President, ICTWS); Tony Fuchs (President, WA-TWS); Kris Kendall & Betsy Howell, Co-Chairs, NW PARC); Teal Waterstrat (President, SNVB).

"Common Resources, Challenges, and Solutions"

08:30-09:00 **Virgil Moore**, Director, Idaho Department of Fish and Game.

09:00-09:30 **Jim Unsworth**, Director, Washington Department of Fish and Wildlife.

09:30-09:50 **"Regional habitat networking: from plans to actions".** Bill Gaines, Director, Washington Conservation Science Institute

09:50-10:20 **"Fire in the Pacific Northwest".** Richy Harrod, USDA Forest Service, Okanogan-Wenatchee National Forest

10:20-10:40 BREAK

10:40-11:00 **"Crossing canyons, crossing borders: Hells Canyon Bighorn Sheep Initiative".** Frances Cassirer, Idaho Department of Fish and Game; Mark Penninger, USDA Forest Service, Wallowa-Whitman National Forest; Paul Wik, Washington Department of Fish and Wildlife

11:00-11:20 **"A dirt-level view of trans-boundary cooperation".** Wayne Wakkinen, Idaho Department of Fish and Game.

11:20-11:40 **"Cooperation and coordination in wolf management across jurisdictional boundaries**." Scott Becker, Washington Department of Fish and Wildlife.

11:40-12:00 Questions and Discussion

12:00-1:30 LUNCH

12:00-13:30 **Idaho Chapter Business Meeting and Luncheon (Casco Bay/Kid Island Bay)**, lunch provided.

Tuesday Afternoon—Bay3 & 4-5

*Names of presenters are capitalized; those presenters with an * are students*

Carnivores (Chair: Blake Murden) (**Room—Bay 3**)

13:30-13:50 **Small mammal communities response to environment via Barn Owl (Tyto alba) pellets in Namibia.** JENNIFER MEREMS*

13:50-14:10 **Characteristics of mortality zones and mitigation strategies for Barn Owls along interstate 84 in southern Idaho.** ERIN ARNOLD*

14:10-14:30 **Barn Owls crossing the road: Examining interplay between occupancy, behavior and roadway mortality in southern Idaho.** TEMPE REGAN*

14:30-14:50 **Occupancy and interspecific interactions of Raccoon and Virginia Opossum in Seattle, Washington.** MARK JORDAN

14:50-15:10 **Genetic characteristics of Red Foxes in northeastern Oregon.** GREGORY GREEN

15:10-15:30 **Population fragmentation and connectivity mapping of American Black Bears in the Canada-USA trans-border region.** MICHAEL PROCTOR

15:30-15:50 BREAK

15:50-16:10 **Wolverine distribution and ecology in the north Cascades ecosystem: Preliminary results of a 10-year study**. CATHY RALEY

16:10-16:30 **Climate mediated invasion: Canada Lynx's response to northbound Bobcat range expansion.** ARTHUR SCULLY*

16:30-16:50 **Effects of harvest on recruitment and wolf pack structure.** DAVID AUSBAND

16:50-17:10 **Monitoring wolf reproduction through the use of expandable radio-collars and abdominal VHF implants in pups, 2012-2015.** LACY ROBINSON

17:10-17:30 **Methodologies and results of the multi-species baseline initiative winter bait station effort in the Idaho panhandle, 2010-2014.** LACY ROBINSON

17:30-18:30 Student Mentoring (Room-Bay 4-5)

17:30-18:30 Poster Set Up (Room-Bay 4-5)

18:30-22:00 Social and Poster Session (Bay 4-5), no host-bar/mixer & hors d'oeuvres

Tuesday Afternoon—Bays 1A-1B

Ignite! (Chair: Julie Maenhout) (**Room—Bay 1A/1B**)

13:30-13:40 **Non-invasive spatially explicit capture-recapture of Canada Lynx to estimate density and abundance in northern Washington State.** ARTHUR E. SCULLY

13:40-13:50 **Field data collection – There's an app for that.** PAM BOND & BRETT GULLETT

13:50-14:00 **Why I play with poo and so should you…** ROSS C. WINTON

14:00-14:10 **Habitat and reproductive fitness of Sage-grouse in the high elevations of eastern Idaho.** ERIC ANDERSON

14:10-14:20 **Translocated and resident Greater Sage-grouse movements on the Yakima Training Center, Washington**. KYLE EBENHOCH

14:20-14:30 **Some things never change: Humpback whales do more than sing.** MICHELLE FOURNET

14:30-14:40 **Temporally, a really reduced discourse in a species of frog; or, TARDIS.** DANIELLE V. NELSON

14:40-14:50 **Invasive American Bullfrogs in Grand Teton National Park.** TESS KREOFSKY

14:50-15:00 **Innovations in forestry to sustain people and biodiversity: Lessons from moist coniferous Forests of the Pacific Northwest.** DEANNA (DEDE) H. OLSON

15:00-15:10 **Addressing the riparian buffer system: Bureaucracy, beliefs, and ways to break through so less becomes more.** JESSICA SHAW

15:10-15:20 **Switching to copper ammunition for hunting mammals.** BILL VOGEL

15:20-15:30 **Remote cameras: More than just pretty pictures?** JOEL SAUDER & JON HORNE

15:30-15:50 BREAK

15:50-16:00 **Managing our Idaho Natural Heritage Program's Species Diversity Database.** ANGIE SCHMIDT

16:00-16:10 **Detection and assessment of ulcerative shell disease – A practical guide for field staff.** TAMMY A. SCHMIDT

16:10-16:20 **Idaho Power Company's avian protection program.** ANTHONIE HOLTHUIJZEN

16:20-16:30 **Common Raven nest monitoring: Part of an overarching strategy to conserve Greater Sage-grouse on the Idaho National Laboratory Site.** QUINN SHIRTLIFF & JEREMY SHIVE

16:30-16:40 **Condors in Hells Canyon.** ANGELA C. SONDENAA

Tuesday Afternoon—Bays 1A-1B, 6, & 4-5

16:40-16:50 **Idaho Elk survival.** BARB MOORE

16:50–17:00 **Social media in science.** BRITTANY PENDELTON

17:00-17:30 (Open)

Sage and Sharp-Tailed Grouse (Chair: David Musil) (**Room—Bay 6**)

13:30-13:50 **Arthropod characteristics at Columbian Sharp-tailed Grouse brood locations in Conservation Reserve Program and shrub-steppe rangeland habitat.** KATEY HUGGLER*

13:50-14:10 **The influence of wind energy development and habitat composition on Columbian Sharp-tailed Grouse habitat selection and fitness in eastern Idaho.** MATT PROETT*

14:10-14:30 **Factors influencing the survival of translocated Greater Sage-grouse and Columbian Sharp-tailed Grouse in Lincoln County, Washington.** ADRIAN RUS *

14:30-14:50 **Characterizing movement patterns of resident and translocated Greater Sage-grouse in Washington through high-resolution GPS telemetry.** PETER J. OLSOY*

14:50-15:10 **Factors influencing nest survival of Greater Sage-grouse in southern Idaho.** ANTHONY J. LOCATELLI

15:10-15:30 **Large-scale field experiments to assess the effects of cattle grazing on Greater Sage-grouse.** COURTNEY J. CONWAY

15:30-15:50 BREAK

15:50-16:10 **NRCS' commitment to Sage-grouse in Idaho.** KEVIN TRAYLOR.

16:10-16:30 **Implementing Greater Sage-grouse conservation: An overview of the 2015 Idaho and southwestern Montana BLM resource management plan amendment.** PAUL MAKELA.

16:30-16:50 **Implementation of Greater Sage-grouse Forest Plan Amendments in Idaho.** ROBERT MICKELSON.

16:50-17:10 **Sage-grouse habitat: The BLM's monitoring and management nexus.** E. ELLSWORTH

17:10-17:30 (Open)

17:30-18:30 Student Mentoring (Room-Bay 4-5)

17:30-18:30 Poster Set Up (Room-Bay 4-5)

18:30-22:00 Social and Poster Session (Bay 4-5), no host-bar/mixer & hors d'oeuvres

20:00-21:00 Quiz Bowl

Tuesday Evening Poster Session-Bays 4-5

*Names of presenters are capitalized; those presenters with an * are students*

Posters: Title and Author

1. **Bullfrogs at the border: Eradication efforts of an invasive amphibian (Lithobates catesbeianus) in the Kootenays, British Columbia.** LINDSAY ANDERSON

2. **Analysis of the biotic and abiotic factors influencing the distribution of two amphibian species in eastern Washington, Spea intermontana and Ambystoma tigrinum.** COREY BRUMBAUGH*

3. **Effects of temperature on jumping performance of Oregon Spotted Frogs and American Bullfrogs.** RAVEN DOW-HYGELUND*

4. **Occupancy and movement of amphibians in the Snoqualmie Pass Interstate 90 corridor.** ANNE GUSTAFSON*

5. **Herpetofauna of Alberta BioBank Project.** KRIS KENDELL

6. **Environmental DNA: Using molecular analysis to detect three species of amphibian in an industrial setting in Alberta.** KRIS KENDELL

7. **Alberta Volunteer Amphibian Monitoring Program.** KRIS KENDELL

8. **Environmental DNA as a technique for monitoring the movements of cryptic species in the Snoqualmie pass Interstate 90 Corridor.** KAYLEIGH MULLEN*

9. (Open space)

10. **Evaluating tradeoffs in risks perceived by foraging herbivores.** MEGAN J. CAMP*

11. **Influence of weather and habitat on Little Brown Bat activity along the North Coast of British Columbia.** PATRICK BURKE*

12. **Long-eared bat taxonomy: Genetic evidence eliminates the species status of Keen's Myotis (Myotis keenii).** CORI L. LAUSEN

13. **The challenges of monitoring bird and bat impacts at offshore windfarms.** ALICIA HIGGS

14. **Seasonal habitat analysis of bull Elk (Cervus elaphus) in the Colockum Herd, Washington.** LEWIS MEYERS

15. **The influence of fuel reduction treatments on the nutritional ecology of Mule and White-tailed Deer in northeastern Washington.** STEPHANIE BERRY*

16. **Niche separation among four mustelids in the Idaho Panhandle is potentially mediated through behavior and elevation.** LACY ROBINSON

17. **Clark Fork River Delta restoration project.** KATHY COUSINS

Tuesday Evening Poster Session– Bays 4-5

Posters: Location, Title and Author

18. **Digging into the annual life-history of Long-billed Curlews: Are sink habitats to blame for local population declines?** STEPHANIE COATES*

19. **Avian community response to salmon recolonization in the Cedar River, Washington.** HANNAH L. CLIPP*

20. **Juvenile survival and dispersal in White-headed Woodpeckers.** PHILIP C. FISCHER

21. **An occupancy study of the Flammulated Owl.** SARA McFALL

22. **Osprey habitat suitability in west-central Idaho: Impacts of prey abundance on Osprey breeding success.** ZACH SANCHEZ*

23. **Power poles, platforms, and snags: The habitat suitability and breeding success of Ospreys (Pandion haliaetus) in west-central Idaho.** J. TYRELL STYHL*

24. **Conditional antipredator behavior: Do both habitat and predator type influence responses to threats?** MIRIAM A. HERNANDEZ*

25. **Quantifying animal personality along the shy-bold spectrum: Choice of test matters.** MEGAN WHETZEL*

26. **Antiparasitic properties of sagebrush (Artemisia spp.) plant secondary metabolites.** BRIEANA GOODS

27. **Is diet selection by Greater Sage-grouse influenced by biomass availability or toxins?** JACQUELINE PEÑA*

28. **Use of camera trap monitoring to detect abundance and distribution of Jaguar and other forest carnivores/prey species in Costa Rican Neotropical rain forests.** LESLIE A. HAY

29. **Idaho Natural Heritage Program's Species Diversity Database.** ANGIE SCHMIDT

30. **Idaho Adopt a Scientist Program (IASP): Engaging classrooms in local research and conservation.** ZOE TINKLE*

Wednesday Morning—Bay 4 & 5

*Names of presenters are capitalized; those presenters with an * are students*

07:00-08:00 **Washington Chapter of The Wildlife Society Business Breakfast (Room –Casco Bay & Kid Island Bay)**

Big Game (Chair: Gregg Serhveen) (**Room—Bay 4**)

08:00-08:20 **Nutritional limitations in the Clearwater Elk herds: Exploring the severity, seasonality, and underlying habitat influences.** RACHEL COOK

08:20-08:40 **Can a low carrying capacity and a high stochastic environment induce a predator pit in Elk populations?** JON HORNE

08:40-09:00 **Habitat selection and spatial responses of Bighorn Sheep to forest canopy in north-central Washington.** TIFFANY BAKER

09:00-09:20 **Migration and seasonal range fidelity across a suite of Idaho ungulates: Do techniques match life history characteristics?** SCOTT BERGEN

09:20-09:40 **Plant chemical defenses contribute to winter nutritional deficit in free-ranging herbivores.** DANIEL MELODY*

09:40-10:00 **Forest succession and nutritional carrying capacity of Elk since the 1980 eruption of Mount St. Helens**. SHANTEL SPARKES*

10:00-10:20 **BREAK**

10:20-10:40 **Functional explanation of plant species preferences by a generalist herbivore; the Columbian Black-tailed Deer.** AMY ULAPPA

10:40-12:00 **OPEN DISCUSSION**

Dry Forest (Chair: Jeff Kozma) (**Room—Bay 5**)

08:00-08:20 **The dry forest of eastern Washington: Issues and opportunities.** WILLIAM GAINES

08:20-08:40 **Dry forest wildlife habitat: Objectives and tradeoffs.** KIM MELLEN-McLEAN

08:40-09:00 **Fire, prey, and competition: Northern Spotted Owl ecology and conservation in eastern Cascades forests.** PETER SINGLETON

09:00-09:20 **Home range size and foraging patterns of White-headed Woodpeckers in western Idaho.** ADAM KEHOE*

09:20-09:40 **Stem decay in dry forest: A natural recycling process and its implications in wildlife use.** ANGEL SAAVEDRA

Wednesday Morning—Bay 5, & 6

09:40-10:00 **Why are most snags never used by woodpeckers for nesting? Wood hardness can limit snag use by cavity-dependent wildlife.** TERESA LORENZ

10:00-10:20 BREAK

10:20-10:40 **Fire as a management tool in eastside forests.** RICHY HARROD

10:40-11:00 **Maintaining structure during timber harvest on private lands - challenges and constraints.** BILL VOGEL & MARTY MAUNEY

11:00-11:20 **SLOPPS: Snags, Logs, Openings, Patches, Piles and Shrubs.** KEN BEVIS

11:20-12:00 **OPEN DISCUSSION**

Field Techniques (Chair: Lindsey Thurman) (**Room—Bay 6**)

08:00-08:20 **Ethics of wildlife capture and handling.** MARK R. JOHNSON

08:20-08:40 **Using clay models to test for avian recognition of aposematic warning coloration of Ring-neck Snakes (Diadophis punctatus).** HANNA CROW*

08:40-09:00 **Hibernation ecology of Silver-haired Bats overwintering in British Columbia, Canada.** CORRI L. LAUSEN

09:00-09:20 **Using Beavers as tools for wetland restoration and climate adaptation in the Skykomish Watershed of Washington.** JASON SCHILLING

09:20-09:40 **Effects of intensive forest management on early-seral associated birds, Oregon Coast Range, 2011-2015**. A.J. KROLL

09:40-10:00 **Effects of three timber harvest prescriptions on breeding density of Pileated Woodpeckers.** ZACH SWEARINGEN

10:00-10:20 BREAK

10:20-10:40 **Evaluating stream-associated amphibian response in a landscape-level forestry experiment in western Washington State.** MARC P. HAYES

10:40-11:00 **A demonstration of field experience detecting and counting wildlife with high resolution cooled infrared and high definition video camera from aerial platforms.** JOHN ROMERO

11:00-11:20 **Testing the forage selection of the American Pika (Ochotona princeps) for use in connectivity corridors in the Washington Cascades.** CARLY WICKHEM*

11:20-11:40 **Efficacy of five methods for converting stands of exotic, sod-forming grass to beneficial bunchgrass/forb mixes**. SHANE ROBERTS

11:40-12:00 (OPEN)

Wednesday Afternoon—Bays 4, & 5

12:00-13:30 SNVB Business Meeting and Luncheon (Casco Bay/Kid Island Bay), lunch provided.

Amphibians (Chair: Clara Wheeler) **(Room—Bay 4)**

13:30-13:50 **An overview of recent Foothill Yellow-legged Frog research in northern California.** CLARA WHEELER

13:50-14:10 **Ecology of amphibian populations in the Williston Reservoir drawdown zone, British Columbia.** MARK THOMPSON

14:10-14:30 **The Oregon Spotted Frog (Rana pretiosa) in lowland western Washington: A population, parentage, and non-breeding habitat analysis.** CHELSEA WADELL

14:30-14:50 **Examination of egg piling behavior in Spotted Frogs (Rana luteiventris and R. pretiosa).** CHRIS ROMBOUGH

14:50-15:10 **I know what you did last summer: Embryonic learning across amphibian life stage transitions.** TIFFANY GARCIA

15:10-15:30 **Condition-dependent terrestrial movement of juvenile Red-legged Frogs.** EVAN BREDEWEG*

15:30-15:50 BREAK

15:50-16:10 **Response of amphibian communities to wetland mitigation in the Greater Yellowstone ecosystem**. LEAH SWARTZ*

16:10-16:30 **Effects of habitat restoration on Northern Red-legged Frogs (Rana aurora).** LAURA TRUNK

16:30-16:50 **"In too deep": Hypoxia in free-living embryos of the frog Rana aurora.** CHRIS ROMBOUGH

16:50-17:10 **Bullfrog impact on Oregon Spotted Frogs: Are bullfrogs as bad as we feared?** JAY BOWERMAN

17:10-17:30 (Open)

Arid Ecosystems (Chair: Bill Vogel) **(Room—Bay 5)**

13:30-13:50 **Range expansion of an introduced population of Checkered Whiptail Lizard (Aspidoscelis neotesselata) in Grant County, Washington.** TROY PETERSON*

Wednesday Afternoon - Bay 5, 6, & 1-2

13:50-14:10 **Potential effects of waste waters from oil and gas extraction on amphibians: Preliminary results from a multi-partner investigation.** BLAKE HOSSACK

14:10-14:30 **Genetic monitoring of the endangered Columbia Basin Pygmy Rabbbit (Brachylagus idahoensis) reintroduction**. STEPHANIE M. DEMAY*

14:30-14:50 **Understanding factors influencing fine-scale habitat use by Pygmy Rabbits (Brachylagus idahoensis).** LAURA A. McMAHON*

14:50-15:10 **Underlying mechanisms of seasonal variation in activity patterns of the Pygmy Rabbit (Brachylagus idahoensis).** CHARLOTTE MILLING*

15:10-15:30 **The plight of prey: Population demographics, foraging behavior, and personality of Piute Ground Squirrels (Urocitellus mollis) in structurally variable habitats.** ZOE TINKLE*

15:30-15:50 BREAK

15:50-16:10 **Short-eared Owl (Asio flammeus) surveys in the intermountain west: An innovative approach using citizen science to conduct long-term monitoring.** ROBERT A. MILLER

16:10-16:30 **Bridge and Seton Watersheds: Grassland bat inventory and monitoring.** JARED HOBBS

16:30-16:50 **A case study in planning and siting an electric transmission line in arid ecosystems.** MARK TESKE

16:50-17:10 **Key threats and conservation efforts in Idaho** -- TBD

17:10-17:30 **Key threats and conservation efforts in Washington.** MARK TESKE

17:30-17:50 **Open Discussion**

Manuscript Preparation Workshop (Chair: Aaron Switalski) **(Room—Bay 6)** *****(Pre-registration is required/Workshop is full)***

13:30-17:30 **Publish or Perish: Avoiding common manuscript pitfalls before you hit "Submit".** VAUGHN PARAGAMIAN

15:30-15:50 BREAK

17:30-18:00 BREAK

18:00-20:00 Social Hour, Banquet, Awards, Silent Auction and Raffle (Room– Bay 1-2)

Thursday Morning—Bays 1A/B & 3

*Names of presenters are capitalized; those presenters with an * are students*

07:00-08:00 Breakfast with a Wildlifer. (Location—The Dockside Restaurant, inside the Coeur d'Alene Resort)

08:00-17:30 Chemical Immobilization and Handling Workshop (lunch provided). **(Room—Bay 1A-/B)** ***(Pre-registration & fee required; register at the conference registration desk)***

Wildlife Diseases (Chair: Blake Hossack) **(Room—Bay 3)**

08:00-08:20 (Open)

08:20-08:40 **Effects of the fungal pathogen Batrachochytrium dendrobatidis on Cascades Frogs (Rana cascadae) in the mountains of Northern California.** JONAH PIOVIA-SCOTT

08:40-09:00 **Influence of exposure time and chytrid fungus strain in tadpole survival of Pacific Chorus Frog and Western Toad.** JENNY URBINA*

09:00-09:20 **Shell disease in Western Pond Turtles in Washington - What we know and what we don't**. KATHERINE HAMAN

09:20-09:40 **Treponeme-associated Bacterial Hoof Disease in Elk from southwest Washington**. KRISTIN MANSFIELD

09:40-10:00 **Effects of sylvatic plague on northern Idaho Ground Squirrels.** AMANDA GOLDBERG*

10:00-10:20 BREAK

10:20-10:40 **A critical role for disease persistence in population viability assessments of Bighorn Sheep.** KEZIA MANLOVE*

10:40-11:00 **The epidemiology of Ranavirus in Wood Frogs in the Northeast: Lessons for the Northwest?** JESSE BRUNNER

11:00-11:20 **Biosecurity in aquatic environments.** LAURA SPRAGUE

11:20-11:40 **Projecting the global distribution of the emerging amphibian fungal pathogen Batrachochytrium dendrobatidis, based on IPCC Climate Futures.** DEANNA OLSON

11:40-12:00 **Batrachochytrium salamandrivorans (Bsal): Coordinating a proactive response to an emerging amphibian disease.** BLAKE HOSSACK

12:00-13:30 Lunch

Thursday Morning —Bay 6

Freshwater Mussels (Chair: Teal Waterstrat) **(Room—Bay 6)**

08:00-08:20	**Xerces' citizen science mussel work in the Portland area.** MICHELLE BLACKBURN
08:20-08:40	**Collaborative data collection of fresh water mussels in Idaho: Utilizing existing snorkel protocols to obtain information.** BRE ANDERSON
08:40-09:00	**Micro-climatic envelopes of terrestrial gastropods.** MICHAEL LUCID
09:00-09:20	**Reproductive biology of Anodonta nuttaliana, A. oregonensis, Margaritifera falcata, and Gonidea angulata in the Columbia Basin.** ALEXA MAINE
09:20-09:40	**It's not just Quagga Mussels - When freshwater Unionids go invasive.** CYNTHIA TAIT
09:40-10:00	**Extinction risk assessment of western North American freshwater mussels: Anodonta oregonensis, A. nuttalliana, Margaritifera falcata, and Gonidea angulata.** EMILIE BLEVINS
10:00-10:20	**BREAK**
10:20-10:40	**The distribution and diversity of freshwater mussels in Idaho.** STEVE LYNSE
10:40-11:00	**Wyoming's native freshwater mussels.** PHILIP MATHIAS
11:00-11:20	**Freshwater mussel survey of the Kettle River at Lake Roosevelt National Recreation Area.** ERIC STARKEY
11:20-11:40	**Moving forward with management of Gonidea angulata in the Okanogan Valley of BC, Canada.** JOHN MAGEROY
11:40-12:00	**The status of Margaritifera falcata in British Columbia: Taking small steps forward**. JOHN MAGEROY
12:00-12:20	**Conservation status of freshwater mussels in California.** JEANETTE HOWARD
12:20-13:30	**Lunch**

18:30-21:30 **NW PARC Informal Social,** Coeur d'Alene Tap House Unchained, 210 E. Sherman Ave., Coeur d'Alene, ID. Everyone is welcome to attend, however, seating may be limited.

Thursday Morning & Afternoon—Bay 5

2016 Annual Meeting Symposium

Conservation Across Borders

(Pre-registration & fee required)

Room Bay 5 (Chairs: Betsy Howell & Kris Kendell)

8:30-9:00 Registration

9:00-9:15 **Welcome! And Introductions**

9:15-9:45 **A Snake Peek at What is Happening at National PARC.** Priya Nanjappa, Association of Fish & Wildlife Agencies, and Jen Williams, National Park Service

9:45-10:45 **Keynote Address**: **Protecting What Matters.** Jamie Reaser, National Invasive Species Council

10:45-11:15 **Break**

11:15-11:45 **FrogWatch USA: Bringing Together Amphibian Enthusiasts Through Citizen Science.** Valorie Titus, Green Mountain College

11:45-12:15 **Snakes on a Plane, Truck or Box!** Charlie Justus, Idaho Department of Fish & Game

12:15-13:15 **Lunch (included in registration fee)**

13:15-13:45 **Repercussions of Herpetofauna Regulations on Herpetoculturists**. Mary Abbott, Idaho Treasure Valley Herpetology Society

13:45-14:15 **Illegal Wildlife Trade in the Pacific Northwest**. John Goldman, U.S. Fish & Wildlife Service

14:15-14:45 **The Journey to Restore San Francisco's Mountain Lake for the Western Pond Turtle**. Jessie Bushell, San Francisco Zoo

14:45-15:00 **Break**

15:00-15:30 **Amphibian and Reptile Conservation Within and Across State and International Boundaries: How to PARC Over the Lines**. Eric Gardner, Washington Department of Fish & Wildlife

15:30-16:00 **Amphibian and Reptile Disease Update**. Dede Olson, U.S. Forest Service

16:00-16:30 **Discussion and concluding remarks.**

18:30-21:30 NW PARC Informal Social, Coeur d'Alene Tap House Unchained, 210 E. Sherman Ave., Coeur d'Alene, ID. Everyone is welcome to attend, however, however, seating may be limited.

Thursday Afternoon—Bay 3

Idaho Bird Conservation Partnership—Agenda

(Chair: Jay Carlisle)

13:30 **Welcome and Introductions** – Jay Carlisle
13:45 **Partner updates:**

- **Pacific Flyway Nongame Technical Committee update on IBCP relevant topics (Short Eared Owls, rodenticides, wetlands connectivity, etc.)** – Colleen Moulton, IDFG

- **Additional speakers to be announced.**

14:15 **Working Group updates** (3-10 min update per group) – Working Group leaders. Brief updates from each working group on recent accomplishments and the focus of breakout discussions today and tomorrow, including:

- **SWAP continual improvement and implementation** – Colleen Moulton & Rita Dixon
- **MBTA Centennial and window strike updates** – Deniz Aygen, Heidi Ware, & Carrie Hugo
- **Short-eared Owl surveys** – Rob Miller
- **Bird conservation workshops for partner agencies** – Don Kemner
- **Other topics as time allows (Harlequin Ducks, high elevation birds, etc.)**

~15:15 **Break**

15:30-17:00 **Breakout discussions:**

- **Outreach, Education, & Citizen Science:**
  - Uncapped pipes, window strikes, MBTA Centennial
- **Research and Monitoring**
  - Short-eared Owl citizen science project
  - Harlequin Ducks follow-up discussion
  - High elevation birds
- **Conservation Delivery**
  - Bird workshops for federal agencies and tribes (*in prep*)

~18 or 18:30pm Optional group dinner (location to be announced)

FRIDAY Morning—IDFG Regional Office

Location—IDFG Regional Office, 2885 Kathleen Avenue, Coeur d'Alene

08:00-17:30 **Chemical Immobilization and Handling** (Located in the Roosevelt Room of the Hunter Education Wing, north of main IDFG office) ****(Pre-registration and fee required)**

08:45-12:00 **Idaho Bird Conservation Partnership** (Location is the Leopold Room of the Hunter Education Wing, north of main IDFG office)

Idaho Bird Conservation Partnership—Agenda

(Chair: Jay Carlisle)

Friday morning, 26 February

8:45 Convene … coffee/tea
9:00 **Brief updates from Thursday afternoon breakouts**
9:15 **Breakout sessions continued …**

10:45 **Break**
11:00 **Next steps: work plans & deliverables for the spring/ summer**
~12:00 Meeting adjourned (*continued lunch discussions for those interested)*

Presenting speaker's name is marked with a ◊, and abstracts are in alphabetical order presenter. Student presentations are denoted by an * before the title of the talk.

Collaborative Data Collection of Freshwater Mussels in Idaho: Utilizing Existing Snorkel Protocols to Obtain Information. Breanna Anderson◊, Joel Sauder, *Idaho Department of Fish and Game, 3316 16th St., Lewiston, ID 8350l; breanna.anderson@idfg.idaho.gov; joel.sauder@idfg.idaho.gov*

Information about many of Idaho's freshwater mussels is sparse. This is of particular concern for species like the Western Pearlshell (*Margaritifera falcata*) that has been identified as a species of greatest conservation need in Idaho. Recently, wildlife and fisheries biologists within the Idaho Department of Fish and Game have collaborated to improve detections of mussels as a part of regularly occurring fish surveys. Using an existing stream snorkeling survey protocol, data fields of species, presence, condition class, general abundance, and rough size estimates, were added to the snorkeler's datasheets and mussel identification was added to their preseason training agenda. Three years of these surveys resulted in more live mussel locations being reported than had been reported in the preceding 50 years, with almost no additional survey costs to the Department. Capturing anecdotal observations in specific data fields instead of leaving them to be recorded in the comments field had resulted in significantly more observations. This data will form the foundation for more in depth mussel research in the future.

*** Characteristics of Mortality Zones and Mitigation Strategies for Barn Owls along Interstate 84 in Southern Idaho.** Erin Arnold◊, *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; erin.arnold4@gmail.com;* Steve Hanser, *U.S. Geological Survey, Reston, VA; shanser@usgs.gov;* Tempe Regan, *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; temperegan@u.boisestate.edu;* Jeremy Thompson, *Borah High School, Boise, ID; jeremy.thompson@boiseschools.org;* Eric Yensen, *Department of Biology, The College of Idaho, Caldwell, ID; eyensen@collegeofidaho.edu;* Angela Kociolek, *Road Ecology Program Area, Western Transportation Institute, Montana State University, Bozeman, MT; angela.kociolek@coe.montana.edu;* Melinda Lowe, *Idaho Transportation Department, Boise, ID; melinda.lowe@itd.idaho.gov;* James Belthoff, *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; jbeltho@boisestate.edu*

One of the world's highest roadway mortality rates for Barn Owls (*Tyto alba*) occurs along Interstate 84 (I-84) in southern Idaho. Although mortality occurs in numerous portions of the I-84 corridor, there are segments where extraordinary numbers of owls are killed. Our objectives were to understand the spatial, road geometric, and biotic (e.g., land cover and prey) factors potentially contributing to Barn Owl-vehicle collisions, identify areas of greatest mortality, assess how high mortality zones have changed over time, and envision management/mitigation activities that may represent the next steps in reducing vehicle collisions. Standardized road kill surveys conducted from 2004 to 2006 located 812 dead Barn Owls. Between 2013 and 2015 surveys located another 550 dead Barn Owls. Small mammal abundance, commercial annual average daily traffic, and distance to nearest water feature were positively correlated with Barn Owl mortality, and habitat in the verge, width of the median, percentage of human structures, and cumulative secondary road length were negatively correlated with owl mortality. Mortality hotspots remained consistent between earlier and recent survey time periods, although particular segments with the greatest mortality shifted slightly.

Specific mitigation recommendationsinclude establishing low-flight barriers to minimize owl-vehicle interactions and promoting taller shrubs rather than grass in the right-of way to reduce small mammal habitat and discourage owl foraging.

Effects of Harvest on Recruitment and Wolf Pack Structure. David E Ausband◊, *Idaho Department of Fish and Game, 2885 W. Kathleen, Coeur d' Alene, ID 83815; david.ausband@idfg.idaho.gov;* Michael S Mitchell, *US Geological Survey, Montana Cooperative Wildlife Research Unit, University of Montana, 205 Natural Sciences Building, Missoula, MT 59812; Michael.mitchell@mso.umt.edu;* Carisa R Stansbury, *University of Idaho, Department of Fish and Wildlife Sciences, Moscow, ID 83844;* Jennifer L Stenglein, *Wisconsin Department of Natural Resources, Madison, WI 53705;* Lisette P Waits, *University of Idaho, Department of Fish and Wildlife Sciences, Moscow, ID 83844; lwaits@uidaho.edu*

Recruitment in wolves can be negatively affected by reductions in group size, changes to group composition and breeder turnover. We investigated how harvest affects group size, composition, and ultimately recruitment (i.e., pup survival to 15 months) in Gray Wolves (*Canis lupus*). We used noninvasive genetic sampling and 18 microsatellite loci to construct group pedigrees and estimate recruitment for wolves under three different harvest regimes ranging from heavily harvested to fully protected in Alberta, Canada, and Idaho and Yellowstone National Park. We hypothesized that increasing mortality reduces recruitment because of reduced group size, reduced intragroup diversity (i.e., fewer adults of varied sex and ages), and breeder turnover. Alternatively, harvest could increase recruitment due to increased food availability or harvest mortality may not affect recruitment differently than natural mortality. Harvest reduced recruitment but group size, intragroup diversity, breeder turnover, and the potential to inherit a breeding position all affected recruitment as well. Group size and related metrics (number of breeders present) weakened the negative effects of harvest on recruitment. Not all additions to group size had positive effects, however. The presence of older nonbreeding males reduced recruitment. Given this, selection should favor female-biased sex ratios and early dispersal (or expulsion) for males; we observed both over a limited timeframe. We show that ameliorating the negative effects of harvest on recruitment is one benefit of group-living but individuals are not equal in their contributions to recruitment within groups.

Habitat Selection and Spatial Responses of Bighorn Sheep to Forest Canopy in North-central Washington. Tiffany L Baker◊, Lisa Shipley, Mark E Swanson, *School of the Environment, Washington State University, P.O. Box 646410, Pullman, WA 99164-6410; tiffany.baker@wsu.edu; shipley@wsu.edu; markswanson@wsu.edu*

Fire suppression has allowed conifers to encroach into historically open grasslands and shrublands. Woody encroachment may reduce habitat quantity and quality for Bighorn Sheep (*Ovis canadensis*), which rely on open escape terrain. We examined the influence of conifer canopy cover, along with topography and forage resources, on habitat selection by bighorns in north-central Washington where thinning and prescribed fire treatments have been applied to encroaching forest to restore historic landscape conditions. To model habitat selection of Bighorn Sheep using Resource Selection Functions (RSFs), we estimated Utilization Distributions (UDs) from global position system (GPS) locations of 21 radio-collared sheep (14 females and 7 males) using the Brownian bridge movement model. After creating annual, lambing, summer, and winter 99% home ranges from UDs, we generated random points within each 99% home range to represent available habitat. We then used logistic regression to compare

GPS locations (i.e., "use") to random points (i.e., "available") after assigning them to habitat variables that we created in a geographic information system. As we predicted, Bighorn Sheep selected areas with lower tree canopy cover, even when controlling for topography and potential foraging habitat, and also consistently selected for steeper slopes. Restoring or maintaining open habitat in areas with woody encroachment may influence movements and increase the value of habitat for Bighorn Sheep. These RSF models can be used by state and federal agencies to plan forest restoration at a landscape scale to manage for Bighorn Sheep and other species that have adapted to similar habitat types.

Migration and Seasonal Range Fidelity Across a Suite of Idaho Ungulates: Do Techniques Match Life History Characteristics? Scott Bergen◊, *Idaho Dept. of Fish and Game, 1345 Barton Road, Pocatello, ID 83402; scott.bergen@idfg.idaho.gov;* Jon Horne, *Idaho Dept. of Fish and Game, 33316 16th St, Lewiston, ID 83501;* Mark Hurley*, Idaho Dept. of Fish and Game, 600 South Walnut, Boise, ID 83707*

Idaho has a high diversity of ungulate species across an array of ecological zones. Some ungulates seasonally migrate- others do not, even within the same species in the same ecological region. Using global positioning system (GPS) collar location data, we applied net-squared displacement techniques (NSD) to delineate spatiotemporal movement characteristics for Elk (*Cervus elaphus*), Moose (*Alces alces*), Bighorn Sheep (*Ovis canadensis*), Pronghorn Antelope (*Antilocapra americana*) and Mule Deer (*Odocoileus hemionus*) based on NSD analysis of GPS collar data for the average seasonal migration distance, duration, and timing. Pronghorn, if migratory, have average seasonal migrations of the greatest distance (70 km) followed by Mule Deer (39 km), Moose (27 km), Elk (27 km) and Bighorn Sheep (26 km). Mule Deer have the highest proportion of their populations having a seasonal migratory life history (97%) followed by Pronghorn Antelope (~96%), Elk (86%), Moose (74%) and Bighorn Sheep (18%). When available, multi-year location data have shown that some species have a higher spatial fidelity to their summer ranges relative to winter ranges but traditionally techniques developed to quantify migration have been developed from a winter range perspective. We investigate the possible implications for those species having a higher summer range spatial fidelity for identifying and characterizing seasonal migrations as well as management implications.

SLOPPS: Snags, Logs, Openings, Patches, Piles and Shrubs. Ken Bevis◊**,** *Washington Department of Natural Resources, 713 Bowers Rd., Ellensburg, WA 98926; Ken.Bevis@dnr.wa.gov*

When thinning forests to increase resiliency in the face of drought or fire, habitat structures are often removed to the detriment of wildlife in the dry forest system. Key habitat elements that can be consciously retained while addressing the overstocking of stands are: Snags, Logs, Openings, Patches, Piles and Shrubs – or SLOPPS. This talk will discuss how to specifically address and maintain habitat quality, while improving stand health and resiliency. Examples and strategies will be described. Those interested in creating diverse stands, not "parked out", will find this talk inspiring.

Volunteer-based Freshwater Mussel Surveys Show Urban Streams can Sustain Threatened Native Freshwater Mussel Populations. Michele Blackburn◊, Celeste Mazzacano, *The Xerces Society for Invertebrate Conservation, 628 NE Broadway, Portland, OR 97202; Michele.blackburn@xerces.org*

Freshwater mussels are among the most at-risk animals in North America. Although they play critical roles in stream ecology and their life history is closely tied to native fish, relatively little is known about their distribution and abundance in the Pacific Northwest. Furthermore, the role of urbanized watersheds as a refuge has not been largely considered and reproductive status and connectivity of native mussel populations in Portland-area watersheds has only recently been assessed. The Xerces Society partnered with community groups to train volunteers in mussel surveys to address gaps in biotic community data within the Johnson Creek watershed (Portland, OR). Despite multiple impairments, the watershed supports beds of Western Pearlshell (*Margaritifera falcata*) mussels which are relatively abundant on upstream reaches of Johnson Creek, but absent from the more urbanized lower watershed where Floaters (*Anodonta* sp.) were found in substantial numbers. Most are older and of similar age cohorts, but young mussels were also found. Xerces has used this volunteer-based survey model to develop effective protocols for mussel translocation activities and survivorship surveys. Our work has addressed large gaps in biodiversity data, effectively educated and engaged local stakeholders, evaluated existing translocation techniques and documented their success, and underscores the ability of citizen scientists to make meaningful contributions to our understanding of watershed biota. Future work can be built on these studies, including expanding mussel conservation in the Northwest and informing best management practices for mussel salvages and management needs among regional natural resource agencies.

Extinction Risk Assessment of Western North American Freshwater Mussels: *Anodonta oregonensis*, *A. nuttalliana*, *Margaritifera falcata*, and *Gonidea angulata.* Emilie Blevins◊, Sarina Jepsen, *Xerces Society for Invertebrate Conservation, 628 NE Broadway Suite 200, Portland, OR 97232; emilie.blevins@xerces.org; sarina@xerces.org;* Jayne Brim Box, Donna Nez, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fish and Wildlife Programs, 46411 Ti'Mine Way, Pendleton, OR 97801; brimbox@gmail.com; donnanez@ctuir.org*

Much attention has been paid to the decline of eastern North American freshwater mussels, where approximately three quarters are considered imperiled (238 taxa) or extinct (29 taxa). Compared to their eastern counterparts, relatively little attention has been paid to western species, and detailed information on their life history, conservation status and management priorities remains incomplete. Awareness, however, has increased in recent years, and anecdotal information on western freshwater mussel declines has also emerged. To address and appraise these apparent declines, we systematically investigated the status of western freshwater mussels through a two-step process. First, we built a range-wide database that documented species' occurrences (Xerces/CTUIR Western Freshwater Mussel Database) and obtained over 7300 records by soliciting information from researchers, conservation agencies, museums, lay people, and published and grey literature. Second, we used these records to map the historic (pre-1990) range-wide distribution of four western freshwater mussel species (*Anodonta oregonensis, A. nuttalliana, Margaritifera falcata,* and *Gonidea angulata*), and then compared their historic distribution to their current (1990 to present) distributions. We then used the Categories and

Criteria of the International Union for the Conservation of Nature (IUCN) Red List to determine the current extinction risk of these four species. We suggest the following IUCN Categories: two species are Vulnerable (*Anodonta nuttalliana* and *Gonidea angulata*), one Near Threatened (*Margaritifera falcata*), and one of Least Concern (*A. oregonensis*). This analysis also revealed important data gaps and provides direction for future research and survey efforts.

Examination of Egg Piling Behavior in Spotted Frogs (*Rana luteiventris* and *R. pretiosa*). Jay Bowerman, *Sunriver Nature Center, 57245 River Rd., Sunriver, OR 97707; frogs1@sunrivernaturecenter.*org*;* Chris Rombough◊, *Rombough Biological, P.O. Box 365, Aurora, OR 97002; rambo2718@yahoo.com*

Spotted Frogs (*Rana luteiventris*) have a tendency to lay eggs in piles. This behavior is believed to provide a thermal advantage via the "greenhouse effect": eggs in piles are warmer and hatch more quickly than non-piled eggs, conferring a selective advantage. From 2001-2014, we examined this hypothesis in populations of both *Rana luteiventris* and *R. pretiosa*. During embryonic development, we collected data on a series of variables, including temperatures of adjacent single and piled egg masses. We also recorded the time to hatching and development stage at hatching for both egg mass configurations. The two egg mass configurations (single and piled) exhibited little difference in thermal profiles, mean temperature, or overall temperature range. The data collected during this study do not demonstrate a thermal advantage of egg piling. We propose an alternate hypothesis for this behavior.

Bullfrog Impact on Oregon Spotted Frogs: Are Bullfrogs as Bad as We Feared? Jay Bowerman◊, *Sunriver Nature Center, P.O. Box 3533, Sunriver, OR 97707*

This study investigates changes in numbers of Oregon Spotted Frogs (*Rana* pretiosa) following the introduction of American Bullfrogs (*Lithobates catesbeiana*) into a large, well-monitored, and previously stable population of Oregon Spotted Frogs in central Oregon. Multi-year monitoring data compare egg mass counts and numbers of Oregon Spotted Frogs captured in fall and spring migrations before and after bullfrogs became established in wetlands of Sunriver, Oregon. Although annual baseline numbers vary stochastically prior to the introduction of bullfrogs, subsequent numbers have consistently fallen below long-term averages, and now appear to be in steep decline.

Microhabitat Preference of The Oregon Ensatina (*Ensatina escholtzii oregonensis*) in Snohomish County, Washington. Krista M Boyle◊, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926*; *Krista-Little@hotmail.com*

The Oregon Ensatina (*Ensatina eschcholtzii oregonensis)* is one of the more abundant and commonly observed salamanders in central Snohomish County, Washington. This species is often found among leaf litter and downed woody debris along riparian corridors in mixed coniferous and deciduous forests. The purpose of our study was to conduct a preliminary investigation of microhabitat preference of *E. e. oregonensis* that we observed in two different forested areas at a site near Lake Stevens, Washington. The sampled microhabitats were divided into four categories: fallen bark, rotten logs, artificial cover and other (under moss, leaf litter, rocks). Observed individuals from each category were recorded over the span of several days in mid-summer through early-spring. Of the 56 total individuals observed, the highest frequency of individuals was found under alder bark (*Alnus* spp.) that had been sloughed off by woodpeckers

(70%). The second highest frequency of individuals was found under rotten logs (21%) while few (7%) were found under artificial cover, and 2% were found under moss. Based on our observations, it seems *E. e. oregonensis* show a preference towards fallen alder bark. One factor driving this occurrence may be because we observed an abundance of possible arthropod prey under such bark, more so than in other microhabitats.

*** Condition-dependent Terrestrial Movement of Juvenile Red-legged Frogs**. Evan Bredeweg◊, Tiffany Garcia, *Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331-3803; evan.bredeweg@oregonstate.edu;* Anita Morzillo, *University of Connecticut, U-4087, 1376 Storrs Road, Storrs, CT 06269-4087*

Terrestrial dispersal and movement of amphibian species is a vital component of their biphasic life cycle. For pond-breeding amphibians, this process allows for exchange of individuals between breeding ponds which contributes to metapopulation dynamics, making amphibians a focus of extensive research. Outside of aquatic conditions, there has been little research on the terrestrial movement of amphibians. I investigated factors affecting the movement of juvenile Red-legged Frogs (*Rana aurora*) in experimental runways. Red-legged Frogs were collected as eggs and raised through metamorphosis in mesocosms under either permanent or ephemeral conditions. After metamorphosis, individuals were removed from the mesocosms, measured, uniquely tagged with elastomer, and moved to holding terrariums. Individuals were placed in one of four 1x20m enclosed runways with compacted top soil substrate, and then relocated after 30 minutes and their movement measured. Individuals were alternatively assigned to either wet or dry runway conditions. Results show that animals increased the probability of a movement event (distance>50cm) in wet conditions and the longer they had been removed from the pond environment. Longer movement events were more likely under dry conditions for individuals of larger mass. Amphibian movements are commonly thought to be shaped by moisture gradients in order to avoid desiccation risk. My research with *R. aurora* has shown that while moisture does play a role in movement choices, dry conditions are not insurmountable barriers and can in fact increase the distance of amphibian movements.

*** Change in Agricultural Land Use Influencing the Distribution of *Spea intermontana*.** Corey Brumbaugh◊, *Central Washington University, 400 E. University Way Ellensburg, WA 98926-7537; brumbaughc@cwu.edu;* Will Clark, *Western Wyoming Community College, 2500 College Drive, P.O. Box 428, Rock Springs, WY 82902-0428; wclark@wwcc.wy.edu;* R Steven Wagner, Robert E Weaver, *Central Washington University, 400 E. University Way, Ellensburg, WA 98926-7537; WagnerS@cwu.edu; weaverro@cwu.edu*

Southeastern Washington State is comprised of many different macro-habitat types from shrub-steppe and Ponderosa Pine (*Pinus ponderosa*) forests, to dense high elevation spruce-fir stands. There are deep canyons with fast-flowing rivers that cut through the basalt, as well as grasslands, and expansive pristine mountain meadows. Remoteness of this region has been largely unexplored in terms of the distribution and abundance of amphibians and reptiles. As a result, we gathered data on 16 species of reptiles and amphibians from five counties in southeastern Washington. These data were gathered from the Washington Department of Fish and Wildlife State Database, the Connor Museum at Washington State University, as well as data gathered during field surveys from 2006-2009. One of the more abundant species is the Great Basin Spadefoot Toad (*Spea intermontana*) and some research suggest this species is more abundant near agricultural sites. Using USGS aerial photographs, we mapped agricultural land

use using ArcGIS. We then compared the difference in agricultural land use in the 1950's versus agricultural land use in the mid 2000's. For this presentation we will discuss the distribution patterns of *S. intermontana* across this landscape. These data will give us a better understanding of past and current distributions of *S. intermontana* and the use of disturbed agricultural landscapes in southeastern Washington.

The Epidemiology of Ranavirus in Wood Frogs in the Northeast: Lessons for the Northwest? Jesse Brunner◊, Emily Hall, Erica Crespi*; School of Biological Sciences, Washington State University, Pullman, WA 99164; jesse.brunner@wsu.edu*

Wood Frogs (*Lithobates sylvaticus*) are incredibly susceptible to infections with the ranavirus, Frog virus 3 (FV3). In laboratory and mesocosm experiments Wood Frogs are easily infected and very likely to die from infections. Theoretically one would expect that ranavirus should be rare in Wood Frogs or be causing declines. Instead, ranavirus is frequently detected in Wood Frog tadpoles and adults across their eastern range with no sign of declines. We synthesize results from experimental challenges and ranavirus surveillance in ponds to better characterize the epidemiology of these emerging viruses in Wood Frogs and pond-breeding amphibians more generally.

Emerging and Re-emerging Wildlife Disease and Health threats to Pacific Northwest Wildlife. Julia Burc◊, *Oregon Department of Fish and Wildlife, 7118 NE Vandenberg Ave., Corvallis, OR 97330, julia.d.burco@state.or.us*

Increasingly, disease has been recognized as playing a significant role in population dynamics and declines worldwide. Historic and emerging disease issues of a broad range of Pacific Northwest wildlife will be discussed, with an emphasis on current diagnoses, implications to wildlife, people, and domestic animals, in addition to future research directions. Some topics discussed will include the winter auklet crash of 2014-15, avian influenza, hemorrhagic diseases of cervids, Elk (*Cervus elaphus*) hoof disease, and toxins in the environment.

Large-scale Field Experiments to Assess the Effects of Cattle Grazing on Greater Sage-grouse. Courtney J Conway◊, *US Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, 875 Perimeter Drive, University of Idaho, Moscow, ID 83844; cconway@uidaho.edu;* Karen Launchbaugh, *University of Idaho, 875 Perimeter Drive, Moscow, ID 83844; klaunchb@uidaho.edu*; Anthony Locatelli, *Idaho Cooperative Fish and Wildlife Research Unit, 875 Perimeter Drive, University of Idaho, Moscow, ID 83844; alocatelli@uidaho.edu;* David Musil, *Idaho Department of Fish and Game, Idaho Department of Fish and Game, Jerome, ID 83338; david.musil@idfg.idaho.gov;* Paul Makela, *Bureau of Land Management, Boise, ID 83709; pmakela@blm.gov;* Shane Roberts, *Idaho Department of Fish and Game, Idaho Falls, ID 83401; shane.roberts@idfg.idaho.gov*

The effect of livestock grazing on Greater Sage-grouse (*Centrocercus urophasianus*) is a topic of debate. We have initiated a series of large-scale field experiments designed to test whether spring cattle grazing affects Sage-grouse vital rates and habitat characteristics. We implemented a staggered-entry Before-After-Control-Impact paired study design to rigorously assess any potential effects of spring cattle grazing on Sage-grouse demographic traits. We initiated field work on this collaborative study in 2014 and are ready to manipulate grazing intensity in spring 2016 at our first two study sites. We have preliminary data to assess the

correlation between grazing intensity and Sage-grouse demographic traits at four study sites. Nesting success of Sage-grouse varied among our first four study sites (30-67%; *n*=163 nests) but all estimates were within the range of those reported from past studies. This project reflects an unprecedented collaborative effort among many organizations with an 11-member planning team working with agencies and ranchers to carry out large-scale grazing experiments.

Nutritional Limitations in the Clearwater Elk Herds: Exploring the Severity, Seasonality, and Underlying Habitat Influences. Rachel C. Cook◊, John G. Cook, *National Council for Air and Stream Improvement, Inc., 1401 Gekeler Lane, La Grande, OR 97850; rachierae@gmail.com; cookjg.ncasi@gmail.com;* Jim White, *Idaho Department of Fish and Game, 3316 16th St, Lewiston, ID 83501; jim.white@idfg.idaho.gov;* Michael J. Wisdom, *US Forest Service; 1401 Gekeler Lane, La Grande, OR 97850; mwisdom@fs.fed.us*

Partnered with the Clearwater Basin Collaborative, we collected data on body condition, pregnancy, lactation status, and age of female Elk (*Cervus elaphus*) in north-central Idaho to understand how nutrition may influence population dynamics across a diverse range of vegetation conditions in the Clearwater Region. Elk were captured in spring and autumn for two years in five Game Management Units: 11, 10, 10A, 12 and 15. We found significant differences in body fat and pregnancy rates of lactating females in autumn among the herds. Preliminary modeling to predict levels of dietary digestible energy during summer in the region suggest that underlying habitat and vegetation characteristics may explain a portion of this variation. We also found differences in spring body fat levels across herds, but these differences were directly attributed to condition and lactation status the previous autumn. Those animals that entered winter in better condition exited winter in better condition, and overwinter changes in condition were unrelated to differences in winter severity among herds. Our data so far indicate summer nutrition is limiting accrual of body fat and pregnancy rates, may influence juvenile growth and development, and may influence probability of survival in winter in some herds in the Clearwater Basin. The condition data also may help clarify how habitat, succession and nutrition influence population dynamics of Elk across the Clearwater Region and the need for managing habitat on behalf of Elk.

*** Using Clay Models to Test for Avian Recognition of Aposematic Warning Coloration of Ring-Neck Snakes (*Diadophis punctatus*).** Hanna Crow◊, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg WA 98926; weaverro@cwu.edu*

Aposematic coloration is common among vertebrates and invertebrates. The bright and contrasting colors warn predators of distasteful and even poisonous compounds. Recognition of such warning signals has been shown within mammals, fish, reptiles and birds. We examined the efficacy of such possible warning coloration in a small, cryptic species of snake, the Ring-neck Snake (*Diadophis punctatus*). Ring-neck Snakes are a trans-continental species that average less than 70 cm total length. Within the western United States they are associated with oak-pine woodland and along riparian zones in semi-arid habitats. When discovered by possible predators, Ring-neck Snakes reveal vibrant yellow or orange bellies, and an upward curling of the bright red ventral surface of the tail. For our experiment we used six types of clay models. Three were green with alternating patterns of dots (no dots, single, or double row) and three models were bright orange with the same pattern of dots. Models (*n*=246) were placed in areas where several species of birds could find them. After 4-6 days, models were gathered and scored for bite marks and the percentage of bite marks for each type was determined. The percentages for the green

models with varying patterns of dots are as follows: no dot 34.6%, single row 27.1%, and double row 32.3%. The percentages for the orange models with varying patterns of dots are as follows: no dot 2.3%, single row 0.8%, and double row 3%. Our data suggests that there is avian recognition of aposematic warning coloration in *D. punctatus.*

*** Genetic Monitoring of the Endangered Columbia Basin Pygmy Rabbit Reintroduction.** Stephanie M DeMay◊, *Environmental Science Program, University of Idaho, 875 Perimeter Drive MS 1130, Moscow, ID 83844; sdemay@vandals.uidaho.edu;* Lisette P Waits, Janet L Rachlow, *Department of Fish and Wildlife Sciences, University of Idaho, 875 Perimeter Drive MS 1136, Moscow, ID 83844; lwaits@uidaho.edu; jrachlow@uidaho.edu*; Penny A Becker, *Washington Department of Fish and Wildlife, 600 Capitol Way N., Olympia, WA 98501; penny.becker@dfw.wa.gov*

Monitoring demographic and genetic parameters of recovering populations of endangered species is crucial for evaluating and informing conservation strategies to maximize the chances of a successful recovery. We conducted genetic monitoring using tissue and fecal DNA to evaluate the recovery of the endangered Columbia Basin Pygmy Rabbit (*Brachylagus idahoensis*) in central Washington State, during the initial three years of a renewed reintroduction effort. Within large breeding enclosures, we quantified reproductive output for males and females, which decreased as a function of population density and individual homozygosity. Multiple paternity occurred in 81% of litters, and we report the first documented cases of juvenile breeding by Pygmy Rabbits. During this study, 1206 Pygmy Rabbits were released to the wild from the breeding enclosures, and we quantified post-release dispersal, survival, and reproduction, and monitored the genetic diversity and composition of the released and wild surviving populations. We detected 44-91 individuals surviving each year during follow-up winter surveys. Juvenile survival differed across years and was positively influenced by release date, release weight (an index for age), and heterozygosity. Adult survival was similarly influenced by release day, with some evidence for an effect of heterozygosity. Reproduction was low, with only 14 wild-born individuals detected during the study. Genetic monitoring proved an effective way to evaluate the demographic and genetic health of the reintroduced population, to inform changes to the conservation strategy and generate a dataset that can be used in the future research and adaptive management for this species.

Focus on Sage-Grouse Habitat: BLM's Monitoring and Management Nexus. Ethan Ellsworth◊*, US Bureau of Land Management, Idaho State Office Branch of Resources and Science, 1387 South Vinnell Way, Boise, ID 83709; eellsworth@blm.gov*

In Idaho, the Bureau of Land Management (BLM) has committed to monitoring nearly 9 million acres of allocated Sage-grouse (*Centrocercus urophasianus*) habitat. This ambitious monitoring framework is designed to 1) evaluate the effectiveness of BLM land use plans, vegetation treatments and use authorizations, and 2) inform management and conservation actions. Evaluation criteria are based on a suite of science-based indicators that best represent "desired conditions" for Sage-grouse at multiple scales of habitat selection. Indicators include characteristics such as anthropogenic disturbances at the mid-scale, seasonal habitat connectivity at the fine-scale, and vegetation cover at the site-scale. I will summarize the BLM's habitat monitoring strategy, and provide examples of how this approach will be use to implement management actions in Idaho to conserve, enhance and restore Sage-grouse habitat.

The Dry Forest of Eastern Washington: Issues and Opportunities. William L Gaines◊, *Washington Conservation Science Institute, 12725 Wilson Street, Leavenworth, WA 98826*

The dry forests of eastern Washington provide important habitats for a wide-array of wildlife species and an interface with a growing human population. These dry forests have undergone a century of change, resulting in forest and habitat conditions that have dramatically departed from their historical conditions, making them considerably more susceptible to uncharacteristically severe fires. I will characterize the unique features of the dry forests, highlight the challenges managers face in their restoration, and outline a strategy for action. The strategy includes the integration of focal wildlife habitats with other key ecosystem components, such as fire, to accomplish urgently needed landscape-scale ecosystem restoration.

I Know What You Did Last Summer: Embryonic Learning Across Amphibian Life Stage Transitions. Tiffany Garcia◊, *Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis OR 97331;* Jenny Urbina, *Environmental Science Program, Oregon State University;* Evan Bredeweg, *Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis OR 97331;* Maud Ferrari, *University Of Saskatchewan, Department of Veterinary Biomedical Sciences, 52 Campus Drive, Saskatoon, Canada SK S7N 5B4*

A wide variety of taxa have the ability to learn about their environment during the prenatal or embryonic period. This embryonic learning results in associated latent behavioral responses that can increase survival rates in risky environments. Predation risk can be particularly strong selection pressure for many organisms as there are significant advantages in recognizing novel predators. We hypothesized that learning may be dependent on evolutionary history with specific predator species in addition to environmental exposure. In a fully factorial experiment, we exposed Pacific Chorus Frog (*Pseudacris regilla*) larvae from breeding sites with predatory fish and sites with no resident fish to Rainbow Trout (*Oncorhynchus mykiss*) chemical cues, conspecific cues, or fish and conspecific cues combined. After hatching, we quantified larval refuge use to various chemical cue combinations and found that larvae from populations with resident Rainbow Trout exhibited a learned response to trout cues. These larvae avoided risk by increasing refuge in the presence of the cue. Individuals were not, however, able to generalize across other predator cues. This research contributes to our understanding of latent behavioral effects and the impacts of novel predators on amphibian species across life history stages.

*** Effects of Sylvatic Plague on Northern Idaho Ground Squirrels.** Amanda R Goldberg◊, *University of Idaho, 875 Perimeter Dr., Moscow, ID 83844; agoldberg@uidaho.edu;* Courtney J Conway, *US Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, 875 Perimeter Dr., Moscow, ID 83844; cconway@uidaho.edu;* Diane Evans Mack, *Idaho Department of Fish and Game, 555 Deinhard Ln., McCall, ID 83638; diane.evansmack@idfg.idaho.gov;* Greg Burak*, US Fish and Wildlife Service, 1387 S. Vinnell Way, Suite 368, Boise, ID 83709; greg_burak@fws.gov;* Dean E Biggins*, US Geological Survey, Fort Collins Science Center, 2150 Centre Ave., Bldg C, Fort Collins, CO 80526; bigginsd@usgs.gov*

Northern Idaho Ground Squirrels *(Urocitellus brunneus*) were listed as federally threatened by the USFWS in 2000. Habitat degradation is considered the main cause of the species' decline. We are using a Before-After Control-Impact design to test two hypotheses to

explain why Northern Idaho Ground Squirrel populations have declined: (1) habitat degradation, and (2) sylvatic plague. To test the habitat degradation hypothesis, we are evaluating whether experimental thin-and-burn treatments increase survival, annual fecundity, natal recruitment, location of hibernacula, and population growth. Over the past three years, we have attached radio-collars to 94 adult Northern Idaho Ground Squirrels to locate their hibernacula and have implemented an intensive capture-mark-recapture program at 13 study sites. To test the sylvatic plague hypothesis, we are evaluating whether experimental removal of fleas (the vector of plague) increases survival of Northern Idaho Ground Squirrels and three coexisting species: Columbian Ground Squirrels (*Urocitellus columbianus*), Yellow-pine Chipmunks (*Tamias amoenus*), and Deer Mice (*Peromyscus maniculatus*). Compared to control sites, re-encounter rates (the predicted probability that an animal survives from one year to the next) were 1.4 times greater on flea removal sites for Columbian Ground Squirrels, 1.1 times higher on flea removal sites for Northern Idaho Ground Squirrels, and 3.5 times higher on flea removal sites for chipmunks. These results reflect one-year of sampling at 10 study sites. We plan to add two more years of sampling and to include an additional eight study sites to more rigorously test the potential influence of plague on Northern Idaho Ground Squirrels.

Genetic Characteristics of Red Foxes in Northeastern Oregon. Gregory A Green◊, *Owl Ridge NRC, 22116 45th Ave. SE, Bothell, WA 98021; ggreen@owlridgenrc.com;* Benjamin N Sacks, *Canid Diversity and Conservation Lab, 248 CCAH, Veterinary Genetics Laboratory, University of California, Davis, One Shields Ave., Davis, CA 95618;* Leonard J Erickson, *Oregon Department of Fish and Wildlife, 107 20th St., La Grande, OR 97850;* Keith B Aubry, *US Forest Service, Pacific Northwest Research Station, 3625 93rd Ave. SW, Olympia, WA 98512*

The Rocky Mountain Red Fox (*Vulpes vulpes macroura*), once common in the Blue Mountain ecoregion of northeastern Oregon, was considered rare in eastern Oregon by the 1930s and thought to be extirpated by the 1960s, when putatively new Red Fox populations began to appear. Although the new foxes were long presumed to be nonnative (originating from fur-farms), they were often phenotypically similar to native Red Foxes, suggesting the alternative possibility that they arose from range expansions, either by small numbers of remnant native foxes at higher elevations or by Rocky Mountain Red Foxes to the east. In this study, we used mitochondrial DNA to investigate the origins of extant Red Fox populations in northeastern Oregon. Our findings indicate that both native and nonnative sources contributed to the Red Fox populations currently occupying this region. In particular, Red Foxes in montane habitats of their former range in northeastern Oregon reflect predominantly native ancestry, whereas those in more lowland habitats outside the boundaries of their former range represent a mix of native and nonnative ancestry.

Shell Disease in Western Pond Turtles in Washington – What We Know and What We Don't. Katherine Haman◊, *Washington Department of Fish and Wildlife, 1111 Washington St. SE, Olympia, WA 98501*, Western Pond Turtle Health Team, *Exotic/Zoo Pathology Service, PAWS, Oregon Zoo, Washington Department of Fish and Wildlife, Washington State University, Woodland Park Zoo*

The Western pond turtle (WPT) is an endangered reptile in Washington State. As part of the recovery plan, hatchling turtles have been head-started since the early 1990s, either at the Woodland Park Zoo or the Oregon Zoo. This recovery program was determined a success until 2012, when it became clear that WPT populations across the state had an ulcerative shell disease

of unknown etiology. Retrospective analyses of images suggest shell disease was present in WPT populations as early as 2003. Recently, a fungal agent was identified infecting and causing severe lesions in an adult male WPT. Results from molecular techniques (next generation sequencing) are pending and have the potential to not only identify the primary pathogen but also characterize differences in the shell microbiome of turtles with disease and healthy individuals. Additional research conducted by Washington State University, in collaboration with Washington Department of Fish and Wildlife, is using imaging to investigate shell (carapace and plastron) abnormalities in young turtles. Preliminary results from this study indicate shell abnormalities are present as early as two years of age. Treatment of individual turtles with severe shell disease is currently a priority for managing this disease in WPT in Washington. Long-term recovery of treated individuals at this time is unknown. Shell disease in Washington WPT populations has the potential to severely limit population recovery of this endangered species. Identifying the etiology of this disease is critical as it will lead to improved management actions to not only control, but also prevent this devastating disease in WPT populations.

Fire as a Management Tool in Eastside Forests. Richy J Harrod[◊], *Deputy Fire Staff Officer, Okanogan-Wenatchee National Forest, 215 Melody Lane, Wenatchee, WA 98801; rharrod@fs.fed.us*

Most restoration projects within dry, eastside forests are designed with reduction of fuels as the primary objective. Fuel reduction aims to create fire resilient stands by reducing surface fuels, reducing ladder fuels, and reducing crown density. This three-part objective is focused on limiting torching and active crown fire so that stands largely survive wildfire much like historical dry forests that were maintained by frequent, low severity fire. Fuel treatments range from using prescribed fire alone, to combinations of commercial or non-commercial thinning treatments followed by prescribed fire. Fuel treatments, especially prescribed fire, can meet other objectives as well. Prescribed fire can be used to create patterns of vegetation, reduce some structural components (e.g. understory layers), or create new structures such as snags. Fire created snags are often resistant to insects and decay fungi thereby increasing their longevity as snags. Examples of fuels treatments using prescribed fire and thinning will be presented and benefits to wildlife will be discussed.

Evaluating Stream-associated Amphibian Response in a Landscape-level Forestry Experiment in Western Washington State. Marc P Hayes[◊], Aimee P McIntyre, Eric M Lund, *Washington Department of Fish and Wildlife, Habitat Program, Aquatic Research Section, Olympia, WA 98501; Marc.Hayes@dfw.wa.gov; Aimee.McIntyre@dfw.wa.gov; Eric.Lund@dfw.wa.gov;* Jay Jones, Jack Giovanni, Andrew J Kroll, *Weyerhaeuser, Federal Way, WA 98063; jay.jones@weyerhaeuser.com; jack.giovanini@weyerhaeuser.com; AJ.Kroll@weyerhaeuser.com;* Timothy Quinn, *Washington Department of Fish and Wildlife, Habitat Program, Science Division, Olympia, WA 98501; Timothy.Quinn@dfw.wa.gov*

In a Before-After Control-Impact landscape-level experiment conducted in western Washington State over five years (2006–2010), we compared the responses of stream-associated amphibians (Coastal Tailed Frog [*Ascaphus truei*], and Torrent [*Rhyacotriton*] and Giant [*Dicamptodon*] salamanders) to clearcut harvest using three different treatments and unharvested references. Experimental units were 17 non-fish-bearing basins. Treatments varied in buffer length, and included the current Washington State Forest Practices (FP) buffer (~50% of stream length), and longer (100%) and shorter (0%) buffers; harvest treatments were replicated three or

four times. No stream-associated amphibian species were extirpated from headwater streams in any treatment. Treatment effects on linear density varied by genus, and for Tailed Frogs, by life stage. Giant Salamander linear density declined 82% (95% CI: 55-93%) pre- to post-harvest in the FP treatment relative to the reference. Pre- to post-harvest, linear density of Coastal Tailed Frog larvae was 4.1 (1.6-10.0) and 8.2 (3.3-20.1) times greater in the 100% and FP treatments than the reference, and post-metamorph Coastal Tailed Frog linear density in the 0% treatment was 5.5 (0.9-36.6) times that of the reference. We found no clear evidence of a difference in response to treatments for Torrent Salamanders. We observed all stream-associated amphibian species in areas lacking a riparian buffer, where logging slash accumulations were greatest. Overall, we conclude that the current FP buffer is effective in maintaining stream-associated amphibian populations, at least in the two years immediately post-harvest.

Bridge and Seton Watersheds: Grassland Bat Inventory and Monitoring. Jared Hobbs[◊] *Hemmera Consulting. 303-1221 Broad Street, Victoria, BC V8W 2A4; jhobbs@hemmera.com*

In August 2014 we used a combination of acoustic monitoring, mist-netting, and radio-telemetry to inventory and monitor at-risk bat species in the Lillooet area. We captured a total of 97 bats (11 species; 8 sampling locations) including seven Spotted Bats (*Euderma maculatum*). Telemetry was used, for Spotted Bats, to determine maternity roost locations. Through triangulation, we determined that bats were foraging over open bunchgrass/sagebrush plateaus. Home range estimates were 157 to 458 hectares, and the maximum distance traveled in a 30 minute monitoring period by any one bat was estimated at 2.8 km. Cumulative flight distances, using straight line distance from movement data, ranged 6.9 to 18.8 km. Pallid Bats (*Antrozous pallidus*) were not captured, but highly suitable sage-grassland habitats with rocky outcrops were identified north of Lillooet along the Fraser River. Some acoustic recordings in this study did possess Pallid Bat vocal characteristics. If present, Pallid Bat is likely to be rare and/or patchily distributed. Additional long-term passive acoustic monitoring between August 21, 2014 and January 9, 2015 revealed a new species, Eastern Red Bat (*Lasiurus borealis*) only recently confirmed in BC. This is an extralimital record for this species. Hoary Bat (*L. cinereus*), a migratory tree-roosting species, was also captured and recorded in unexpected numbers in open grassland habitat well into the fall acoustic monitoring period. These data suggest that the Fraser River may be a major bat migration route and possibly serving as a corridor for bats travelling seasonally between inland areas and the coast.

Can a Low Carrying Capacity and a Highly Stochastic Environment Induce a Predator Pit in Elk Populations? Jon Horne[◊], *Idaho Dept. of Fish and Game, 33316 16th St, Lewiston, ID 83501; jon.horne@idfg.idaho.*gov*;* Scott Bergen *1345 Barton Road, Pocatello, ID 83402;* Mark Hurley*, Idaho Dept. of Fish and Game, 600 South Walnut, Boise, ID 83707*

Due to concern over declining elk populations and the unknown effects of Gray Wolf (*Canis lupus*) predation, the Idaho Department of Fish and Game initiated a survival study of Elk (*Cervus elaphus)* in north-central Idaho. A total of 82 adult and 80 calves (~6 months old) were captured and fitted with global positioning system radio-collars from the winter of 2009 – winter 2014. Adult survival rates averaged 86% (range 76% - 97%). Calf survival rates averaged 44% but varied dramatically from year to year. We used a stochastic model of elk-wolf dynamics to investigate the implications of highly stochastic growth rates indicative of the observed survival rates. In particular, we were interested in the interaction between Elk density-dependent growth,

carrying capacity and the amount of stochasticity in predation rates. We found that when predation rates were highly stochastic and carrying capacities were low, populations behave as if they were in a predator pit; but if carrying capacity was high or stochasticy low, populations grew out of the predator pit. These results suggest that in a stochastic environment, populations may actually be influenced by both bottom-up and top-down forcing simultaneously as opposed to being governed by one or the other.

***Batrachochytrium salamandrivorans*: Coordinating a Proactive Response to an Emerging Amphibian Disease.** Blake R Hossack◊, *US Geological Survey, Northern Rocky Mountain Science Center, Missoula, MT 59801; blake_hossack@usgs.gov;* Deanna H Olson, *US Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331;* M Camille Harris, *US Geological Survey, Office of Ecosystems, Reston, VA 20192; mcharris@usgs.gov*

Emerging infectious diseases are one of the greatest threats to global biodiversity. First discovered in 1998, the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*; Bd) has caused declines of frogs and toads globally, possibly even causing extinction of some species. Recent discovery of a related fungus (*Batrachochytrium salamandrivorans*; Bsal) that is lethal to salamanders portends a repeat of declines caused by Bd. So far, Bsal disease outbreaks have only been reported in wild and captive newts in northern Europe. The fungus likely originated in southeast Asia, where it has been detected on newts without causing disease. The high salamander species richness in North America suggests Bsal could spread here and have dire consequences. Based on lessons learned from Bd, the U.S. Geological Survey Amphibian Research and Monitoring Initiative, and Partners in Amphibian and Reptile Conservation are working with U.S. and international scientists and managers to begin formulating a coordinated approach to Bsal investigations. This coordination is broad-ranging and includes establishing standardized methods for diagnostics and research, surveillance and monitoring, decision support and management responses, communications, and data management. We will provide an overview of the science and relevant policy and management options for this recently emerged threat.

Potential Effects of Waste Waters from Oil and Gas Extraction on Amphibians: Preliminary Results from a Multi-partner Investigation. Blake Hossack◊, Ken Honeycutt, Todd Preston, *US Geological Survey, Northern Rocky Mountain Science Center, Missoula, MT 59801*; *blake_hossack@usgs.gov;* Holly Puglis, *US Geological Survey, Columbia Environmental Research Center, Columbia, MO 65201;* William Battaglin, *US Geological Survey, Denver Federal Center, Denver, CO 80225;* Kelly Smalling, *US Geological Survey, New Jersey Water Science Center, Lawrenceville, NJ 08648;* Douglas Kent, *US Geological Survey, Menlo Park, CA 94025;* Isabelle Cozzarelli, Katherine Skalak, *US Geological Survey, Reston, VA 20192;* Joanna Thamke, *US Geological Survey, Montana Water Science Center, Helena, MT 59601;* Chauncey Anderson, *US Geological Survey, Oregon Water Science Center, Portland, OR 97201*

Development of unconventional techniques for oil and gas extraction has fueled an unprecedented expansion of energy extraction and associated economic growth in the northern Great Plains. A large portion of this expansion has occurred in the Williston Basin and Prairie Pothole regions, a landscape with broad expanses of prairie and wetlands that have enormous

ecological and economic value. Although disposal practices for waste waters produced during oil and gas extraction have improved greatly, occasional releases can result in large quantities of high-salinity brines that persist in the environment. There is a growing body of work focused on water and sediment chemistry in these areas, but research into effects of wastes on higher trophic levels in wetlands has been limited. We built on existing research and leveraged the work of multiple groups within USGS to conduct a controlled experiment that tests effects of sediment from reference and waste-affected wetlands on survival and growth of amphibian larvae, and estimated species richness and abundance of amphibians across several wetlands spanning a contamination gradient. We also performed chemical analysis of sediment, groundwater, surface water, and amphibian tissues. Results are intended to help inform management decisions about wildlife conservation in the region, efficacy of remediation actions, and improve protocols for management of future oil and gas wastes.

The Decline of Native Freshwater Mussels (Bivalvia: Unionoida) in California as Determined from Historical and Current Surveys. Jeanette Howard◊, *The Nature Conservancy, 201 Mission Street, 4th Floor, San Francisco, CA 94105; jeanette_howard@tnc.org;* Joseph L Furnish, *US Forest Service, Pacific Southwest Region, 1323 Club Drive, Vallejo, CA 94592; josephfurnish@att.net;* Jayne Brim Box, *The Confederated Tribes of the Umatilla Indian Reservation, 46411 Timine Way, Pendleton, OR 97801; brimbox@gmail.com;* Sarina Jepsen, *The Xerces Society for Invertebrate Conservation, 628 NE Broadway, Suite 200, Portland, OR 97232; sarina@xerces.org*

Freshwater mussels are increasingly recognized as important components of aquatic ecosystems but paradoxically are one of the most critically imperiled faunal groups in North America. In California the conservation status of all three native genera has not been comprehensively evaluated in over 30 years. We determined the current distribution of freshwater mussels in California by resurveying historical sites of known occurrences and evaluating the relative change between historical and contemporary surveys. A total of 450 historical records were compiled and represented 116 unique, locatable sites. Nearly 70% of the historical sites were resurveyed, and freshwater mussels were found at 47% of the resurveyed sites. Of the three mussel genera (*Anodonta*, *Gonidea* and *Margaritifera*) known from California, *Anodonta* was historically the most commonly observed genus, but was only found at 33% of the resurveyed sites. Although *Margaritifera* and *Gonidea* were historically found at fewer sites than *Anodonta*, they were extant at 65% and 55% of the resurveyed sites, respectively. Mussel losses were especially apparent in southern California, with mussels extirpated from 13 of 14 resurveyed sites. The absence of mussels from many historical sites, especially in southern California, parallels the on-going decline of freshwater mussel populations nationally.

Arthropod Characteristics at Columbian Sharp-tailed Grouse Brood Locations in Conservation Reserve Program and Shrub-steppe Rangeland Habitat. Katey Huggler◊, M Elliott, K Reese, *University of Idaho, Moscow, ID 83844;* J Knetter, *Idaho Department of Fish & Game, Boise, ID 83712;* P Coates, *US Geological Survey, Dixon, CA 95620;* G Gillette, *Idaho State University, Pocatello, ID 83209*

The conversion of wildlife habitat to cropland is one of the greatest conservation threats to vertebrate species occupying grasslands in North America. As a result, many restoration efforts exist to restore grasslands; the Conservation Reserve Program (CRP) is preeminent

among them. In Idaho, over 260,000 hectares have been converted back to perennial vegetation via CRP. Columbian Sharp-tailed Grouse (*Tympanucus phasianellus columbianus*) are believedto have benefited from the perennial vegetation CRP provides, but it is unclear what mechanisms are responsible. Arthropods are an important resource for chick survival and growth during the first four weeks of life. We measured aboveground arthropod biomass and diversity to quantify the value of CRP for Columbian Sharp-tailed Grouse. We collected sweep net samples of arthropods at brood locations in CRP and shrub-steppe rangelands in southeastern Idaho during 2012 and 2013. Arthropod samples (n=138) were dried, counted and sorted by morphospecies. We found no difference in total arthropod biomass between brood locations in CRP and shrub-steppe rangelands. Arthropod diversity was lower in CRP than shrub-steppe rangelands. Hymenoptera, Coleoptera, and Lepidoptera biomass was higher in CRP than shrub-steppe; Orthoptera was higher in shrub-steppe habitat. Columbian Sharp-tailed Grouse can successfully rear chicks in CRP habitat which contains an abundance and diversity of arthropods and is better habitat than cultivated croplands. Future development of CRP habitat should focus on establishing forb abundance and diversity within seeded grasslands to increase the abundance and diversity of arthropods believed to be important to Columbian Sharp-tailed Grouse chick growth and survival.

Ethics of Wildlife Capture and Handling. Mark R. Johnson DVM[◊], *Global Wildlife Resources, P.O. Box 1319, Hamilton, MT 59840; mjohnson@wildliferesources.com*

With the development of non-invasive research techniques, wildlife capture and handling is still a common and often essential component of research and management. Capture and handling however can result in animal injury and mortality. The significance of these impacts on the animal are not only determined by the field techniques used, they are also strongly influenced by the choices of the wildlife biologist. As the culture of our society and the culture of our profession evolves, there is more discussion about state of the art methods in animal handling and promoting a respectful and caring attitude for each animal. With these values comes the recognition that the well-being of the animal is of the utmost importance. If we choose, we can bring values of care, honor, and respect for each animal into the field and incorporate them into our tools and techniques. Examples include thorough field preparation, using head covers and ground cloths, and monitoring temperature, pulse, and respiration whenever animals are chemically immobilized.

Occupancy and Interspecific Interactions of Raccoon and Virginia Opossum in Seattle, Washington. Mark J Jordan[◊], *Seattle University, Biology Department, 901 12th Avenue, Seattle, WA 98122; jordanma@seattleu.edu;* Nicholas D Iapoce, *iapocen@seattleu.edu;* Destiny Mims, *mimsd@seattleu.edu*

We have a relatively limited understanding of how natural processes like habitat selection and species interactions function in urban landscapes that have been highly modified by humans. Further, little research has assessed the impacts of habitat restoration on wildlife in such highly modified environments. To address these knowledge gaps, we used camera traps to determine the patch and matrix landscape features that affect occupancy in two human commensal species, Raccoon (*Procyon lotor*) and Virginia Opossum (*Didelphis virginiana*) in natural areas in Seattle, WA during three summer field seasons in 2013-2015. The primary restoration activity in

these areas was the removal of invasive species and planting of native understory and canopy species. Occupancy rates were relatively high for both species: 0.89 (95% CI: 0.55-0.98) for Raccoons and 0.84 (0.60-0.95) for Opossums, with a slightly lower, though not statistically significant, occupancy rate for Raccoons in natural areas that had not experienced restoration. Camera timestamps showed significantly different activity times for the two species (Watson's $U^2 = 0.59$; $P<0.001$), with Opossums most active in the early part of the night and Raccoons exhibiting a crepuscular activity pattern. These results suggest temporal resource partitioning between these two ecologically similar species.

*** Home Range Size and Foraging Patterns of White-headed Woodpeckers in Western Idaho.** Adam R Kehoe◊, *Department of Ecology, Montana State University, Bozeman, MT 59717; adam.r.kehoe@gmail.com;* Victoria A Saab, Quresh Latif, *USDA Forest Service, Rocky Mountain Research Station, Bozeman, MT 59717; vsaab@fs.fed.us; qlatif@fs.fed.us;* Jonathan G Dudley, *USDA Forest Service, Rocky Mountain Research Station, Boise, ID 83702; jdudley@fs.fed.us*

Home range size (HRS) often fluctuates with availability of food resources. Typically, we expect decreasing HRS's with increasing food abundance. We studied HRS and foraging patterns of the White-headed Woodpecker (*Picoides albolarvatus*) in western Idaho. This woodpecker is a species of conservation concern due to loss and degradation of Ponderosa Pine (*Pinus ponderosa*)-dominated forests, which are now undergoing extensive restoration. Cones and arthropods found on large-diameter ponderosa pine trees represent important food resources for this woodpecker. We used linear regression to analyze HRS relationships with proportion of time spent foraging on ponderosa pine cones and on large-diameter (dbh ≥50cm) ponderosa pine trees. We expected smaller HRS's with increasing foraging time on cones and large ponderosa. We obtained 30-75 relocations for 11 breeding woodpeckers (each individual observed foraging from 1–10 hours) during the post-fledging period (July–September) in 2014–2015. Individual HRS's ranged 24–169 ha and 5–51 ha estimated with 90% and 50% fixed kernels, respectively. As predicted, we found a negative relationship between HRS and proportion of foraging time on β_1[SE] =-1.45[0.50], P=0.018 for 90% kernel; β_1[SE] =-1.94[0.57], P=0.008 for 50% kernel; n=11). We found no evidence, however, of a negative relationship with proportion foraging time β_1[SE] =1.542 [1.767], P=0.222 for 90% kernel β_1[SE] =1.676[1.491], P=0.290 for 50% kernel; n=11). Effects of management treatments on White-headed Woodpecker post-fledging success will likely depend on how treatments affect cone-producing ponderosa pine trees. The importance of large ponderosa is less clear.

Effects of Intensive Forest Management on Early-seral Associated Birds, Oregon Coast Range, 2011-2015. A.J. Kroll◊, *Weyerhaeuser, P.O. Box 9777, Federal Way, WA 98063; aj.kroll@weyerhaeuser.com;* Jake Verschuyl, *National Council for Air and Stream Improvement, Anacortes, WA 98221; jverschuyl@ncasi.org*; Jack Giovanini, *Weyerhaeuser, P.O. Box 9777, Federal Way, WA 98063; jack.giovanini@weyerhaeuser.com;* Matthew Betts, *Oregon State University, Corvallis, OR 97331; matt.betts@oregonstate.edu*

Land use change, increased intensity of forest management, and decreased harvest rates have resulted in a loss of diverse young forest stands in the Pacific Northwest. For example, use of herbicides to suppress herbaceous and woody plant species may reduce some components of biological diversity in intensively managed stands. We designed a large-scale experimental study to test the influence of intensive forest management on the abundance of early seral bird species

in the Oregon Coast Range. Experimental applications included 'Intensive" (heavy herbicide application), 'Moderate' (operational), and 'Light' (alternative) treatments as well as controlswith no herbicide application post-harvest. We present detection-corrected bird abundance results across 32 experimentally treated stands, 2011-2015. In relation to the controls, we found evidence for reductions in abundance of four of 18 early-seral associated bird species in the Moderate and/or Intensive treatments five years after stand initiation. These results support the prediction that intensive management truncates habitat quality in initial years following herbicide treatment. However, for other species, negative effects decreased substantially over time or evidence existed for positive effects of herbicide applications. Future work will examine longevity of early seral conditions in managed stands before tree canopies begin to close.

Hibernation Ecology of Silver-haired Bats Overwintering in British Columbia, Canada. Cori L Lausen◊, *Wildlife Conservation Society Canada, P.O. Box 606, Kaslo, BC V0G 1M0; clausen@wcs.org;* Thomas J Hill, *Fish and Wildlife Compensation Program Columbia Region, 601 – 18th Street, Castlegar, BC V1N 2N1; tjhill18@hotmail.com*

The Silver-haired Bat (*Lasionycteris noctivagans*) is generally considered a 'migratory-hibernator'; migrating to areas where it overwinters with periods of dormancy. It has long been hypothesized that this species may not be migratory in British Columbia, or migration distances are short, supported by its year-round detection in the province. We studied *L. noctivagans* at three study locations in southeast B.C. from 2009–2014. Using temperature-sensitive transmitters in winter, we documented arousal patterns of both sexes. We determined that *L. noctivagans* hibernate in mines, rock-crevices, trees and snags, often switching roosts during the winter period. Hibernacula microclimates are high in humidity, but colder than required for optimal growth of the psychrophilic fungus *Pseudogymnoascus destructans*, which is responsible for white-nosed syndrome. By banding individuals at two mines in both summer and winter, we documented the first evidence of year-round residency at mines by male *L. noctivagans*. Recaptures of both males and females banded as juveniles and recaptured as adults in subsequent years confirms roost fidelity. Evidence of winter mating was found in some January and February captures. Patterned acoustic recordings by *L. noctivagans* could be described as "songs" and may be associated with mating behavior given their predominance during fall and winter.

Factors Influencing Nest Survival of Greater Sage-grouse in Southern Idaho. Anthony J Locatelli◊, *Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish & Wildlife Sciences, University of Idaho, Moscow, ID 83844; alocatelli@uidaho.edu;* Courtney J Conway, *US Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish & Wildlife Sciences, University of Idaho, Moscow, ID 83844; cconway@uidaho.edu;* Dave Musil, *Idaho Department of Fish and Game, Jerome, ID 83338; david.musil@idfg.idaho.go;* Karen Launchbaugh, *Department of Forest, Rangeland, and Fire Sciences, University of Idaho, Moscow, ID 83844; klaunchb@uidaho.edu;* Shane Roberts, *Idaho Department of Fish and Game, Idaho Falls, ID 83401;* David Gotsch, *Department of Fish and Wildlife Sciences, University of Idaho, Moscow, ID 83844; dgotsch@uidaho.edu*

Identifying factors that cause variation in reproductive output of a species is important for designing effective management plans for wildlife populations. Such information is particularly important for declining or rare species that are the subject of explicit management efforts. Nest survival is often considered a key vital rate in Greater Sage-grouse (Centrocercus urophasianus)

because variation in Sage-grouse nest survival is thought to have a large influence on variation in population growth. We monitored 159 Greater Sage-grouse nests in 2014 and 2015 across four study sites in southern Idaho. Apparent nest success was 43% (n = 53) in 2014 and 46% in 2015 (n = 106). We assessed the relative influence of the following variables on the probability of nest survival in Greater Sage-grouse: female age, nest initiation date, weather variables, vegetation characteristics surrounding the nest site, and anthropogenic features. Our results should help land managers target specific habitat features for management and thereby enhance reproductive success of Greater Sage-grouse.

Why are most snags never used by woodpeckers for nesting? Wood hardness can limit snag use by cavity-dependent wildlife. Teresa J Lorenz◊, *US Forest Service, Pacific Northwest Research Station, 3625 93rd Ave. SW, Olympia, WA 98521; tlorenz@fs.fed.us;* Kerri T Vierling, *Department of Fish and Wildlife, University of Idaho, Moscow, ID 83844; kerriv@uidaho.edu;* Timothy R Johnson, *Department of Statistical Sciences, University of Idaho, Moscow, ID 83844;* Philip C Fischer*, 1405 Jesica Drive, Selah, WA 98942*

Woodpeckers are important for excavating cavities and a large number of studies have examined their nesting preferences. However, quantitative information is lacking on the role of wood hardness in limiting cavity excavation. In dry mixed-conifer forests along the east slope Cascades in Washington we compared wood hardness at nest sites for six woodpecker species and examined the role of wood hardness in nest-site selection. At nest sites (n = 259) we found that interior wood (3-10 cm deep) was softer than exterior wood (0-3 cm deep) for all species ($F_{(1,517)} = 66$, $P < 0.001$). Among species, there were no differences in wood hardness in the nest interior, but nest sites had softer interior wood than random (non-use) sites (n = 559; $F_{(1,517)} = 106$, $P < 0.001$). Interior wood hardness was the most influential factor in nest-site selection at both spatial scales we examined – in the selection of nest snags in territories and in the selection of nest locations on snags. Regardless of hypothesized excavation abilities, each species appeared limited by wood hardness and we estimated that 77- 96% of all wood on the landscape was too hard to be excavated. This finding is critical because past studies that did not measure wood hardness likely counted some snags as available for woodpeckers that were too hard, potentially biasing results. We recommend that land managers retain as many snags and defective live trees as possible following timber harvest to insure a suitable quantity of substrates are available for cavity excavation.

Micro-Climatic Envelopes of Terrestrial Gastropods. Michael Lucid◊, *Idaho Department of Fish and Game, 2885 Kathleen Avenue, Coeur d' Alene, ID 83805; michael.lucid@idfg.idaho.gov;* Sam Cushman, *US Forest Service, Rocky Mountain Research Station, 2500 South Pine Knoll Drive, Flagstaff, AZ 86001; scushman@fs.fed.us;* Shannon Ehlers, *Idaho Department of Fish and Game, 2885 Kathleen Avenue, Coeur d' Alene, ID 83805; shannon.ehlers@idfg.idaho.gov;* Andrew Shirk, *Climate Impacts Group, University of Washington, Box 355674, Seattle, WA 98195; ashirk@uw.edu;* Chris Witt, *US Forest Service, Rocky Mountain Research Station, 322 East Front Street, Suite 401, Boise, ID 83702; chriswitt@fs.fed.us;* Tom Burke, *1761 Game Farm Road, Ellensburg, WA 98926; burketeca@hotmail.com*

Low vagility ectothermic organisms with permeable skin are often thought to be more sensitive to environmental conditions than organisms without these characteristics. However, quantitative analyses which delineate environmental conditions for wide suites of such species

are rare. Global temperatures are predicted to rise 2-4°C in the next 20-30 years and it may be possible to manage micro-climates to maintain suitable temperature ranges for species if narrow micro-climatic niches are delineated. From 2010-2014 the Multi-species Baseline Initiative co-located air temperature data loggers with terrestrial gastropod surveys at 992 unique sites in 879 5x5km^2 survey cells across 22,975 km^2 in northern Idaho and adjoining mountain ranges. At each site we collected air temperature every 90 minutes for 1-4 years and calculated mean annual air temperatures for each site (-0.242-14.174°C, mean = 6.311°C). We collected 9,391 gastropod specimens representing 58 native and non-native species. For species detected at ≥15 survey sites (n = 26 species) we determined 19 (73%) showed strong association within a 2-4°C temperature range. These species were classified as having 'warm' (n = 9), 'cool' (n = 6), or 'very cool' (n = 4) climatic envelopes dependent on if the mean detection site temperature was greater or less than the study area mean temperature (6.311°C). This dataset of air temperature associations for low vagility species will help inform management actions to maintain necessary micro-climate conditions for terrestrial gastropods.

The Distribution and Diversity of Freshwater Mussels in Idaho. Steven J Lysne[◊], *Department of Life Sciences, College of Western Idaho, 5500 East Opportunity Drive, Nampa, ID 83687; stevelysne@cwidaho.cc*

The conservation and management of freshwater mussels has been the focus of increased research attention in recent years. Scientists and resource managers are identifying both the diversity of species, using molecular techniques, and the distribution and abundance of species with the goal of better understanding freshwater mussel ecologies to prioritize management actions. The Idaho Freshwater Mollusk Project (IFMP) is an effort to describe and analyze the diversity, distribution, and conservation status of all freshwater mollusks in Idaho. We collect element occurrence data from state and federal natural resource agencies, public and private museums, private industry, and citizen scientists, and analyze this data in the context of both past and present distributions and land-use patterns. Results from our work are communicated to scientists and natural resource managers with the goal of providing useful information to those responsible for setting conservation priorities and managing Idaho's native species. To date the IFMP has collected over 4000 element occurrences of freshwater mollusks including 21 species and sub-species of mussels from six genera and three families. The distribution of mussels is influenced by geography with the Margaritiferidae generally restricted to higher elevations and colder mountain streams characterized by extreme high and low flows and the presence of presumed salmonid hosts. The Unionidae and Sphaeriidae are generally distributed at lower elevations and in warmer streams characterized by greater anthropogenic alterations to water chemistry and quantity. The implications of our findings for freshwater mussel conservation are discussed and future research directions offered.

Moving Forward with Management of *Gonidea angulata* in the Okanagan Valley of British Columbia, Canada. Jon Mageroy[◊], Ian Walker, Roxanne Snook, *University of British Columbia Okanagan, 3333 University Way, Kelowna, BC V1V1V7; jmageroy@mail.ubc.ca; ian.walker@ubc.ca; roxannesnook@hotmail.com;* Lora Nield, *British Columbia Ministry of Forests, Lands and Natural Resource Operations, 102 Industrial Place, Penticton, BC V2A7C8; lora.nield@gov.bc.ca;* Sean MacConnachie, *Fisheries and Oceans Canada, 3190 Hammond Bay Road, Nanaimo, BC V9T6N7; Sean.MacConnachie@dfo-mpo.gc.ca;* Greg Wilson, *British*

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In Canada, the Western Ridged Mussel (*Gonidea angulata*) is only found within the Okanagan Valley, British Columbia. However, it has disappeared from sites within the valley and has been listed as endangered. Therefore, the province of British Columbia, Fisheries and Oceans Canada, and the University of British Columbia Okanagan have been working in partnership to fill knowledge gaps and improve the management of this species. Surveys show that the mussel is present in several of the lakes and in the Okanagan River. There are some sites that have quite dense mussel beds, where juvenile recruitment is known to be occurring. Other sites are showing a decline in mussels. Habitat studies and modelling show that, in the lakes, the mussel prefers areas with highly embedded substrate, high on sand and boulders. Further, the preferred locations are typically shallow areas of points or bays, which experience high fetch (wind exposure). In the river, surveys show that the mussel prefers the banks of channelized sections, rather than natural or restored sections. Host fish field studies strongly suggest that Prickly Sculpin (*Cottus asper*) is the most important host for the mussel in the valley, although there are other potential hosts. Fish surveys suggest that limited host availability, likely due to the impacts of introduced fish species, may be a threat to the mussel in the southern part of the valley. Based on these findings, the province is taking management actions to protect known mussel beds, habitat and the mussel's host fish.

The Status of *Margaritifera falcata* in British Columbia: Taking Small Steps Forward… Jon Mageroy[◊], *University of British Columbia Okanagan, 3333 University Way, Kelowna, BC V1V 1V7 and A Rocha Canada, 19353 16th Avenue, Surrey, BC, V3Z 9V2; jmageroy@mail.ubc.ca;* Greg Wilson, *British Columbia Ministry of Environment, Conservation Science Section, P.O. Box 9338 Station Provincial Government, Victoria, BC V8W 9M1; greg.wilson@gov.bc.ca;* Laine Fung, Jessica Rae, *A Rocha Canada, 19353 16th Avenue, Surrey, BC, V3Z 9V2; lainefung@outlook.com; jesshazelrae@gmail.com;* Rich Harbo, *Department of Fisheries and Oceans Canada (retired), Suite 200, 401 Burrard Street, Vancouver, BC V6C 3S4; rharbo@shaw.ca,* Craig Whightman, *British Columbia Conservation Foundation, Living Rivers – Georgia Basin/Vancouver Island, 5569 Cortez Road, North Vancouver, BC V7R 4P9; cwightman@bccf.com;* Ron Ptolemy, *British Columbia Ministry of Environment, Conservation Science Section, P.O. Box 9338 Station Provincial Government, Victoria, BC V8W 9M1; ron.ptolemy@gov.bc.ca;* Lea Gelling, Dave McEwan, *British Columbia Ministry of Environment, British Columbia Conservation Data Centre, P.O. Box 9338 Station Provincial Government, Victoria, BC V8W 9M2; lea.gelling@gov.bc.ca; dave.mcewan@gov.bc.ca;* Shannon McFadyen, *University of Victoria, 3800 Finnerty Road, Victoria, BC V8P 5C2; smcfadye@uvic.ca;* Jacqueline Madill, André Martel, *Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON K1P 6P4; jmadill@mus-nature.ca; amartel@mus-nature.ca;* Ray

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In British Columbia, the Western Pearlshell (*Margaritifera falcata*) is one of five to seven known species of freshwater mussels. As it is considered to be widespread, and there is little known harvest of the species, little effort/funding has been available to investigate its status or biology/life history. However, through the combined efforts of a variety of organizations, small steps forward are being taken to increase the knowledge about this species. Sites with the mussel are known from most of the ecoregions in the southernmost two thirds of the province. However, many of these sites only include presence/absence data and/or lack recent surveys. The few sites that include counts show that many of the surveyed rivers and streams contain small areas with very dense mussel beds, while a few rivers and streams have very low numbers of mussels. Only three rivers have been surveyed with respect to length/size distributions. Surveys show that juvenile recruitment is occurring in these rivers. Among them, only one river has been surveyed on two occasions. Surveys in 2009 and 2015 show a decline in the mussel population. However, length distributions and evaluation of juvenile recruitment show a rejuvenation within the population. Further studies are definitively needed to provide a better understanding of the species status in British Columbia. Hopefully, repeated surveys of sites and more length distribution data will help evaluate population trends and basic biology throughout the province.

Reproductive Biology of *Anodonta nuttalliana*, *A. oregonensis, Margaritifera falcata*, and *Gonidea angulata* in the Columbia River Basin. Alexa Maine◊, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fisheries Program, Freshwater Mussel Project, 46411 Timine Way, Pendleton, OR 97801;* Christine O'Brien, *Browns River Environmental Consultants, 130 Sesame St., Waynesville, NC 28785, Christine.amblema@gmail.com;* Jayne Brim Box, Donna Nez, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fisheries Program, Freshwater Mussel Project, 46411 Timine Way, Pendleton, OR 97801*

Freshwater mussels in the western United States are in decline, including in the Umatilla River system in eastern Oregon. The Confederated Tribes of the Umatilla Indian Reservation is committed to restoring freshwater mussels in the Umatilla River and surrounding basins, as part of its "First Foods" approach to natural resource management and conservation. Until recently little was known about the life history of freshwater mussels in the Pacific Northwest, including information on host fishes and habitat requirements. Because freshwater mussels require a host fish to complete their life cycle, conservation and restoration efforts are hampered by this lack of host fish knowledge. We studied the reproductive biology of *Anodonta spp*., *Gonidea angulata* and *Margaritifera falcata* in the laboratory and in field trials in the Umatilla River. We found *A. oregonensis* with viable glochidia in mid-March, gravid *A. nuttalliana* from late spring through early summer, gravid *G. angulata* in June, and *M. falcata* with viable glochidia in mid-April. Host fish experiments identified the Longnose Dace (*Rhinichthys cataractae*), Speckled Dace (*R.*

osculus), Redside Shiner (*Richardsonius balteatus*), Torrent Sculpin (*Cottus rhotheus*), and Margined Sculpin (*C. marginatus*) as viable hosts for *A. nuttalliana.* Fish identified as suitable hosts for *A. oregonensis* include Speckled Dace, Margined Sculpin, Redside Shiner, RainbowTrout (*Oncorhynchus mykiss*), and Chinook Salmon (*O. tshawytscha*). The Torrent Sculpin and Shorthead Sculpin (*C. confuses*) were found to be viable hosts for *G. angulata.* The Rainbow Trout was identified as a suitable host fish for *M. falcata*. Future efforts will include testing propagation and rearing methods for transformed juvenile mussels.

Implementing Greater Sage-Grouse Conservation: An Overview of the 2015 Idaho and Southwestern Montana BLM Resource Management Plan Amendment. Paul Makela[◊], *US Bureau of Land Management, Idaho State Office Branch of Resources and Science, 1387 South Vinnell Way, Boise, ID 83709; pmakela@blm.gov*

In 2010 the U.S. Fish and Wildlife Service (FWS) found the Greater Sage-Grouse (*Centrocercus urophasianus*), hereafter GRSG, warranted for listing under the Endangered Species Act (ESA) but precluded by higher priority listing activities. A lack of adequate regulatory mechanisms in Bureau of Land Management (BLM) and Forest Service (FS) resource management plans was identified as a contributing factor. In response, the BLM and FS initiated a heretofore unprecedented conservation planning effort to complete Environmental Impact Statements to amend resource management plans across much of the western United States prior to a final listing determination. The approved plan amendments incorporated a suite of actions to conserve GRSG including restrictive land use allocations for certain activities, required project design features, management direction for agency programs, protective buffers, anthropogenic disturbance caps, seasonal restrictions, habitat objectives, adaptive triggers, fire and invasive species assessment and more. Records of Decision for the Great Basin and Rocky Mountain GRSG planning regions were signed on September 21, 2015 and the FWS subsequently found the GRSG not warranted for ESA listing because primary threats were ameliorated by conservation efforts implemented by federal and state agencies and private landowners. This presentation provides a brief overview of the Idaho and Southwestern Montana BLM Resource Management Plan Amendment.

*** A Critical Role for Disease Persistence in Population Viability Assessments of Bighorn Sheep.** Kezia Manlove[◊], *Department of Biology, Pennsylvania State University, 15 E. Mason Street Apt. A, Bozeman, MT 59715; kezia.manlove@gmail.com;* Frances Cassirer, *Idaho Department of Fish and Game, 3316 16th St., Lewiston, ID 83501; frances.cassirer@idfg.idaho.gov;* Paul Cross*, USGS Northern Rocky Mountain Science Center, Bozeman, MT 59715;* Raina Plowright*, Department of Microbiology and Immunology, Montana State University, Bozeman, MT 59717; raina.plowright@montana.edu;* Peter Hudson*, Center for Infectious Disease Dynamics, Pennsylvania State University, State College, PA 16802; pjh18@psu.edu*

Disease-induced die-offs of Bighorn Sheep (*Ovis canadensis*) are a widely recognized management challenge for the American Rocky Mountains. Impacts of the poor recruitment that often follows these all-age disease events are less understood. Here we study the long-term effects of lamb disease on Bighorn Sheep population growth rates. We found that population dynamics are very sensitive to the frequency of pathogen introduction – a strong argument for continuing policies aimed to segregate Bighorn and domestic sheep – but we also show that long-term population viability depends critically on the duration over which disease persists in

lambs. Our models suggest that long-term pathogen persistence may precipitate a phase-transition in Bighorn Sheep population dynamics, from a period of rapid growth prior to disease onset, to a period of stagnant-to-declining population trajectories. Taken together, our results underscore the importance of understanding pathogen, and disease persistence, in order to optimally manage Bighorn Sheep throughout the mountain west.

Treponeme-associated Bacterial Hoof Disease in Elk from Southwest Washington. Kristin G Mansfield[◊], *Washington Department of Fish and Wildlife, 2315 North Discovery Place, Spokane Valley, WA 99216; kristin.mansfield@dfw.wa.gov;* Nicholas J Evans, *Department of Infection Biology, Institute of Infection and Global Health, School of Veterinary Science, University of Liverpool, Liverpool Science Park IC2, 146 Brownlow Hill, Liverpool, UK L3 5RF;evansnj@liverpool.ac.uk;* Sushan Han, *Diagnostic Medicine Center, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523; sushan.han@colostate.edu*

Reports of Elk (*Cervus elaphus*) with lameness and severely deformed or missing hooves increased dramatically in southwest Washington during the late winter and early spring of 2008. The geographic distribution of reports of the disease has continued to expand since then, and at this time is estimated to encompass a core area of approximately 10,500 km^2 (4,000 mi^2). A diagnostic investigation to determine the cause was initiated in 2009. Radiography, bacteriology, virology, serology, and trace mineral analysis failed to reveal a cause of the disease. Histopathology and silver staining of lesions from affected hooves demonstrated the presence of deeply invasive spirochetes accompanied by significant inflammation. Furthermore, *Treponema phagedenis*-like and *Treponema medium*-like spirochetes were isolated from diseased Elk hooves. These isolated *Treponema* represent two of the three phylotypes known to be highly associated with hoof diseases in domestic animals: bovine digital dermatitis in cattle and contagious ovine digital dermatitis in sheep. Based on findings to date, it appears that *Treponema* spp. may have a causal role in the emergence of a significant disease of free-ranging elk in the Pacific Northwest of North America.

Wyoming's Native Freshwater Mussels. Philip Mathias[◊], *Wyoming Game and Fish Department, 3030 Energy Lane, Casper, WY 82604; philip.mathias@wyo.gov*

Seven of North America's native freshwater mussel species can be found in Wyoming. Much knowledge has been gained about these seven species since 2011 through U.S. Fish and Wildlife Service (USFWS) State Wildlife Grant (SWG) and Wyoming Governor's ESA funded native mussel surveys. Wyoming is a headwaters state that is divided into Atlantic and Pacific Ocean drainages. California Floater (*Anodonta californiensis*) and Western Pearlshell (*Margaritifera falcata*) can be found west of the continental divide, while the Cylindrical Papershell (*Anodontoides ferussacianus*), Plain Pocketbook (*Lampsilis cardium*), Fatmucket (*Lampsilis siliquoidea*), White Heelsplitter (*Lasmigona complanata*), and Giant Floater (*Pyganodon grandis*) are all found east of the continental divide. Survey techniques were developed in 2011 that used timed visual and tactile searches to look and feel for native mussels; stream channel parameters were also measured (i.e. width, depth, substrate). After five field seasons of native mussel surveys, much work is still needed to accurately determine each species' statewide distribution and to refine each species' Native Species Status (NSS) rank for

the 2017 revision of Wyoming's State Wildlife Action Plan (SWAP). Refined distributions for all but *L. cardium* and *P. grandis* have been developed and several range expansions have been documented since the 2010 SWAP. Specific NSS ranks have been assigned to every species except *P. grandis*, which will remain with an NSS unknown in Wyoming's 2017 SWAP revision. Native mussel surveys have been funded through February of 2019 using USWFS SWG funding.

*** Understanding Factors Influencing Fine-scale Habitat Use by Pygmy Rabbits.** Laura A McMahon◊, Janet L Rachlow, *Department of Fish and Wildlife Sciences, University of Idaho Department of Fish and Wildlife Sciences, 875 Perimeter Dr. MS 1136, Moscow, ID 83844; mcma2967@vandals.uidaho.edu; jrachlow@uidaho.edu;* Tim R Johnson, *University of Idaho Department of Statistical Science, 875 Perimeter Drive MS 1104, Moscow, ID 83843; trjohns@uidaho.edu;* Jennifer S Forbey, *Department of Biological Sciences, Boise State University, Boise, ID 83725; jenniferforbey@boisestate.edu;* Lisa A Shipley, *School of the Environment, Washington State University, 425 Heald Hall, Pullman, WA 99164; shipley@wsu.edu*

Resource selection by animals that use specific habitat structures, such as nests or burrows, is influenced by the quality of the resources, distance from the structures, and costs associated with moving away from the structures. The Pygmy Rabbit (*Brachylagus idahoensis*) is an obligate burrower that occurs only in sagebrush habitats. In regions characterized by mounded micro-topography (i.e., mima mounds), Pygmy Rabbits concentrate burrow excavation on mima mounds where shrubs are tall and dense relative to the matrix among mounds. Our goal was to quantify patterns of space use by Pygmy Rabbits to evaluate factors that influence resource selection at a relatively fine spatial scale (i.e., the mima mound). We monitored daily movements of adults fitted with radio collars during winter and summer. We measured vegetation properties and burrow characteristics (size, number of openings, concealment at the entrance) on mima mounds that were used and unused by rabbits, and we used GIS to quantify landscape features (e.g., distance to nearest burrow or mound, density of burrow systems, shrub cover). During winter, 92% of locations were within 12 m of burrow systems and rabbits exploited an average of six different burrow systems (range = 2-10). During summer, burrow use declined to 60% of locations, and rabbits exploited more areas of continuous, dense sagebrush vegetation or mima mounds without burrows compared to winter. Preliminary analyses suggest that characteristics of vegetation and burrows, season and sex influenced habitat selection. Understanding habitat selection can help assess habitat quality and targets for habitat management and restoration.

Dry Forest Wildlife Habitat: Objectives and Tradeoffs. Kim Mellen-McLean◊, Maximillian Wahlberg, *USDA Forest Service, 1220 SW 3rd Ave., Portland, OR 97204; kmellenmclean@fs.fed.us; mwahlberg@fs.fed.us;* Barbara Wales, *USDA Forest Service, Blue Mountains Restoration Team, 3502 Hwy. 30, La Grande, OR, 97850; bwales@fs.fed.us*

Ponderosa Pine (*Pinus ponderosa*) forests historically dominated by old, single-storied, open-canopy conditions have declined sharply over the past century and have been replaced by multi-story, closed-canopy forest. The group of species typically associated with open-canopy conditions of the dry forest type include the White-headed Woodpecker (*Picoides albolarvatus*),

Pygmy Nuthatch (*Sitta pygmaea*), White-breasted Nuthatch (*S. carolinensis*), and Flammulated Owl (*Otus flammeolus*). In some areas east of the Cascade crest, the multi-story, closed-canopy forests are providing important habitat for species of concern like the Northern Spotted Owl (*Strix occidentalis*) and Northern Goshawk (*Accipiter gentilis*); managing habitat outside the natural range of variability for these species involves trade-offs and consequences for dry forest adapted species and forest resiliency. We present options for managing these trade-offs when managing wildlife habitat in dry forests.

*** Plant Chemical Defenses Reduce Nutritional Condition in Free-ranging Herbivores.**
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Herbivores must balance nutrient requirements with available browse and the energetic costs of detoxifying co-occurring plant chemical defenses which are potentially toxic. Isle Royal National Park in Lake Superior, Michigan contains an isolated population of Moose (*Alces alces*) and a high proportion of Balsam Fir (*Abies balsamia*), the primary winter browse for moose. Balsam Fir produces high concentrations of chemical defenses including monoterpenes, tannins and polyphenolics. East and west ends of Isle Royale differ in distribution of plant species and mean concentration of defensive chemicals, with a greater density of Balsam Fir occurring on the east and a higher proportion of deciduous trees on the west. We hypothesized that interannual and geographical variation in the energetic costs of detoxifying ingested and absorbed chemical defenses from plants could predict nutritional condition of free-ranging herbivores. Glucuronic acid to creatinine ratios (GA:C) from urine samples can be used as a biomarker of detoxification, with greater ratios equating to greater intake of chemical defenses in the diet. Additionally, urea nitrogen to creatinine ratios (UN:C) from urine samples can be used as a biomarker of nutritional condition with higher ratios equating to lower nutritional health. Seven-hundred snow-collected urine samples, spanning 16 years, were tested for GA:C and UN:C. GA:C ratios were positively correlated with UN:C ratios and were higher in the eastern region where densities of Balsam Fir are greater. Our results suggest that plant defensive compounds are correlated with lower nutritional condition in Moose and may ultimately influence population dynamics of free-ranging herbivores.

*** Small Mammal Communities Response to Environment via Barn Owl (*Tyto alba*) Pellets in Namibia.**
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Small mammals play a vital role in ecosystems as seed disperses, prey for predators, and population control for invertebrates. Small mammal abundance and diversity is an important measure of the overall ecosystem quality; however, virtually nothing is known about the small mammal community in Namibia. To gather information on this system, an analysis of owl pellets, an unbiased, noninvasive sampling method, was conducted. Pellets were collected from a mated pair of Namibian Barn Owls (*Tyto alba*) and their offspring residing on Farm Kiripotib in Namibia, after the increased rainy season of 2011, decreased rainy season of 2013 and an average rainy season of 2014. Throughout 2014, pellets were collected monthly to be analyzed to see monthly variation in diversity. This data provides a window into the biodiversity and

abundance of small mammals in central Namibia and show how these communities respond to annual precipitation. By analyzing these pellets, it was found that evidences suggests that Namibian small mammal biodiversity is higher during a more than average rainy season. Range expansion was also found in certain species.

Short-eared Owl (*Asio flammeus*) Surveys in the Intermountain West: An Innovative Approach Using Citizen Science to Conduct Long-term Monitoring. Robert A Miller◊, *Intermountain Bird Observatory and Idaho Bird Conservation Partnership, 1910 University Drive, MS1515, Boise, ID 83725; RobertMiller7@boisestate.edu;* Neil Paprocki, *Hawkwatch International, Salt Lake City, UT;* Matt Stuber, *US Fish and Wildlife Service and Idaho Bird Conservation Partnership, Boise, ID;* Jay D Carlisle, *Intermountain Bird Observatory and Idaho Bird Conservation Partnership, Boise, ID*

The most significant threat to Short-eared Owls (*Asio flammeus*) in North America is the loss or alteration of native grasslands, shrublands, and wetlands across the species' range. Despite evidence that Short-eared Owl populations are experiencing long-term, range-wide, substantial declines in North America, very little population monitoring has been dedicated to this species. Through creative partnerships we launched a broad survey of Short-eared Owls across Idaho and northern Utah. We recruited citizen-scientists and volunteer professional biologists to perform the surveys, engaging over 130 individuals in the effort. We used multi-scale occupancy models to evaluate habitat associations and multi-scale abundance models to produce the first broad-scale estimate of the Short-eared Owl population size within the region. In the coming years, we expect to scale our successful citizen-science model to encompass the range of Short-eared Owls in western North America.

*** Underlying Mechanisms of Seasonal Variation in Activity Patterns of the Pygmy Rabbit (*Brachylagus idahoensis*).** Charlotte Milling◊, Janet L Rachlow, *University of Idaho Fish and Wildlife Sciences, 875 Perimeter Drive Mailstop 1136, Moscow, ID 83843; cmilling@uidaho.edu; jrachlow@uidaho.edu;* Tim Johnson, *University of Idaho Department of Statistical Science, 875 Perimeter Drive Mailstop 1104, Moscow, ID 83843; trjohns@uidaho.edu;* Jennifer Forbey, *Boise State University Department of Biological Sciences, Science 102C, Boise State University, Boise, ID 83725; jenniferforbey@boisestate.edu;* Lisa Shipley, *Washington State University School of the Environment, 425 Heald Hall, Pullman, WA 99164; shipley@wsu.edu*

Understanding behavioral responses of wildlife to the thermal environment is of increasing importance in a changing global climate. Temporal partitioning of active and resting periods is a common behavioral thermoregulation strategy that also can be influenced by perceived predation risk and reproductive behavior. We investigated daily activity patterns of free-ranging Pygmy Rabbits (*Brachylagus idahoensis*), small-bodied endotherms that are exposed to extreme seasonal temperatures and predation pressures in the sagebrush steppe. We hypothesized that during summer, activity would be predominantly nocturnal when ambient temperatures are lowest, and we expected increasingly crepuscular peaks around the time of full moons to avoid nocturnal predators. We also hypothesized that timing of activity would shift during winter to diurnal or evening timeframes when ambient temperatures are relatively high. Because males participate in mate-seeking behaviors, we also anticipated elevated levels of activity by males relative to females. Twenty-five individuals (12 females and 13 males) were fitted with light sensing accelerometers during both seasons to record activity and burrow use.

We used periodic regression to model the relative importance of environmental (temperature and moon phase) and individual (sex and reproductive status) variables to observed patterns of activity. Although Pygmy Rabbits were active at all times of day, most activity occurred at night during both summer and winter. Furthermore, reproductive status was seasonally important, because timing and duration of nocturnal activity was greater for reproductive males during late winter. This research will contribute to understanding how the thermal environment and potential changes in climate influence behavior and habitat use.

Projecting the Global Distribution of the Emerging Amphibian Fungal Pathogen *Batrachochytrium dendrobatidis*, Based on IPCC Climate Futures. Deanna H Olson◊, *US Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us;* Gisselle Yang Xie, Andrew R Blaustein, *Department of Integrative Biology, Cordley Hall 3029, Oregon State University, 2701 SW Campus Way, Corvallis, OR 97331*

Climate change represents one of the greatest challenges to biodiversity conservation in the 21st century. As a response to climate change modifying environmental suitability, contemporary species have experienced range shifts. Pathogens are likewise limited by climate thresholds, and therefore their emergence, pathogenicity, and distribution also may be affected by climate change. We consider how future climate change scenarios may influence the global distribution of the Amphibian Chytrid Fungus, *Batrachochytrium dendrobatidis*, a pathogen that is responsible for worldwide amphibian population declines. Previous research has shown the presence and prevalence of the fungus is dependent on climatic variables, in particular temperature metrics. Using a novel approach, we trained an ensemble-learning model (random forest) with the most comprehensive global compilation of chytrid sampling records (~5,000 site-level records, mid-2014 summary), using climatic variables as input features. The learning model was trained with all the worldwide data combined (non-region-specific) and also separately for each region (region-specific), allowing downscaled regional projections. A key finding of our models is that the climate-chytrid relationship differed among geographic regions. In general, using projected climate change scenarios to model the potential future distribution of this chytrid fungus, we predict that its range would shift into higher latitudes and altitudes. In particular, our model predicts a broad expansion of areas environmentally suitable for establishment of *B. dendrobatidis* on amphibian hosts in the temperate zones of the Northern Hemisphere. Our projections are useful for the development of monitoring designs in these areas, especially for sensitive species and those vulnerable to multiple threats.

*** Characterizing Movement Patterns of Resident and Translocated Greater Sage-grouse in Washington through High-resolution GPS Telemetry.** Peter J Olsoy◊, *School of the Environment, Washington State University, 100 Dairy Road/1228 Webster, Pullman, WA 99164-2812; peter.olsoy@wsu.edu;* Michael Atamian, *Washington Department of Fish and Wildlife, 2315 North Discovery Place, Spokane Valley, WA 99216; michael.atamian@dfw.wa.gov;* Jon Gallie, *Washington Department of Fish and Wildlife, 3860 Chelan Highway, Wenatchee, WA 98801; jon.gallie@dfw.wa.gov;* Michael A Schroeder, *Washington Department of Fish and Wildlife, P.O. Box 1077, Bridgeport, WA 98813; michael.schroeder@dfw.wa.gov;* Daniel H Thornton, *School of the Environment, Washington State University; daniel.thornton@wsu.edu*

Greater Sage-grouse (*Centrocercus urophasianus*) have been extensively monitored over the past several years using GPS and VHF telemetry. Although resource selection of Sage-grouse

has been investigated previously across its range, as well as within Washington State, less is known about the basic, fine-scale characteristics of Sage-grouse movement patterns, and how those movement patterns vary between resident and translocated birds, across seasons or sites, and according to landscape structure. We characterized sage-grouse movement patterns (i.e., daily displacement and turning angle) of translocated birds in Lincoln County and resident birds in Douglas County, and found that daily movement of translocated birds is three times higher than resident birds in the first six weeks, then level out to the same rate. We also identified the key factors influencing those movement characteristics, explored resource selection during movement, and compared movement and resource selection between resident and translocated birds. This research informs future translocation planning, and provides a complement to classic resource selection analysis.

*** Range Expansion of an Introduced Population of Checkered Whiptail Lizard (*Aspidoscelis neotesselata*) in Grant County, Washington State.** R Troy Peterson[◊], Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926; petersonro@cwu.edu; weaverro@cwu.edu;* Dawn Snow, *Moses Lake, WA 98837; dawnsnow@hotmail.com;* James M Walker, *Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701; jmwalker@uark.edu*

Our research focused on the recent range expansion and current population size of the Colorado Checkered Whiptail Lizard (*Aspidoscelis neotesselata*) in Grant County, Washington. We conducted fieldwork from May to early October 2015. We surveyed areas adjacent to the original site of introduction by conducting time constrained, visual encounter surveys. We focused on and recorded indications of lizard activity, such as burrows, tail drags, or lizard sightings. We recorded locations of activity using a GPS, while microhabitat conditions were assessed and photographed. Based upon these data and new observations, it is clear that *A. neotesselata* is expanding from the original site of discovery. We observed lizards along the shores of Lind Coulee south of the primary site. Lizards were also observed across from Lind Coulee ca. 2 km to the west. Continued research efforts will focus on the behavior and ecology of these new populations, and to assess any possible impacts they may have.

Effects of the Fungal Pathogen *Batrachochytrium dendrobatidis* on Cascades Frogs (*Rana cascadae*) in the Mountains of Northern California. Jonah Piovia-Scott[◊], *School of Biological Sciences, Washington State University, 14204 NE Salmon Creek Avenue, Vancouver, WA 98686; jonah.piovia-scott@wsu.edu;* Karen Pope, *Pacific Southwest Research Station, US Forest Service. 1700 Bayview Drive, Arcata, CA 95521; kpope@fs.fed.us*

The fungal pathogen *Batrachochytrium dendrobatidis* (Bd) is responsible for amphibian declines and extinctions on a global scale. Some of the most prominent declines have occurred in mountain ranges in western North America. We have been studying the effects of Bd on the Cascades Frog (*Rana cascadae*) in California since 2008. Cascade Frog declines were first observed in the southern Cascade Mountains around the 1980s. By examining museum specimens we have shown that Bd appears to have arrived in the region in the 1970s, suggesting that it may have contributed to the observed declines. Detailed studies of remnant frog populations in the southern Cascades show that Bd infection increases mortality. Thus, it is likely that Bd is hastening the regional extirpation of Cascades Frogs. Furthermore, the probability of infection depends on climate and other environmental variables, suggesting that environmental drivers play a role in determining Cascades Frog persistence. Experimental treatment of juvenile

Cascades Frogs using antifungal drugs increases overwinter survivorship, indicating that effective management tools have the potential to help prevent population extirpation. Finally, we have found that variation in the virulence of Bd has important consequences for Cascade Frog populations – virulent strains are associated with dramatic declines in frog populations and less virulent strains are associated with more stable population dynamics. In summary, Bd appears to be responsible for dramatic declines in Cascades Frogs in California, and the regional persistence of this species is likely to depend on a complex interplay of environmental factors, pathogen virulence, and host resistance.

Population Fragmentation and Connectivity Mapping of American Black Bears in the Canada-USA Trans-border Region. Michael Proctor[◊], *Birchdale Ecological, P.O. Box 606, Kaslo, BC V0G1M0, mproctor@netidea.com;* Wayne Kasworm, *US Fish and Wildlife Service, 385 Fish Hatchery Road, Libby, MT 59923; wayne_kasworm@fws.gov;* Chris Servheen, *US Fish and Wildlife Service, College of Forestry and Conservation, 309 University Hall, University of Montana, Missoula, MT 59812; grizz@umontana.edu;* Justin Teisberg, Thomas G Radandt, *US Fish and Wildlife Service, 385 Fish Hatchery Road, Libby, MT 59923; justin_teisberg@fws.gov; thomas_radandt@fws.gov;* Jesse Lewis, *Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, CO 80523-1474; jslewis@rams.colostate.edu;* David Paetkau, *Wildlife Genetics International, P.O. Box 274, Nelson, BC V1L 5P9; dpaetkau@wildlifegenetics.ca;* Mark S Boyce, *Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9; boyce@ualberta.ca*

Population fragmentation is challenging to detect when adjacent populations are large with minimal genetic differentiation. When detected, estimating appropriate habitat to manage for connectivity can be a data intensive effort. Here we report on our effort to do both analyses on American Black Bears (*Ursus americanus*). We used a pedigree analysis to detect fragmentation across two highway-settlement corridors of Black Bears in the Canada-USA trans-border region. Using 20-locus microsatellite genotypes from 388 Black Bears, we detected 102 first-order relationships (parent-offspring pairs or full siblings). Compared to expected rates that these relationships might span US Highway 2 or BC Highway 3, the observed rate was significantly lower, indicating population level fragmentation. Our radio telemetry results corroborated these patterns. We then developed Resource Selection Function habitat models from global positioning system (GPS) telemetry data on 98 bears and estimated the occurrence of linkage areas across five major highway corridors in northern Idaho, northwestern Montana, and southern British Columbia using least cost and circuit theory methods. Eighty-eight percent of 82,000 GPS locations fell within areas predicted as good Black Bear habitat. Eighty-three percent of 380 highway crossings by black bears were within our predicted linkage areas. We found that Black Bear linkage areas are plentiful on the landscape. The fragmentation we detect does not represent an urgent conservation threat to these bears, as abundance and density values are relatively high. However, our results corroborate our Grizzly Bear (*U. arctos*) fragmentation patterns and further suggest highway-settlement corridors are fragmenting wildlife populations.

*** The Influence of Wind Energy Development and Habitat Composition on Columbian Sharp-tailed Grouse Habitat Selection and Fitness in Eastern Idaho.** Matt Proett[◊], *Department of Wildland Resources, Utah State University, 5230 Old Main Hill, Logan, Utah 84322; matt.proett@idfg.idaho.gov;* Shane Roberts, *Idaho Department of Fish and Game, 4279 Commerce Circle, Idaho Falls, ID 83401; shane.roberts@idfg.idaho.gov;* Terry A Messmer,

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Columbian Sharp-tailed Grouse (CSTG; *Tympanuchus phasianellus columbianus*) occupy less than 5% of their historic breeding range within the U.S. and have been petitioned twice for Endangered Species Act protection. Habitat loss and degradation are considered the primary threats to CSTG populations throughout their range. Many of the habitats occupied by CSTG in Idaho are also optimal locations for wind energy development. Wind energy development has outpaced our understanding of impacts it may have on wildlife populations, including CSTG. We initiated a study to address the influence of wind energy development and habitat composition on CSTG habitat selection and fitness. Between 2014 and 2015 we trapped and radio-marked 135 female and 50 male CSTG from 12 leks in Bonneville County, ID. Grouse were radio-marked across a mosaic of habitat types and along a gradient ranging from 0-11 km from wind turbines. We monitored 148 nests and 68 broods and conducted brood counts at 42 days post-hatch using trained bird dogs. We measured vegetation characteristics at nest and random sites to assess the influence of microsite habitat composition and structure on nest site selection and survival. We developed a GIS-based habitat map to facilitate analyses of the influences of habitat composition and anthropogenic features on nest- and brood-site selection, nest and brood survival, brood size, and adult survival at multiple spatial scales. Results from this study will inform habitat and population management of CSTG throughout their range.

Wolverine Distribution and Ecology in the North Cascades Ecosystem: Preliminary Results of a 10-year Study. Catherine M Raley[◊], Keith B Aubry, *US Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue Southwest, Olympia, WA 98512; craley@fs.fed.us*; John Rohrer, *US Forest Service, Okanogan-Wenatchee National Forest, Methow Valley Ranger District, 24 Chewuch Road, Winthrop, WA 98862;* Scott Fitkin, *Washington Department of Fish and Wildlife, Okanogan District, 350 Bear Creek Road, Winthrop, WA 98862*

The Wolverine (*Gulo gulo*) is a species of conservation concern in southern North America primarily because it occurs only in areas where snow cover persists into late spring, making it potentially vulnerable to the effects of climate change on both the extent and connectivity of suitable habitat. Consequently, understanding the distribution, genetic affinities, and ecological relations of Wolverines in the North Cascades Ecosystem in Washington is essential for informing conservation efforts in the contiguous U.S. We conducted a telemetry study in the North Cascades from 2006 thru 2015 using Argos satellite transmitters. We captured 14 Wolverines and tracked 12 individuals (7 females and 5 males) long enough to obtain reliable data on their spatial-use patterns. Activity areas (100% MCP of locations during any continuous monitoring period lasting $\geq$3 months) were relatively large: 535–1,969 km^2 for females and 1,149–2,992 km^2 for males. Two of the 14 Wolverines we captured did not appear to be residents within our study area, but made long-distance exploratory movements covering at least 483 kilometers during a 7-week period (a sub-adult female) and 564 kilometers during a 12-week period (a sub-adult male). In addition, we located and described two natal dens, demonstrating that reproduction is occurring in the North Cascades Ecosystem. Genetic and field data indicate that our study population is connected to Wolverine populations in the Coast Ranges of British Columbia, rather than those occurring in the northern Rocky Mountains of Idaho, Montana, or Wyoming.

*** Barn Owls Crossing the Road: Examining Interplay Between Occupancy, Behavior and Roadway Mortality in Southern Idaho.** Tempe Regan◊ *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; temperegan@u.boisestate.edu;* Christopher J W McClure, *The Peregrine Fund, Inc., Boise, ID; cmcclure@peregrinefund.org;* Erin Arnold, *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; erin.arnold4@gmail.com;* Angela Kociolek, *Western TransportationInstitute, Montana State University, Bozeman, MT; angela.kociolek@coe.montana.edu;* Melinda Lowe, *Senior Environmental Planner, Idaho Transportation Department, Boise, ID; melinda.lowe@itd.idaho.gov;* Jim Belthoff, *Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID; jbeltho@boisestate.edu*

Barn Owls (*Tyto alba*) are frequent victims of roadway mortality. Interstate-84 (I-84) in southern Idaho has among the world's highest rates of Barn Owl-vehicle collisions. There are sections of I-84 where Barn Owls are killed in extraordinary numbers and others where few die. Nothing is known about patterns of Barn Owl occupancy in this region, thus it is unclear if owls are killed in proportion to their abundance, or if they are equally abundant in segments with lower mortality and somehow escape collisions. We were interested in determining which landscape-level and local features of habitat were related to occupancy, and using model-based results of occupancy to compare with actual Barn Owl mortality locations. During winter and the following autumn of 2014 we surveyed for owls at 289 randomly selected point count locations (three times each, 867 total surveys) along a 300-km stretch of I-84. Each point count included silent listening followed by broadcast of Barn Owl vocalizations with spotlighting. We detected Barn Owls during 102/867 (11.8%) point counts and at 70/289 (24.2%) locations. For winter, the probability of Barn Owl detection was 0.32 ± 0.06 (SE). Winter occupancy increased with proportion crops, tree presence and decreased with background noise. In autumn, detection was 0.45 ± 0.07 (SE). Occupancy increased with decreasing distance from the Snake River, greater stream lengths, and decreased with development. We will discuss results of mortality vs. occupancy analyses, multi-season occupancy models and radio-tracking studies to help understand Barn Owl roadway mortality.

Efficacy of Five Methods for Converting Stands of Exotic, Sod-Forming Grass to Beneficial Bunchgrass/Forb Mixes. Shane Roberts◊, Matt Proett, John O'Neill, *Idaho Department of Fish and Game, 4279 Commerce Circle, Idaho Falls, ID 83401; shane.roberts@idfg.idaho.gov; matt.proett@idfg.idaho.gov; john.oneill@idfg.idaho.gov*

Millions of acres of highly-erodible farm land have been planted with seed mixes that include exotic, rhizomatous (i.e., sod-forming) grasses as part of the Conservation Reserve Program (CRP). Although effective at the CRP program's objective of erosion control, monocultures of sod-forming grass typically have minimal value as wildlife habitat. Land managers often seek to improve the wildlife value of decadent CRP fields, although little information exists on the most effective conversion methods. We evaluated the efficacy of five methods for removing Intermediate Wheatgrass (*Agropyron intermedium*) and Smooth Brome (*Bromus inermis*) and establishing a mix of beneficial grasses and forbs (spring or fall no-till seedings). We implemented and monitored treatments within 20, 1-acre plots (four replicates/treatment) and monitored eight control plots. After three growing seasons, sod-forming grass cover generally decreased with increased intensity of mechanical site preparation; with plots receiving the most intense preparation (two glyphosate applications, plow, disk, pack, fall

□= 8.3%). The least intensive treatment (one glyphosate application, spring seeding) did not differ from the control in sod-forming grass canopy cover. The most intensive treatment also had = 28.4%). A more moderate treatment (one glyphosate application, disk, pack, spring seeding) = 81.7%) but had a sod-forming grass canopy cover 3.4 times higher than the most intensive treatment. We will discuss differences in forb diversity between treatments and treatment costs relative to effectiveness.

Methodologies and Results of the Multi-species Baseline Initiative Winter Bait Station Effort in the Idaho Panhandle, 2010-2014. Lacy Robinson◊, Michael Lucid, *Idaho Dept. of Fish and Game, 2885 W. Kathleen Ave., Coeur d'Alene, ID 83815; lacy.robinson@idfg.idaho.gov; michael.lucid@idfg.idaho.gov;* Sam Cushman, *US Forest Service, 2500 S. Pine Knoll, Flagstaff, AZ 86001; scushman@fs.fed.us*

The Multi-species Baseline Initiative (MBI) is a collaborative of organizations which recently conducted a comprehensive inventory for 20 Species of Greatest Conservation Need across the Idaho Panhandle and adjacent mountain ranges. From 2010-2014, MBI partners established 497 winter bait stations to collect photographs and DNA from forest carnivore species in the Coeur d' Alene, Purcell, Selkirk, Saint Joe, and West Cabinet Mountains. The bait station setup includes a large piece of meat and gun brushes to collect hair (DNA) samples attached to the bait tree and a remote camera attached to an adjacent tree. During the winters of 2010-2014, Wolverine (*Gulo gulo*), Canada Lynx (*Lynx canadensis*), and Fishers (*Martes pennant*) were detected at bait stations in addition to American Marten (*M. Americana*), Bobcat (*L. rufus*), weasels, and other species. Bait stations are an effective means of detecting both rare and common carnivores during the winter months. We provide recommendations on the use of bait stations for monitoring carnivores including seasonality, duration, camera models, and the effectiveness of genetic sampling.

Monitoring Wolf Reproduction through the Use of Expandable Radio-collars and Abdominal VHF Implants in Pups, 2012-2015. Lacy Robinson◊, Jim Hayden, Casey McCormack, *Idaho Dept. of Fish and Game, 2885 W. Kathleen Ave., Coeur d'Alene, ID 83815; lacy.robinson@idfg.idaho.gov; jim.hayden@idfg.idaho.gov; casey.mccormack@idfg.idaho.gov;* Mark Drew, *Wildlife Health Lab, 16569 S. 10th Ave., Caldwell, ID 83607; mark.drew@idfg.idaho.gov*

Post-delisting monitoring requirements for Gray Wolves (*Canis lupus*) include documentation of wolf pack reproduction and the survival of pups to the end of the year they were born. To meet these monitoring requirements, we marked 77 wolf pups from 16 dens with eartags (n=10), expandable VHF collars (n=38), or abdominal VHF implants (n=40) from 2012-2015. As of September 2015, 27 pups were confirmed dead. Causes of death include legal harvest (n=13), unknown (n=5), possible disease (n=4), possible capture related (n=2), control actions (n=2), and illegal harvest (n=1). We compare the benefits and drawbacks of each marking method for long term monitoring of wolf pups. Fitting wolf pups with VHF collars and implants is a less expensive means of monitoring wolf numbers and reproduction than capture of adults through foothold trapping or aerial darting.

"In Too Deep": Hypoxia in Free-Living Embryos of the Frog *Rana aurora*. Chris Rombough◊, *Rombough Biological, P.O. Box 365, Aurora, OR 97002; rambo2718@yahoo.com;*

Laura Trunk, *City of Hillsboro, Jackson Bottom Wetlands Preserve, 2600 SW Hillsboro Hwy., OR 97123; Laura.Trunk@hillsboro-oregon.gov*

Between 2011 and 2014, we studied embryonic development of Northern Red-legged Frogs (*Rana aurora*) in a floodplain wetland. Developing embryos exhibited an unusual pattern of mortality: most died during floods. In 2015, we attempted to determine the cause. We closely monitored embryonic development *in situ*, while simultaneously examining water quality parameters (including temperature, pH, dissolved oxygen [DO], and concentrations of N and P). Data revealed that the embryos which suffered mortality were located in a zone which became hypoxic (DO <2 mg/L) and even anoxic (DO = 0 mg/L) during floods. Within-mass patterns of embryo death were consistent with hypoxia-induced mortality, and we found no evidence of pathogenic organisms or agents. Embryo death in this wetland varies annually as a function of egg mass location and precipitation during incubation.

A Demonstration of Field Experience Detecting and Counting Wildlife with High Resolution Cooled Infrared and High Definition Video Camera from Aerial Platforms.

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Since 2010, Owyhee Air Research, Inc. (OAR) has partnered with various agencies successfully researching wildlife with aerial infrared (AIR). This year, OAR began utilizing a more advanced AIR system accompanied with high definition daylight recording capabilities and integrated GPS functions developed by Wescam®. Mounted on a fixed wing aircraft, this new system has been used to successfully locate and count a variety of wildlife species. OAR has conducted perhaps the largest aerial infrared ungulate survey ever undertaken. Over a two month period ungulates were located and counted on survey transect flights over a variety of terrain, habitat types, and ungulate densities for Idaho Department of Fish and Game. Additionally, the new AIR system was used to detect and census known and unknown Sage-grouse (*Centrocercus urophasianus*) and Sharp-tailed Grouse (*Tympanuchus phasianellus*) leks in six western states. In its current configuration, a fixed-wing aircraft - mounted advanced AIR system has advantages over ground based and aerial visual surveys. Increased wildlife detectability, ability to survey remote areas, greater spatial variation, increased survey size, and no harassment of wildlife in critical ranges and breeding habitat all contribute to survey quality and cost effectiveness. Perhaps the most important value with this system is safety for agency personnel. Recent technological advancements in AIR accompanied with high definition daylight recording capabilities and integrated GPS functions are becoming increasingly valuable tools for aerial wildlife surveys and enable acquisition of otherwise unavailable data.

Factors Influencing the Survival of Translocated Greater Sage-Grouse and Columbian Sharp-tailed Grouse in Lincoln County, Washington.

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Columbian Sharp-tailed Grouse (*Tympanucus phasianellus columbianus*) and Greater Sage-grouse (*Centrocercus urophasianus*) were once widely distributed throughout much of the shrub-steppe habitat in eastern Washington. In the last century, their historic range has been significantly reduced due to the conversion of shrub-steppe to cropland. To better understand the population dynamics and habitat quality of grouse, it is important to determine the factors that influence adult and nest survival. In this study, we examined effects of habitat, demographic, and

weather on the daily nest survival of sympatric and translocated Columbian Sharp-tailed Grouse and Greater Sage-grouse. We measured the vegetation characteristics of 31 Sharp-tailed Grouse and 49 Sage-grouse nests at the Swanson Lakes wildlife area in eastern Washington. We also used ArcGIS to extract weather and habitat data at each nest location. We estimated the daily nest-survival rate and assessed the effects of environmental factors using Program MARK and R. We also used known-fate models in MARK to examine bi-weekly adult grouse survival rates. We found that the nest survival of sage-grouse was positively associated with the average height of perennial bunch grass, nests of adult grouse had a greater survival than those of juveniles, and the probability of nest survival decreased with time since initiation. The nest survival of Sharp-tailed Grouse was positively associated with distance to trees and similarly to the Sage-grouse, the probability of nest survival decreased with time since initiation. Our models may aid in the recovery of these grouse in Washington, guiding habitat management and translocations.

Using Beavers as tools for Wetland Restoration and Climate Adaptation in the Skykomish Watershed of Washington. Jason Schilling◊, *Tulalip Tribes of Washington, 6406 Marine Drive, Tulalip, WA 98271;* Ben Dittbrenner, *School of Environmental and Forestry Sciences, University of Washington, Box 352100, Seattle, WA 98195*

In recent years, the role of North American Beavers (*Castor canadensis*) in wetland restoration and as a potential climate adaptation tool has garnered widespread attention. Beaver populations have continued to rebound in many areas from near extirpation in the early 20th century due to intensive trapping for fur over much of their historic range. This resurgence has presented management challenges in areas where beaver activity and flooding have caused conflicts with human infrastructure and land use. Beavers also represent an opportunity, however, as they have been shown to restore aquatic systems with greater efficiency, long-term success, and less cost than traditional, human-based restoration. In many cases, nuisance Beavers – animals that are causing substantial flooding or damage – can be relocated to areas where wetland and hydrologic restoration has been prioritized. In the past, the success rate of Beaver relocation for restoration purposes has been fairly low. More recently, through a collaborative approach, Beaver relocation practitioners across Washington State have continued to realize increasingly greater relocation and restoration success rates. We trapped and relocated 47 Beavers over two field seasons in 2014 and 2015 at various sites in the Skykomish watershed. To date, they've built 10 dams and have created acres of wetlands. We'll talk about the success of our relocation program to date, and the potential benefits that it will yield as a mitigation tool against altered hydrology associated with climate change.

*** Climate Mediated Invasion: Canada Lynx's Response to Northbound Bobcat Range Expansion.** Arthur E Scully◊, Daniel H Thornton, *Washington State University, P.O. Box 642812, Pullman, WA 99164-6410; Arthur.Scully@wsu.edu; Daniel.Thornton@wsu.edu*

Anthropogenic climate change is predicted to be an extreme, long-term disturbance to current ecosystems, yet our understanding of its effects on species interactions is alarmingly incomplete. While predictive models based on species tolerances to variables explicit to climate change (i.e., temperature and precipitation) exist, they do not include changes to biological interactions which are essential to species persistence. Specialist alpine species that are cold/snow-dependent are predicted to have their ranges reduced to northern latitudes and high elevations while simultaneously, generalist species that can persist in warmer drier climates are predicted to expand northward and upward. We employed a large-scale camera-trapping effort in

northern Washington State to assess space use and spatial interactions between a specialist cold-dependent species, Canada Lynx (*Lynx canadensis*), and a warm-adapted generalist, the Bobcat (*L. rufus*). Using single and two-species occupancy models, we will assess 1) large-scale elevation and habitat preferences of these species in snow-off and snow-on time periods, 2) degree of spatial avoidance between the potential competitors, and 3) whether or not interactions are more intense in snow-off time periods. Data from our study will be used to inform our understanding of how climate change may impact Canada Lynx through interactions with warm-adapted competitors that are expanding northwards.

Fire, Prey, and Competition: Northern Spotted Owl Ecology and Conservation in Eastern Cascades Forests. Peter H Singleton◊, *USDA Forest Service, Pacific Northwest Research Station, 1133 N. Western Ave., Wenatchee, WA 98801; psingleton@fs.fed.us;* Damon Lesmeister, *USDA Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; dlesmeister@fs.fed.us*

Land mangers face substantial challenges in managing habitat for Northern Spotted Owls (*Strix occidentallis caurina*) and other species associated with structurally diverse, closed-canopy forest conditions in dry, fire-prone landscapes of the eastern Cascades in Oregon and Washington. Key issues managers face include: balancing large-scale, high-intensity fire risk reduction with retention of old forest habitat characteristics; providing abundant prey resources in areas where they can be used by spotted owls; and understanding and addressing the implications of competitive interactions with barred owls. This presentation will review recent information on these topics being compiled for the Northwest Forest Plan 20-Year Science Synthesis.

*** Forest Succession and Nutritional Carrying Capacity of Elk since the 1980 Eruption of Mount St. Helens.** Shantel N Sparkes◊, Evelyn H Merrill, Andrew B Geary, *Department of Biological Sciences, University of Alberta, AB T6G 2E9; ssparkes@ualberta.ca; emerrill@ualberta.ca; ageary@ualberta.ca;* Charlie M Crisafulli, *US Forest Service, Olympia Forest Sciences Laboratory, 3625 93rd Avenue SW, Olympia, WA 98512; ccrisafulli@fs.fed.us;* John G Cook, Rachel C Cook, *National Council for Air and Stream Improvement, Forestry and Range Sciences Laboratory, 1401 Gekeler Lane, La Grande, OR 97850; cookjgncasi@gmail.com; rachierae@gmail.com*

Thirty-five years after the eruption of Mount St. Helens (MSH), forest succession in some areas adjacent to MSH has resulted in forest canopy closure and associated loss of the ungulate forage, whereas in highly disturbed areas forage is now peaking in abundance. We used remote sensing and changes in forage abundance from long-term plots to assess the 30-year trend in the nutritional carrying capacity (NCC) of Elk (*Cervus elaphus*) given varying trajectories of forest succession. We hypothesized that advancing forest succession at high elevations has not offset the decline in Elk summer range across the broader landscape. We adapted the FRESH model developed for deer to estimate the number of lactating female Elk (animal days) that can be supported at 5-year intervals since 1980. We incorporated data on Elk diet, forage digestible energy, and Elk nutritional requirements from field studies and the literature to estimate available NCC at the stand level. We adjusted stand-level estimates to landscape-level estimates of NCC based on Elk home range size and habitat selection constraints related to topographic and human activity to reflect use of the area. Habitat selection was derived from 24 and 23 radio-collared elk monitored in 1983-1984 and 2009-2011. We show a gradient in NCC that reflects disturbance

severity from the eruption and post-eruption management that supports our hypothesis. We argue landscape-level changes in NCC based on selected forage and habitat selection provides an important tool for assessing consequences of current succession trends and alternative management scenarios in a spatial context for Elk populations in this region

Freshwater Mussel Survey of the Kettle River at Lake Roosevelt National Recreation Area.
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In August 2013, the Upper Columbia Basin Network conducted a brief survey of the Kettle River at Lake Roosevelt National Recreation Area (LARO) to determine the location and extent of Western Pearlshell (*Margaritifera falcata*) populations (i.e., mussel beds). Four mussel beds were described and documented, only one of which had been previously described. Timed searches were conducted within each mussel bed to determine species richness and relative abundance. Only two species were found during the course of the survey, the Western Pearlshell Mussel and the Oregon Floater (*Anodonta oregonensis)*. Only one live Oregon Floater was encountered. Live Western Pearlshell Mussel catch per unit effort ranged from 466.25 to 1,771.00. Shell measurements were obtained from 85 individual Western Pearlshell taken from a single mussel bed. These shell measurements serve as a proxy for age and indicated a mix of size/age classes within the most upstream site. In addition, five Western Pearlshell valves were thin-sectioned for age determination. Aged individuals ranged from 8 to 68 years old. It is intended that this survey will serve as the foundation for future inquiry into mussel beds in the Kettle River area of LARO.

*** Response of Amphibian Communities to Wetland Mitigation in the Greater Yellowstone Ecosystem.**
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In the United States, a “no net loss” of wetlands policy mandates that when wetland impacts cannot be avoided, they must be mitigated by creating or restoring wetlands of equal or greater area. A primary goal of these projects is often habitat replacement, but success is generally evaluated only through presence of wetland-associated vegetation and physical characteristics, which may not be good surrogates for wetland function. Because amphibians are sensitive to conditions in both the aquatic and surrounding terrestrial environment, evaluating the capacity of created wetlands to serve as functional amphibian habitat may be more meaningful. The Wyoming Department of Transportation recently (2008-2013) constructed and restored 38 wetlands in Teton County, WY to mitigate for loss of wetland area caused by a road reconstruction project. For the past four years, we have been monitoring larval amphibian occupancy in seven of these constructed wetlands, along with seven nearby natural wetlands. Preliminary results suggest that all four native amphibian species have colonized and bred in some created wetlands, but that variation in environmental and design variables such as hydroperiod and vegetation play an important role in determining which species can persist. These results suggest that wetland creation may be an important tool in amphibian conservation, but that the life histories of target species should be accounted for in the design phase to maximize the probability of native amphibian colonization and persistence.

Effects of Three Timber Harvest Prescriptions on Breeding Density of Pileated Woodpeckers. Zach Swearingen[◊], *Idaho Department of Fish and Game, 3316 16th Street, Lewiston, ID 83501*; *zachary.swearingen@idfg.idaho.gov;* Courtney Conway, *US Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, 875 Perimeter Drive, MS 1141, University of Idaho, Moscow, ID 83844; cconway@uidaho.edu;* Frances Cassirer, *IdahoDepartment of Fish and Game, 3316 16th Street, Lewiston, ID 83501; frances.cassirer@idfg.idaho.gov*

We used both correlative and quasi-experimental approaches to examine the effects of three timber harvest prescriptions on the breeding density of Pileated Woodpeckers (*Dryocopus pileatus*) on Craig Mountain Wildlife Management Area (CMWMA) in northcentral Idaho. For the correlative approach, we identified all timber harvests on CMWMA over the past 20 years and assigned them to one of four timber harvest categories (no recent harvest, partial removal cuts, regeneration cuts, and fuel reduction cuts) and then we compared breeding densities of Pileated Woodpeckers (based on surveys conducted during 2013-14) among those four harvest categories. For the quasi-experimental approach, we compared temporal changes in breeding density of Pileated Woodpeckers between 1993-94 (pre-harvest) and 2013-14 (post-harvest) among the four timber harvest categories. Results from both the correlative and quasi-experimental approach suggest a negative correlation between breeding density of Pileated Woodpeckers and harvest intensity. Breeding density of Pileated Woodpeckers was 81% lower in areas that had received fuel reduction cuts compared to areas without recent harvest and breeding density of Pileated Woodpeckers declined 86 % between 1993-94 through 2013-14 in areas which had received regeneration cuts.

It's Not Just Quagga Mussels—When Freshwater Unionids Go Invasive. Cynthia Tait[◊], *USDA Forest Service, Intermountain Region, 324 25th St., Ogden, UT 84401; ctait@fs.fed.us*

Accidental introductions of freshwater mollusks have become common with increased globalization. European Zebra (*Dreissena polymorpha*) and Quagga (*D. bugensis*) mussels have been transported in ballast water and recreational boating across North America. Asian clams were introduced as a food item, and have since spread throughout much of the continent. But unionid bivalves, freshwater mussels that parasitize host fishes for reproduction, also are transported outside their normal range by human activities, and can become serious competitors of their native bivalve relatives, aggravating an already poor conservation status. It is the Giant Floater (*Pyganodon grandis)* and Paper Pondshell *(Utterbackia imbecilis)* from eastern North American, and the Chinese Pond Mussel (S*inanodonta woodiana*) from Asia, that present the biggest threat in the west. Members of the anodontine tribe of Unionidae, they share astoundingly opportunistic life history traits that preadapt them for invasion. These large, thin-shelled mussels have the fastest growth rates and highest reproductive effort of any freshwater mussel species and are adapted for rapid colonization of disturbed but productive habitats. Because of their promiscuous ability to exploit a wide range of native and exotic fishes, their spread is enabled by transport and introduction of their fish hosts. Infestations of *Utterbackia* have recently been recorded in Utah and, along with *Pyganodon,* occur in Arizona. S*inanodonta* has become the dominant species among freshwater mussels in several invaded countries, and was first discovered in the U.S. in 2010.

Ecology of Amphibian Populations in the Williston Reservoir Drawdown Zone, British Columbia. Mark Thompson◊, *DWB Consulting Services Ltd., 1579 9th Ave, Prince George, British Columbia, Canada V2L 3R8*

Clearing of timber and construction of the Portage Mountain Dam--later called the W.A.C. Bennett dam-- commenced in late summer 1964. Full pool levels were reached in 1972. However, debris accumulation on the Williston Reservoir has been a persistent issue since flooding began in 1968. Approximately 38,729 ha of vegetated area were treated prior to flooding, but this accounts for only 21.7 % of the total reservoir area. The surface area of the reservoir covers 1750 km^2 at a length of 251 km. A legacy of accumulating debris piles continues to cause erosion along the shoreline and impacts the lives of amphibians that inhabit the area. Amphibian populations that populated the area prior to flooding now make use of the reservoir and migrate through the drawdown zone where constant wave action swirls the debris to erode the shoreline. Perched debris is used by amphibians for cover and as foraging sites, and breeding sites occur in inlet pockets along the reservoir. BC Hydro has launched a number of initiatives aimed at restoration of stream habitats, but amphibians have been largely neglected in the overarching management plans and objectives. This talk will introduce the audience to research of amphibian populations around the reservoir with particular emphasis on plot and transect surveys that commenced in 2014 and construction of habitat restoration projects in the drawdown zone. The intersection between the reservoir, industry activities, First Nations, and management of amphibians around the reservoir will be discussed in relation to ongoing research.

*** The Plight of Prey: Population Demographics, Foraging Behavior, and Personality of Piute Ground Squirrels (*Urocitellus mollis*) in Structurally Variable Habitats.** Zoe Tinkle◊, *Boise State University, Boise, ID 83725;* P O Montiglio, *University of California Davis, Davis, CA, 95616;* C Baun, *Idaho Army National Guard, Boise, ID 83705;* J Forbey, *Boise State University, Boise, ID 83725*

Individuals within a population of prey often differ in their willingness to take risks (boldness). Variation in boldness can predict foraging behavior and movement, which could influence the demography of a population and interactions with other trophic levels. The objective of this study was to compare population demographics, foraging behaviors and boldness of Piute Ground Squirrels (*Urocitellus mollis*, hereafter Piutes) in two structurally distinct habitats. Piutes are a critical prey species in the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA) in southwestern Idaho. Piutes are found in structurally variable habitats within the sagebrush-steppe ecosystem and encounter heavy predation throughout their range. We conducted a mark-and-recapture study of Piutes in a sagebrush-dominant habitat and a native grass-dominant habitat within the NCA. In addition to three years of demographic data, we quantified foraging effort using giving up density (GUD) feeding stations, and boldness of trapped individuals was measured using behavioral tests. We found that demographic characteristics of Piutes within the two habitats were similar. However, individuals were bolder and boldness was more variable within the sagebrush-dominant habitat than in the native grass-dominant habitat. In addition, individuals ate more (lower GUD) at feeding stations located in the sagebrush-dominant habitat than in the grass-dominant habitat. These results suggest that populations in structurally variable habitats can have similar demographic characteristics but can differ in risk-related behaviors of individuals, such as boldness, within

those populations. We propose that in addition to population demography, the behavioral landscape of populations should be used to inform management decisions.

NRCS' Commitment to Sage-grouse in Idaho. Kevin Traylor◊, *Natural Resources Conservation Service, Nezperce Field Office, 521 Oak Street, Nezperce, ID 83543; kevin.traylor@id.usda.gov*

The Greater Sage-grouse (*Centrocercus urophasianus*), an iconic ground-dwelling bird of the West, has experienced significant population declines during the past 50 years from habitat loss. The U.S. Fish and Wildlife Service (FWS) designated Sage-grouse in 2010 as a candidate for listing under the Endangered Species Act (ESA). Loss and fragmentation of Sage-grouse habitat is the primary threat and has a number of contributors, including human development, encroachment of conifer trees and invasive plants. The Natural Resources Conservation Service (NRCS) is working with ranchers to address these threats on private lands through restoring and protecting key Sage-grouse habitat while ensuring grazing lands remain sustainable and profitable. NRCS launched the Sage-grouse Initiative (SGI) in 2010 to focus efforts that reduce threats to Sage-grouse and the working lands that provide their habitat. NRCS uses a variety of Farm Bill conservation programs to restore and protect habitat, including habitat improvements through the Environmental Quality Incentives Program (EQIP) and long-term conservation easements through the Agricultural Conservation Easement Program (ACEP). EQIP and ACEP program practices are applied using Conservation Measures outlined in the 2010 SGI Conference Report developed by the FWS and NRCS. In September of 2015, the FWS found the Sage-grouse not warranted for ESA listing because primary threats were reduced by conservation efforts implemented by federal and state agencies and private landowners. This presentation provides an overview of the SGI conservation efforts that are applied to private lands in Idaho which have helped to minimize the threats to Sage-grouse.

Effects of Habitat Restoration on Northern Red-legged Frogs (*Rana aurora*). Chris Rombough, *Rombough Biological, P.O. Box 365, Aurora, OR 97002; rambo2718@yahoo.com;* Laura Trunk◊, *City of Hillsboro, Jackson Bottom Wetlands Preserve, 2600 SW Hillsboro Hwy., OR 97123; Laura.Trunk@hillsboro-oregon.gov*

From 2007 to 2015, we studied the effects of habitat restoration on a population of Northern Red-legged Frogs (*Rana aurora*) at a floodplain wetland in northwest Oregon. In 2007 and 2008, we surveyed the floodplain for frogs and collected baseline data (via egg mass surveys) on the only existing population. In 2009, we began habitat restoration, which included removal of invasive species (e.g., reed canary grass [*Phalaris arundinacea*]), planting of native vegetation, and installation of cover such as root wads and vegetated swales around the breeding site. Native herbaceous emergent vegetation was planted within the breeding pond. Annual egg mass monitoring revealed an increase in the number of breeding adult frogs: 10 egg masses were found in 2007 and 206 were found in 2015. Egg masses were also found in adjacent wetlands which had not previously supported frogs, and both adult and juvenile frogs were increasingly found in vegetated uplands around and within the floodplain. Our data show a positive effect of restoration on the local frog population.

Functional Explanation of Plant Species Preferences by a Generalist Herbivore; the Columbian Black-tailed Deer. Amy C Ulappa◊, Lisa Shipley, *School of the Environment, Washington State University, Pullman, WA 99164; amy.ulappa@email.wsu.edu; shipley@wsu.edu*

The ability of herbivores to meet their nutritional requirements is limited by the relatively low levels of required nutrients in plants and the physical and chemical defenses of plants. Generalist herbivores make fine-scale foraging decisions to maximize the nutrients they can acquire per unit time while reducing their exposure to toxic plant secondary metabolites (PSMs). Although several studies have demonstrated that herbivores prefer diets with the highest nutrient and lowest PSM constituents, these studies are primarily confined to laboratory feeding trials with few forage plant options because of the difficulty of observing diet selection in free-ranging herbivores. Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*) are a large generalist herbivore native to the western Cascades and Coastal range of the northwestern United States that depend on a diverse range of plant species found in the forest understory and open-canopy early seral forests. Using hand-raised tractable Black-tailed Deer, we measured plant selection by deer in 63 forest stands in western Washington ranging in age from 1-90 years by comparing the composition of each plant in the diet to its availability at the site. Additionally, we measured thorn presence, bite size (leaf size), digestibility, energy content, protein content, and defensive chemicals such as tannins, terpenes and alkaloids of plant species consumed by deer. Our results explore Black-tailed Deer plant preferences and which variables best explain plant selection or avoidance by deer foraging in a natural environment.

*** Influence of Exposure Time and Chytrid Fungus Strain in Tadpole Survival of Pacific Chorus Frog and Western Toad.** Jenny Urbina◊, *Environmental Sciences, Oregon State University, Corvallis, OR 97330; urbinagj@oregonstate.edu*

Diseases play a major role in determining life history, population dynamics and community structure. One disease affecting amphibian populations globally is chytridiomycosis caused by *Batrachochytrium dendrobatidis* (Bd). Bd is a pathogenic fungus that primarily affects keratinized structures in tadpoles and metamorphs. We currently lack information regarding direct Bd impacts on early amphibian life history stages as well as research on latent effects of Bd exposure on development and survival. Exposure of amphibian embryos to pathogens can trigger effects later, such as in the tadpole stage, by reducing survival and developmental rates. We examined the effects of Bd exposure using two different Bd strains and exposure times on embryos of the Pacific Chorus Frog (*Pseudacris regilla*) and Western Toad (*Anaxyrus boreas*) in a factorial design. We found that both; Bd strain and exposure time had effects on species survival. Western Toad embryos exposed later to Bd showed lower survival in their tadpole stage when exposed to both Bd strains. In contrast, Pacific Chorus Frog individuals survived after being exposed to Bd; neither the strain nor the time of exposure influenced the survival of tadpoles. Our results suggest both pathogen strain and exposure time can have survival effects on later development stages of Western toad.

Maintaining Structure during Timber Harvest on Private Lands -- Challenges and Constraints. Bill Vogel◊, *US Fish and Wildlife Service Washington Fish and Wildlife Office, 510 Desmond Dr. SE, Lacey, WA 98503; bill_vogel@fws.gov;* Marty Mauney◊, *Washington State Department of Natural Resources, 713 Bowers Rd., Ellensburg, WA 98926; Marty.Mauney@DNR.WA.gov*

We will discuss the various harvest scenarios that are commonly used on private lands. A review of safety guidelines with respect to snags will be provided. We will also discuss the various economic constraints such as mill availability and transport distances, and then explore potential solutions and potential outcomes.

The Oregon Spotted Frog (*Rana pretiosa*) in Lowland Western Washington: A Population, Parentage, and Non-breeding Habitat Analysis. Chelsea Waddell[◊], *Adapt Engineering & Environmental Consultants, 10725 SW Barbur Blvd., Portland, OR 97219; ChelseaDWaddell@gmail.com;* Marc Hayes, *Washington Department of Fish and Wildlife, Habitat Program, Science Division, Olympia, WA 98501; Marc.Hayes@dfw.wa.gov*

The at-risk Oregon Spotted Frog (OSF, *Rana pretiosa*) has disappeared from much of its geographic range. It is endangered in Washington State and threatened under the US Endangered Species Act. Unlike its well-studied breeding habitat, adult non-breeding habitat utilization in western Washington remains poorly understood. There, many OSF populations are small, genetically isolated, and embedded in a rapidly urbanizing matrix. Therefore, determining the total habitat footprint of each OSF population is critical to their conservation. This study investigated the spatial relationship between breeding and non-breeding active season habitat utilization for adult OSFs by genetically sampling members of one small population. Thirty-two percent (n=109) of the 336 egg masses laid in 2014 (February-March) at the study site, West Rocky Prairie (WRP), were previously genetically sampled. This effort genetically sampled 56 adult OSFs in their non-breeding active-season habitat (July-September), and linked adults to breeding locations based on parentage analysis using CERVUS.3.0.7. Straight-line distance measurements of parent: offspring pairs (n=12) revealed that parents traveled varying distances between breeding and non-breeding active season habitat, including two that moved >2 km. Based on the 12 microsatellites examined and COLONY analysis (N_e = 25; 95% CI: 15-43), 54% of sampled adults had ≥1 sibling within the sampled population, which may suggest recent bottlenecking. Most captured frogs (83%) were found in a small (10×6 m) pond, indicating that non-breeding active season habitat may be limited. This study provides critical information about OSFs at WRP, and an important basis for conceptualizing non-breeding active season habitat in other OSF populations.

An Overview of Recent Foothill Yellow-legged Frog Research in Northern California. Clara A Wheeler[◊], Hartwell H Welsh, Jr, *USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory, 1700 Bayview, Arcata, CA 95521; cawheeler@fs.fed.us, hwelsh@fs.fed.us*

The Foothill Yellow-legged Frog (*Rana boylii*) is a species of concern in Oregon and California and was petitioned for federal listing in 2012. The USFWS found that there was substantial evidence for further investigation and a detailed review of the species and its conservation status is currently being conducted. We recently completed a multi-agency conservation assessment for *R. boylii* in California. The assessment will be released as a General Technical Report in the upcoming months. While water development and diversions have been well-documented as a primary cause of population declines, the assessment identified information gaps that include a better understanding of how the breeding ecology of the species relates to modified flow regimes and temperatures. Here we summarize current and on-going research on Foothill Yellow-legged Frogs in northern California. In a study within the Trinity River watershed, we found that oviposition, hatching success, and metamorphosis occurred later,

and metamorphs were smaller and leaner along the regulated and colder main stem relative to six unregulated tributaries. In two additional studies, water temperature appeared to influence the onset and patterns of breeding activities. Later breeding activity delays metamorphosis and may have future consequences such as lower over-wintering survival of post-metamorphic frogs and smaller size at maturity. Management of reservoir-controlled rivers should account for the influence of the thermal regime on the onset of breeding activities, and the development of vulnerable embryonic and larval life stages to improve outcomes for declining amphibian populations.

Testing the Forage Selection of the American Pika (*Ochotona princeps*) for use in Connectivity Corridors in the Washington Cascades. Carly Wickhem◊**,** *Central Washington University, Department of Biological Sciences, Science Building - Room 129A, 400 E. University Way, Ellensburg, WA 98926; wickhemc@cwu.edu;* Kristina Ernest**,** *Central Washington University, Department of Biological Sciences, Science Building - Room 236E, 400 E. University Way, Ellensburg, WA 98926; ernestk@cwu.edu;* and Lisa Shipley, *Washington State University, School of the Environment, 425 Heald Hall, Pullman, WA 99164; shipley@wsu.edu*

One of the aims of the Snoqualmie Pass East Project (SPEP) in the Cascades of central Washington is to construct nearly 30 wildlife crossing-structures along a 15-mile stretch of Interstate-90. Crossing-structures in this area could make major strides in rejoining fish and wildlife populations that have been disconnected for more than 50 years. American Pikas (*Ochotona princeps)* are being monitored with respect to the SPEP because they have specific habitat requirements and are poor dispersers. Making the crossing-structures "Pika-friendly" will be important. Recent research suggests that the presence of quality vegetation may help Pika populations avoid declines and extirpations, so planting suitable forage within and adjacent to the crossings will be essential. During the summer and fall of 2015, we completed 70 cafeteria-style preference experiments using 10 different forage species that were common in Pika-occupied habitats. In these trials, Pikas were given the equal opportunity to forage on 5-6 species at one time. The results of these trials were analyzed using the Jacobs selectivity index. Douglas-fir (*Pseudotsuga menziesii),* Sitka Alder (*Alnus viridis)*, willow (*Salix* spp.*)*, and Black Cottonwood (*Populus balsamifera trichocarpa)* had the overall highest average selection indices. Samples of each of the tested plant species are being analyzed for nutritional components and some plant secondary metabolites. These analyses will help identify which nutritional components and plant secondary metabolites Pikas are selecting for when they forage. Plants found to be preferred and nutritious will be recommended for planting in the upcoming crossing-structures.

Presenting author's name is marked with a ◊, and abstracts are in alphabetical order by first author. Student presentations are denoted by an * before the title of the poster.

Bullfrogs at the Border: Eradication Efforts of an Invasive Amphibian (*Lithobates catesbeianus*) in the Kootenays, British Columbia. Terry Anderson, Lindsay Anderson◊, Irene Manley, *Ministry of Forests, Lands and Natural Resource Operations, Province of British Columbia, 333 Victoria Street, Nelson, BC V1L 4K3*; *terry.anderson@gov.bc.ca; lindsay.anderson@gov.bc.ca; irene.manley@gov.bc.ca;* Jennifer Vogel, Chelsea Bennet, *Central Kootenay Invasive Species Society, 622 Front Street, Nelson, BC V1L 4B7; jvogel@ckiss.ca; c_bennett065@hotmail.com;* Marc-Andre Beaucher, *Creston Valley Wildlife Management Area, Box 640, Creston, BC V0B 1G0; biology@crestonwildlife.ca;* Michael Lucid, *Idaho Department of Fish and Game, 2885 Kathleen Ave, Coeur d' Alene, ID 83815; michael.lucid@idfg.idaho.gov;* Purnima Govindarajulu, *Ministry of Environment, Province of British Columbia, P.O. Box 9338 Stn Prov Govt, Victoria, BC V8W 9M1*; *purnima.govindarajulu@gov.bc.ca*

The American Bullfrog (*Lithobates catesbeianus*) is a globally invasive species, suspected to cause substantial negative impacts to native species populations through resource competition, direct predation and transmission of disease. In 2015, bullfrogs were detected for the first time in the Kootenay Region of British Columbia (the Kootenays), a region of great biodiversity and home to numerous at-risk species. Using the catch-depletion method (by electro-shock technique), we investigated population demographics, population density, sex ratio, morphology, and pathogen profile (ranavirus, chytridiomycosis) of the first adult bullfrog population detected in the Kootenays. Here, we present results from first efforts of detection, eradication and monitoring of an invasive species recently detected across the international border into the region. Knowledge about its population density, catchability/eradication/control of the species by electroshock (and other methods) is key when considering the development of sound population control programs.

*** The Influence of Fuel Reduction Treatments on the Nutritional Ecology of Mule and White-tailed Deer in Northeastern Washington.** Stephanie Berry◊, Lisa Shipley, *School of the Environment, P.O. Box 642812, Washington State University, Pullman, WA 99164-2812; stephanie.berry@wsu.edu; shipley@wsu.edu*

To reduce the chances of large fires, federal forests are reducing fuel loads through thinning and prescribed burning. By opening the canopy, these actions can potentially increase the nutritional value of habitats for deer. Our project examines the effects of canopy cover and time since thinning on the quality and quantity of forage, nutritional carrying capacity and nutrient intake rates of tractable Mule Deer (*Odocoileus hemionus*) and White-tailed Deer (*O. virginianus*) in the Colville National Forest in northeastern Washington. We sampled the biomass and nutritional quality of understory biomass in 29 stands over two seasons that ranged from 20 – 100% canopy cover and 0 – 20 years post-thinning. In addition, we measured bite rate, bite size, diet composition, and diet quality of tractable deer – four Mule Deer and four White-tailed Deer. Forage biomass increased with decreasing canopy, and showed a curvilinear relationship with time since planting. We also examined the response of deer harvesting rates

and diet quality to canopy cover and time since thinning. The results of this project can help managers identify and plan thinning treatments to create habitats that better meet the nutritional needs of wild deer.

*** Analysis of the Biotic and Abiotic Factors Influencing the Distribution of two Amphibian Species in Eastern Washington, *Spea intermontana* and *Ambystoma tigrinum.*** Corey Brumbaugh[◊], Robert E Weaver, R Steven Wagner, *Central Washington University, 400 E. University Way, Ellensburg, WA 98926-7537; brumbaughc@cwu.edu; weaverro@cwu.edu; WagnerS@cwu.edu*

While eastern Washington State has a variety of macro habitat types, from dense high elevation spruce-fir stands to Ponderosa Pine (*Pinus ponderosa*) forests and shrub-steppe hills; agricultural lands, including annually irrigated crop fields, orchards, vineyards, and livestock farms are also a dominant feature in this region. Such areas are generally not considered suitable habitat for most species of reptiles and amphibians. However, anecdotal evidence suggests that Spadefoot Toads (*Spea intermontana*) and Tiger Salamanders (*Ambystoma tigrinum*) are distributed among these agricultural sites. This study is focused on the biotic and abiotic factors driving the distribution patterns of these species, which includes their overall patterns of distribution and general ecology. For *S. intermontana*, factors that increase surface activity and metamorphosis rate during periods of drought will be examined. For *A. tigrinum*, radio telemetry will be used to determine patterns of movements during breeding periods, as well as migrations during drier months and post vernal pool disappearance.

*** Influence of Weather and Habitat on Little Brown Bat Activity along the North Coast of British Columbia.** Patrick Burke[◊], *Stantec Consulting Ltd, 500-4730 Kingsway, Burnaby, BC V5H0C6 and Biodiversity Research Centre at the University of British Columbia, 6270 University Boulevard, Vancouver, BC V6T 1Z4; patrick.burke@stantec.com*

During the winter of 2014, one of British Columbia's most common and widespread bat species, the Little Brown Bat (*Myotis lucifugus*), was added to the List of Wildlife Species at Risk in Canada (known as Schedule 1 of the Canadian *Species at Risk Act*). This species is being impacted severely by a fungal disease in eastern North America. However, there is evidence that western populations of *M. lucifugus* exhibit different annual activity patterns and distributions than the more familiar eastern populations. We investigated the relationship between weather and habitat on activity of *M. lucifugus* in the coastal temperate rainforest of northern British Columbia. Between October 2014 and October 2015 we collected over 1,100 detector-nights of passive acoustic recordings at six fixed stations and five mobile stations at two coastal sites. We aim to test the effect of habitat and weather covariates on bat activity using high-resolution vegetation community and meteorological data. Preliminary results suggest that *M. lucifugus* is present across varied habitats throughout the region between April and November, but seasonally selects for certain habitat types.

*** Evaluating Tradeoffs in Risks Perceived by Foraging Herbivores.** Meghan J Camp[◊], Lisa A. Shipley, *Washington State University, Pullman, WA 99163;* Jennifer Sorenson Forbey, *Boise State University, Boise, ID 83725;* Janet L Rachlow, Timothy R Johnson, *University of Idaho, Moscow, ID 83844*

When selecting foraging patches, herbivores are faced with multiple risks imposed by their environment such as consuming food that does not meet their daily energy requirements,

toxicity from plant secondary compounds, and predation. Because these risks operate simultaneously, animals must make tradeoffs between them when selecting foraging patches. To better understand how animals trade off food and predation risks, we manipulated both in a series of experiments with Pygmy Rabbits (*Brachylagus idahoensis*) and Mountain Cottontail Rabbits (*Sylvilagus nuttallii*), which differ in their size, ability to digest fiber and detoxify toxins, and use of burrows. In these experiments, rabbits were given a choice between two foraging patches that varied in the amount of fiber, toxins, level of exposure to predators, and distance from a burrow. Using the method of paired comparisons, we estimated and compared relative risks and tradeoffs both within and between species. Fiber, toxins, exposure to predators, and distance from a burrow all increased the risk of patches for Pygmy Rabbits, whereas only fiber and toxins did so for cottontails. In addition, the relative risk of toxins was lower, and the relative risk of distance was higher for Pygmy Rabbits than cottontails. Pygmy Rabbits traded off food quality for safety whereas cottontails traded off safety for food quality. This study provides a functional understanding of how the quality of food and predation risk influence habitat use by these rabbits, advancing our ability to assess habitat quality for mammals across landscapes.

*** Avian Community Response to Salmon Recolonization in the Cedar River, Washington.**
Hannah L Clipp◊, *West Virginia University School of Natural Resources, 322 Percival Hall, Morgantown, WV 26506; hlclipp@mix.wvu.edu;* Thomas P Good, Peter M Kiffney, *National Oceanic and Atmospheric Administration Northwest Fisheries Science Center, 2725 Montlake Boulevard E, Seattle, WA 98112; tom.good@noaa.gov; peter.kiffney@noaa.gov*

Anadromous Pacific salmon (*Oncorhynchus* spp.) can play a significant role in the trophic ecology of freshwater rivers connected to the Pacific Ocean. However, there is limited research on how the presence of salmon influences their avian predators. This study investigated avian community metrics in relation to salmon density and habitat variables in the Cedar River, WA. In 2003, a fish ladder was installed to allow Pacific salmon to recolonize the Cedar River after over 100 years of exclusion, which resulted in varying salmon densities with increasing distance from the ladder. To assess the potential effects of salmon on bird communities, we conducted bird strip surveys from July 6-17, 2015, along 4-5 100-m transects within seven reaches (distinguished by gradient and salmon density) of the Cedar River, totaling 30 unique transects. We performed both morning and afternoon surveys multiple times at each transect. We recorded the number, species, and both general and foraging behavior of all birds observed. Habitat data included gradient (high vs. low), river width and depth, and availability of perches (i.e., snags, large boulders). Data collection and analyses of density/abundance, foraging behavior, diversity, and species composition is ongoing. These metrics will be compared between reaches and correlated to salmon density and habitat characteristics. Birds can disperse salmon-transported nutrients across a large landscape. The study results will assist in understanding the relationship between Pacific salmon and birds, their roles in linking aquatic and terrestrial food webs, and the potential watershed effects of salmon recolonization.

*** Digging into the Annual Life-history of Long-billed Curlews: Are Sink Habitats to Blame for Local Population Declines?**
Stephanie Coates◊, J. Carlisle, H. Ware, and J. Pollock. *Intermountain Bird Observatory, Boise State University, Boise, ID 83725*

Exploring the complete annual cycles of migratory birds, especially those with broad spatial ranges, is a key element for successful conservation. At a former breeding stronghold in southwestern Idaho, the Long-billed Curlew (*Numenius americanus)* population has declined by

approximately 90% in less than 40 years. However, range-wide surveys indicate far less drastic decreases. We hypothesize that high levels of anthropogenic disturbance coupled with thriving predator communities on the breeding grounds contribute to the crashing local population. Thus, after years of localized reproductive success monitoring we expanded in 2015 to include multiple sites in the Intermountain West with various habitat, predator, and disturbance regimes. We analyzed territory-level habitat variables and daily-survival rates of 88 nests from four sites. Preliminary findings show apparent hatch rates ranged from 23-56% among sites. In addition to disturbance and landscape-level habitat assessments, on-going migratory connectivity research will help identify wintering ground threats, and fit local declines into the broader context of annual life history.

Clark Fork River Delta Restoration Project. Kathy Cousins[◊], *Idaho Department of Fish and Game, 2885 W. Kathleen Avenue, Coeur d'Alene, ID 83854; kathy.cousins@idfg.idaho.gov*; Brian Heck, *Ducks Unlimited, Pacific NW Office, Spokane, WA; bheck@ducks.org*

The Idaho Department of Fish and Game and Ducks Unlimited, along with other partners, initiated and completed a portion of the restoration activates proposed for the Clark Fork River delta in 2015. Extensive bank erosion has occurred to islands and shorelines in the delta, resulting in losses of soil, native riparian and wetland vegetation, as well as the quantity and quality of fish and wildlife habitat. This erosion is the result of wave action and water level fluctuations of Lake Pend Oreille due to the operation of the Albeni Falls dam. In addition, about 15–25% of all habitat loss in the delta is attributed to the operation of the Cabinet Gorge dam located upstream on the Clark Fork River. The altered hydrology in the Clark Fork River and delta has resulted in changes in the wetland and aquatic vegetation cover, such that many of the delta's wetland functions are severely impaired. Therefore, the goal of this project is to protect areas vulnerable to erosion while improving and diversifying key riparian and wetland habitats behind the protection to restore ecological function in the delta. The 2015 construction effort resulted in over 40 submerged areas being raised (by moving 260,000 cubic yards of fill) so that these areas are now above the lake's summer full pool. These raised areas were seeded and over 70 volunteers and school students planted over 100,000 plants. About 20,490 linear feet of delta island shoreline was stabilized using over 50,000 tons of rock and 50,000 soil choked willow poles.

*** Effects of Temperature on Jumping Performance of Oregon Spotted Frogs and American Bullfrogs.** Raven Dow-Hygelund[◊], Jay Bowerman, *Sunriver Nature Center & Observatory, P.O. Box 3533, Sunriver, OR 97707; motionraven@gmail.com; frogs1@sunrivernaturecenter.org*

We compared jumping performance of Oregon Spotted Frogs (*Rana Pretiosa*), and the invasive American Bullfrog (*Lithobates catesbeiana*) at temperatures of 5, 15 and 25 C and with frogs acclimated at either 5 C or 20 C. We also investigated the relation between body size and jumping performance across a wide range of bullfrog sizes. Oregon Spotted Frogs outperformed similar sized bullfrogs at all three temperatures, but the rate of improvement with rising temperature was significantly greater for bullfrogs. These results suggest that that while Oregon Spotted Frogs are well adapted to cool conditions of our area, a warming climate will further favor bullfrogs over Oregon Spotted Frogs.

Juvenile Survival and Dispersal in White-headed Woodpeckers. Philip C Fischer◊, *1405 Jesica Drive, Selah, WA 98942; pcfischer@gmail.com;* Teresa J Lorenz, *US Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98521; tlorenz@fs.fed.us*

White-headed Woodpeckers (*Picoides albolarvatus*) are a sensitive species and important cavity excavators in dry pine forests of the northwest. While their nesting ecology has been well-studied, information is lacking on the fate of young after fledging. Past research has speculated that first-year survival and dispersal distances are low and limit populations. From 2014 to 2015, we radio-tagged 42 juvenile White-headed Woodpeckers in central Washington, and tracked them during the first four months post-fledging. In 2014, we found that Kaplan-Meier survival □= 0.89, 95% CI: 0.43-0.98) did not differ from adult survival (n = 34) measured from 2011 to □= 0.93, 95% CI: 0.76-0.98; $\chi^2 < 0.01$, $P = 0.98$). Dispersal distances in 2014 were also greater than expected based on past telemetry studies with related woodpecker species. Average dispersal distance at four months was 16.5 km (±13.2 km) and included one dispersal event of 45.6 km, which is greater than mean and maximum dispersal for Black-backed (*P. arcticus*), Red-cockaded (*P. borealis*), and Red-bellied (*Melanerpes carolinus*) Woodpeckers tracked in past studies. We will update these preliminary estimates of survival and dispersal with information collected in summer and fall 2015.

Antiparasitic Properties of Sagebrush (*Artemisia* spp.) Plant Secondary Metabolites. Brieana Goods◊, *Division of Natural Science and Mathematics, Lewis-Clark State College, 500 8th Ave, Lewiston, ID 83501; bmgoods@lcmail.lcsc.edu;* Marcella Fremgen, Jacqueline Peña, *Department of Biological Sciences, Boise State University, 1910 University Dr, Boise, ID 83725; marcella.fremgen@westernalum.org; jacquelinepena@u.boisestate.edu;* Carolyn Dadabay, *Department of Chemistry, College of Idaho, 2112 Cleveland Blvd, Caldwell, ID 83605: CDadabay@collegeofidaho.edu;* Jennifer Forbey, *Department of Biological Sciences, Boise State University, 1910 University Dr, Boise, ID 83725; jenniferforbey@boisestate.edu*

Herbivores may help us discover therapeutic natural products by observing which plants they consume when they are infected with diseases. Greater Sage-grouse (*Centrocercus urophasianus*) host a tapeworm (*Raillietina centroceri*) common to birds. Sage-grouse are specialist herbivores that forage selectively on sagebrush (*Artemisia* spp.), a plant that produces diverse secondary metabolites, many with cytotoxic properties. We hypothesized selection of sagebrush by Sage-grouse with specific compounds or concentrations of compounds can reduce parasite loads. We tested our hypothesis using Egg Hatch Assays to test the antiparasitic activity of sagebrush chemicals selected by Sage-grouse during winter. We predicted individual compounds from the selected sagebrush would inhibit parasite eggs from hatching. Geese (*Branta canadensis*) are generalist herbivores which also host *Raillietina* tapeworms. We predicted parasites from sagebrush specialists (Sage-grouse) and dietary generalists (goose) would respond differently to chemicals in sagebrush based on co-evolutionary histories. Our positive controls included albendazole and levamisole, medications commonly used to treat tapeworm infections. Cineole and camphor (monoterpenes from sagebrush) had similar inhibition of parasite hatching of eggs from goose feces compared to positive controls. Culturing of eggs from Sage-grouse feces were problematic and are on-going. Our results using goose parasites suggest that sagebrush chemicals have antiparasitic properties in generalists. Results will be used to identify and isolate sagebrush chemicals that can be developed for antiparasitic uses for wildlife, domestic animals, and humans.

*** Occupancy and Movement of Amphibians in the Snoqualmie Pass Interstate 90 Corridor.** Anne Gustafson◊, Steve Wagner, *Department of Biological Sciences, Central Washington University, 400 E. University Way, Ellensburg, WA 98926; gustafsoan@cwu.edu; WagnerS@cwu.edu*

Detection of amphibians is challenging because of their cryptic nature and occupancy modeling provides a means of estimating amphibian abundance. We conducted amphibian surveys on nine creeks with sections on either side of the Washington State Department of Transportation's Interstate 90 Snoqualmie Pass East project and one upstream section as a control reach. This project emphasizes habitat connectivity and wildlife crossings that mimic the natural habitat and are integrated into the highway design. Creeks that cross the highway are a mix of restored sites and potential crossing structure sites. We detected Pacific Giant Salamanders (*Dicamptodon tenebrosus*), Cascade Frogs (*Rana cascadae*), Western Toads (*Anaxyrus [Bufo] boreas*), Tailed Frogs (*Ascaphus truei*), and the Pacific Chorus Frog (*Pseudacris* [*Hyla] regilla*). Using occupancy modeling, we estimated amphibian occupancy at each survey site and for each species present. *R. cascadae* and *D. tenebrosus* were found within newly completed underpasses, specifically the Rocky Run and Wolfe Creek underpasses that both mimic the surrounding habitat. Over 300 amphibians were detected with *D. tenebrosus* being the most prevalent, *R. cascadae* and *A. truei* respectively being the second and third most common species found in these creek habitats. Information will be used to evaluate the microhabitat features influencing occupancy of particular species. Results support estimates of the probability of crossing structure use and provide guidance on habitat features that can be incorporated into future crossing structures to increase connectivity.

Use of Camera Trap Monitoring to Detect Abundance and Distribution of Jaguar and other Forest Carnivores/Prey Species in Costa Rican Neotropical Rain Forests. Christian Rohnert, Kayla Siepmann, Elliot Haragos, Brytanie Self, Johanna Hay-Smith, Zach Thompson, and Leslie A Hay◊, *Northwest Nazarene University, 623 S University Blvd., Nampa ID, 83686.*
The goal of this study is to evaluate differences in presence, relative abundance and distribution of felids and their prey in two Neotropical rainforest areas in Costa Rica. We monitored low and high elevation network trails using 40 Bushnell cameras with scent lures. Five felid species were recorded in two protected rainforest areas at different elevations including Jaguar (*Panthera onca*), Puma (*Puma concolor*), Ocelot (*Leopardus pardalis*), Margay (*L. weldii*), and Jaguarundi (*Puma yagouaroundi*) along with several prey species both nocturnally and diurnally. We recorded 29 observations of Jaguar in both forest sites, resulting in more incidences at high elevations. Puma were observed 105 times at camera stations, at all elevations. Thirteen different forest mammal prey species were recorded at those same elevations. For total observation, ungulates (i.e., Peccaries [*Pecari tejacu*] and Tapir [*Tapirus* sp.]) comprised 29%, meso-mammals including large rodents (i.e., Paca [*Cuniculus paca*] and Agouti [*Dasyprocta*]) comprised 46%, and large ground dwelling birds (i.e., Curassow [Cracidae], Guan [Cracidae] and Tinamou [Tinamidae]) comprised 25% of observations. Relative abundance indices (RAIs) demonstrated a wide range for all wildlife species, with higher RAIs at the high elevation sites with less human activity. Animals were strongly attracted to the perfume scent lure with subsequent behavioral observations (e.g., sniffing, rubbing, rolling, resting) at scent stations. In summary, mammalian carnivores and prey species were diverse in both tropical rainforest sites, but diversity and frequencies were lower at low elevations where the habitat is more fragmented with higher human presence.

*** Conditional Antipredator Behavior: Do Both Habitat and Predator Type Influence Responses to Threats?** Miriam A Hernandez◊, Charlotte R Milling, Megan Whetzel, Laura A McMahon, Janet L Rachlow, *University of Idaho Fish and Wildlife Sciences, 875 Perimeter Drive Mailstop 1136, Moscow, ID 83843; cmilling@uidaho.edu; jrachlow@uidaho.edu;* Jennifer Forbey, *Boise State University Department of Biological Sciences, Science 102C, Boise State University, Boise, ID 83725; jenniferforbey@boisestate.edu;* Lisa Shipley, *Washington State University School of the Environment, 425 Heald Hall, Pullman, WA 99164; shipley@wsu.edu*

Cryptic prey often select resting sites based on perceived predation risk. Vegetation structure can influence perceptions of risk via the properties of concealment from and visibility of potential predators, as well as proximity to a safe refuge. Antipredator behavior also is influenced by vulnerability to different predators (e.g., aerial versus terrestrial) and the influence of habitat on the ability of prey to detect and escape predators. We quantified the response of Pygmy Rabbits (*Brachylagus idahoensis*) to simulated aerial and terrestrial predator attacks to evaluate the influence of both habitat and predator type on predation avoidance behavior. We hypothesized that responses to predator threats would be influenced by proximity of a burrow refuge, the structure of the surrounding vegetation, and the type of predator. We used radio telemetry to locate 26 Pygmy Rabbits on multiple occasions during summer 2015. We simulated aerial predator threats by throwing a black projectile 1-2 m immediately over the animal and terrestrial predator threats by approaching the animal on foot. At each resting location, we measured habitat parameters and behavioral responses (changes in posture, flight initiation distances, and use of burrows). Results indicated that individuals most often responded to aerial threats by freezing, whereas terrestrial threats triggered flight behaviors that differed with vegetation concealment. Flight initiation distances were negatively associated with concealment, and this relationship was most apparent at distances away from burrows. This research documents that antipredator behaviors are a result of complex interactions between both habitat properties and predator type.

The Challenges of Monitoring Bird and Bat Impacts at Offshore Windfarms. Alicia Higgs◊, George Ritchotte◊, *Herrera Environmental Consultants, 2200 6th Ave., Suite 1100, Seattle, WA 98121; ahiggs@herrerainc.com; gritchotte@herrerainc.com*

Interest in offshore wind energy is increasing and some of the first offshore windfarms are being developed and tested in the United States. Potential impacts to birds and bats at offshore windfarms are currently not well understood. Numerous data gaps make it difficult to conduct accurate risk assessments. We identify several key data gaps for the west coast including: bird migration routes offshore; bird flight heights over water; bird interactions with non-fishing vessels; presence of far-ranging threatened or endangered species, such as the Short-tailed Albatross (*Phoebastria albatrus*); and bat use of offshore areas. In addition, post-construction monitoring of impacts offshore presents unique challenges compared to inland windfarms. For example, weather conditions and technical issues make traditional monitoring methods difficult, and carcass recovery is nearly impossible at sea. We compare monitoring techniques at inland and offshore windfarms to identify potential methods for filling the data gaps in offshore windfarm impacts. These methods include evaluating radar, infrared, acoustic, and blade sensor systems.

Herpetofauna of Alberta BioBank Project. Kris Kendell[◊], *Alberta Conservation Association, Sherwood Park, AB T8A 6J7; kris.kendell@ab-conservation.com;* Brian Eaton, *Alberta Innovates - Technology Futures, Vegreville, AB T9C 1T4; brian.eaton@albertainnovates.ca;* Anthony Russell, *University of Calgary, Calgary, AB T2N 1N4; arussell@ucalgary.ca,* Mark Steinhilber, Ian Kriston, *Royal Alberta Museum, Edmonton, AB T5N 0M6; mark.steinhilber@gov.ab.ca; ian.kriston@gov.ab.ca*

The Herpetofauna of Alberta BioBank (HABB) is a collaborative project developed by the Alberta Amphibian and Reptile Specialist Group (AARSG) and the Royal Alberta Museum (RAM). AARSG, chaired by the Alberta Conservation Association, is a network of scientists and naturalists dedicated to the study and conservation of amphibians and reptiles in Alberta. One role of the AARSG is to initiate new projects that will be beneficial to all who are interested in amphibians and reptiles in this province. The HABB project is the first of these initiatives. AARSG, through the HABB project, coordinates the collection, curation, and supply of amphibian and reptile tissue for genetic, disease and contaminant research, and other applications. The objective is to ultimately develop a tissue bank that covers the entirety of the province, on a grid-like basis. Currently the testing of the collection protocol and curation process is underway, based upon the acquisition of anuran and salamander larvae. Tissues are being collected and preserved following a standardized protocol and are then shipped to the RAM in Edmonton for verification of identification, curation, storage and disbursement. Based upon the current testing procedure, protocols will later be developed for the collection and handling of tissue from other anuran and salamander life stages, and reptile species. The BioBank will be managed by the RAM and disbursement of tissue will be at its discretion.

Environmental DNA: Using Molecular Analysis to Detect Three Species of Amphibian in an Industrial Setting in Alberta. Kris Kendell[◊], *101 9 Chippewa Road, Sherwood Park, AB T8A 6J7; kris.kendell@ab-conservation.com;* David W. Coltman, Corey S. Davis, Cynthia A. Paszkowski, *Department of Biological Sciences, CW 405, Biological Sciences Building, University of Alberta, Edmonton, AB T6G 2E9; dcoltman@ualberta.ca; cordavis@ualberta.ca; cindy.paszkowski@ualberta.ca;* Doug Manzer, *Alberta Conservation Association; 12501 20 Ave., Crowsnest Pass, AB T0K 0E0; doug.manzer@ab-conservation.com*

Traditional amphibian monitoring using physical detection can be biased because of the secretive nature of many amphibians. This presents a need for innovative approaches to amphibian monitoring that are more sensitive and comprehensive. In aquatic habitats sloughing cellular debris creates an accumulation of nucleic acids that becomes detectable with molecular techniques. We conducted traditional amphibian surveys within three waterbodies at the Shell Carmon Creek project near Peace River, Alberta and collected 10 water and 10 sediment samples from each pond. We tested for the presence of Wood Frog (*Lithobates sylvaticus*), Boreal Chorus Frog (*Pseudacris maculata*) and Western Toad (*Anaxyrus boreas*) eDNA in each sample against physical detection data for each species at each site. Species diagnostic cytochrome c oxidase DNA sequences were amplified using PCR and sequenced using an Ion Torrent Personal Genome Machine. We determined DNA isolated from Wood Frog, Boreal Chorus Frog and Western Toad tissue yields a decreasing number of reads upon dilution which helped determine the minimum amount of DNA that can be detected in eDNA samples. All samples were tested for PCR inhibitors by spiking tissue DNA PCRs with eDNA and determining the loss of PCR efficiency in these reactions (relative to controls). Lastly, we used “blocking” primers to determine if excessive amounts of eDNA from one species precludes the detection of rarer

species. The Shell Carmon Creek water and sediment samples are further testing the limitations of the eDNA method for short and long-term monitoring purposes of amphibians in an industrial setting.

Alberta Volunteer Amphibian Monitoring Program. Kris Kendell[◊], *Alberta Conservation Association, Sherwood Park, AB T8A 6J7; kris.kendell@ab-conservation.com*

Alberta Conservation Association (ACA) delivers the Alberta Volunteer Amphibian Monitoring Program (AVAMP) in partnership with Alberta Environment and Parks. AVAMP is a long-term community survey of amphibians established in 1992 under the auspices of the Declining Amphibian Population Task Force (DAPTF) in response to information showing that many populations of amphibians throughout the world have declined. Such declines have been documented in Alberta (e.g., Northern Leopard Frog [*Lithobates pipiens*]). AVAMP participants contribute to the advancement of amphibian and reptile conservation through submission of voluntary data on their own time, without direct supervision from ACA. AVAMP is an effective and economical means to collect basic data (i.e., species, date, location and surveyor) that can be used by researchers, government, educators, and consulting companies. This data provides general distribution information for herpetofauna populations in the province and, along with other data, assist in updating the general status of amphibians and reptiles in Alberta. All data collected through the project is entered into Fish and Wildlife Management Information System (FWMIS) database. FWMIS provides a central repository where government staff, industry and the public can store and access fisheries and wildlife data. AVAMP data is an important contribution to this knowledge base.

Long-eared Bat Taxonomy: Genetic Evidence Eliminates the Species Status of Keen's Myotis (*Myotis keenii*). Cori L Lausen[◊], *Wildlife Conservation Society Canada, P.O. Box 606, Kaslo, BC V0G 1M0; clausen@wcs.org;* Doug Burles, *1038 Pine Springs Road, Kamloops, BC V2B 8A8; dburles@telus.net;* Dave Nagorsen, *Mammalia Biological Consulting, 4268 Metchosin Road, Victoria, BC V9C 3Z4; mammalia@shaw.ca;* Karen Blejwas, *Alaska Dept. of Fish & Game, P.O. Box 110024, Juneau, AK 99811-0024; karen.blejwas@alaska.gov;* Purnima Govindarajulu, *BC Ministry of Environment, 4th floor, 2975 Jutland Road, Victoria, BC V8W 9M1; Purnima.Govindarajulu@gov.bc.ca;* Laura Friis, *305-1270 Johnson St, Victoria BC V8V 3P1; laurafriis@shaw.ca*

Four species of long-eared myotis bats occur in British Columbia: Keen's Myotis (*Myotis keenii*), Northern Myotis (*M. septentrionalis*), Long-eared Myotis (*M. evotis*), and Fringed Myotis (*M. thysanodes*). *Myotis keenii* and *M. evotis* are especially difficult to tell apart in the hand in areas where the species are sympatric. Field differentiation is desired given the 'vulnerable/sensitive' conservation status listings of *M. keenii* across its range, versus the 'secure' listing of *M. evotis*. Small differences in skull morphology, coloration, and mitochondrial DNA have been used to try to distinguish the two species, but it has been unclear as to whether species distinction is biologically warranted. To examine this question, we microsatellite genotyped 257 long-eared myotis, sampled from a wide range of locations along the BC, Alaska and Washington coasts, and as far east as Alberta. One hundred ninety-five of these samples were potential *M. keenii* or *M. evotis* based on morphology. We also included 24 Little Brown Myotis (*Myotis lucifugus*), as a closely related outgroup. We used 14 microsatellite markers and plotted all genotypes in Genetix to observe the nuclear relationship between individuals. Four clear clusters, representing 4 species were delineated: *M. septentrionalis, M.*

thysanodes, M. lucifugus and a mixed cluster of *M. keenii/M. evotis*. The highly mixed cluster of all potential *M. keenii* and *M. evotis* provides clear evidence that these individuals represent a single species that interbreeds. A few cases of hybridization between *M. thysanodes* and *M. evotis/keenii* were also noted.

An Occupancy Study of the Flammulated Owl. Sara McFall◊, *Conboy Lake National Wildlife Refuge, 100 Wildlife Refuge Road Glenwood, WA 98619; sara_mcfall@fws.gov*

We conducted surveys to locate Flammulated Owls (*Psiloscops flammeolus*) from May 26, 2015 to May 29th, 2015 on the Conboy Lake National Wildlife Refuge near Glenwood, Washington. We used protocols from the Partners in Flight-Western Working Group. We selected four survey sites from likely habitat that included forested areas around the refuge; one at Wildlife Refuge Road, two at BZ-Glenwood Hwy and one in the middle of the Kelley Road tract. These sites were split into two groups with one of the BZ-Glenwood Hwy sites in each group. The sites were surveyed alternately on nights with optimal weather. Each site consisted of pre-selected GPS point locations. Due to lack of audio equipment, an iPhone and an adapter were used to connect to the vehicle's radio and a recording of a Flammulated Owl male territorial hoot was played. Each point consisted of five, two minute intervals consisting of 30 seconds of the call followed by a 90 second interval of listening for a return hoot. Flammulated Owls were detected on multiple days during this survey at two different sites.

Seasonal Habitat Analysis of Bull Elk (*Cervus elaphus*) in the Colockum Herd, Washington. Lewis Meyers◊, *Washington Department of Fish and Wildlife, 809 E Juniper Avenue Apartment 2, Ellensburg, WA 98926; meyersl@cwu.edu*

The Washington Department of Fish and Wildlife satellite radio-collared 39 adult bull Elk (*Cervus elaphus*) in the Colockum Herd in Kittitas County, Washington and allowed me to analyze their movements from September 2013 to September 2015. Winter ranges were defined as areas the Elk occupied from November 15 through March 15 and summer ranges as areas that were occupied from May 15 through September 15. Several habitat variables were analyzed through the use of a geographic information system (GIS) to develop a habitat model that compared habitat use by bull Elk in this study with cow Elk from a previous study. Predictor variables were measured every 13 hours for each animal and included elevation, slope, aspect, normalized difference vegetation index, proximity to water, wetlands, roads, and fire scar occupation. Density was used as a response variable and was taken using a kernel function to estimate occupation of an area. Bull Elk prefer different habitat variables between summer and winter ranges than cow Elk, as well as different dates for migration from summer ranges to winter ranges. A habitat-suitability map was generated for both winter and summer habitats using a resource selection function. Weights assessing relative use of the predictor variables were based on the outcome of a general linear model, as well as results based on relevant literature.

*** Environmental DNA as a Technique for Monitoring the Movements of Cryptic Species in the Snoqualmie Pass I-90 Corridor.** Kayleigh Mullen◊, Steve Wagner, *Department of Biological Sciences, Central Washington University, 400 East University Way, Ellensburg, WA 98926; mullenk@cwu.edu; wagners@cwu.edu*

In recent years many restoration efforts have focused on fresh water habitats, with endeavours to remove barriers to streams, restore riparian complexity, and reconnect rivers with their floodplains. An example of such work is the Snoqualmie Pass I-90 East Project, where the

Washington State Department of Transportation is improving passage for both humans and wildlife. Monitoring species responses to restoration is an important aspect of conservation work, notably to find which species are occupying these areas and their annual movements. Using environmental DNA (eDNA) as a survey technique has been shown to be a sensitive, cost efficient monitoring method for cryptic and rare species, within both lentic and lotic systems. As work continues in Snoqualmie Pass, eDNA methods have been employed to uncover the responses to species in the area including; Western Toad (*Bufo boreas*), the endemic Pacific Giant Salamander (*Dicamptodon tenebrous*), Bull Trout (*Salvelinus confluetus*), a species severely affected by stream barriers, and Mountain beaver (*Aplodontia rufa*). The 15-mile stretch of highway currently under development crosses 14 tributary stems that feed in to Keechelus Lake and the Yakima River. Over the course of a year, eDNA methods are being used to take 'snapshots' of species diversity and occupancy in these creeks, streams, and wetlands. We are comparing eDNA to traditional survey techniques and occupancy modelling to evaluate its efficacy for detection of rare species. Our findings show eDNA has the potential to be a valuable survey technique to evaluate the movement of rare species restored habitats.

*** Is Diet Selection by Greater Sage-grouse Influenced by Biomass Availability or Toxins?**

Jacqueline Peña◊, Marcella R Fremgen, Jennifer Forbey, *Department of Biological Sciences, Boise State University, 1910 University Dr, Boise, ID 83725; jacquelinepena@u.boisestate.edu; marcella.fremgen@westernalum.org; jenniferforbey@boisestate.edu*

Foraging herbivores must meet nutritional requirements by not only finding enough plant biomass to consume, but also finding plants with the highest protein and lowest concentration of potentially toxic secondary metabolites. Greater Sage-grouse (*Centrocercus urophasianus*) selected a species of sagebrush (*Artemisia*) that had lower concentrations of monoterpenes within a habitat over a more abundant species with higher concentration of monoterpenes. Diet selection by Sage-grouse may be driven by other factors at smaller spatial scales once a species is selected. Preliminary data has shown that different morphotypes of sagebrush within a patch have different chemical profiles and different leaf morphologies, and these traits may influence diet selection by Sage-grouse at a scale below the species level. Our research aims to determine how diet selection is influenced by the density of morphotypes of plants (availability of leaves) within a foraging patch and whether Sage-grouse select specific morphotypes of sagebrush to maximize biomass consumed per bite (larger leaves) or minimize toxin consumed per bite (lower concentration of toxins). For each sagebrush morphotype we determined density and volume. We then measured biomass and monoterpene concentration of the leaves on a per bite basis. Our results showed that browsing is not proportional to biomass availability, but that Sage-grouse selected sagebrush morphotypes to minimize toxin intake. This research is important to understand plant-herbivore interactions and to know how Sage-grouse select and use habitats at different spatial scales.

*** Observing Self-medicating Behavior in Wildlife to Direct Drug Discovery.**

Britt A. Pendleton◊, Benjamin M. Dudek, Julie A. Heath, Jennifer Forbey, *Department of Biological Sciences, Boise State University, Boise, ID 83725;* Carolyn Dadabay, *Department of Chemistry, College of Idaho, Caldwell, ID 83605*

Self-medication, otherwise known as zoopharmacognosy, by wild animals has been documented in the literature since the mid-1900s and has helped to drive some important discoveries in modern medicine. Several studies show that diet selection by wild herbivores are

driven by plant secondary metabolites (PSMs) that could be developed as promising new medications. PSMs are defensive compounds synthesized by the plant to discourage browsing by herbivores and can have various toxic effects by interrupting metabolic pathways once ingested. Some animal species may exploit PSMs to combat physiologic stressors such as parasites, disease, and pain, or to increase memory. Observing the use of certain plants for self-medication in wild animals may offer a more directed approach than random screening to discover new compounds to treat disease. We showcase how the behavior of Sage-grouse (*Centrocercus urophasianus*), Golden Eagles (*Aquila chrysaetos*), and Piute Ground Squirrels (*Urocitellus mollis*) could help direct us to the bioactive properties of chemicals in sagebrush (*Artemisia* spp). These local systems are a great place to explore how behavior of wildlife can aid in drug discovery in our own backyard.

Niche Separation among Three Mustelids in the Idaho Panhandle is potentially Mediated through Behavior and Elevation. Lacy Robinson◊, Michael Lucid, *Idaho Dept. of Fish and Game, 2885 W. Kathleen Ave., Coeur d'Alene, ID 83815; lacy.robinson@idfg.idaho.gov; michael.lucid@idfg.idaho.gov;* Sam Cushman, *US Forest Service, 2500 S. Pine Knoll, Flagstaff AZ, 86001; scushman@fs.fed.us*

Species that share similar life history strategies within families will evolve means of segregating their ecological niches to avoid direct competition where they co-occur. For similarly sized carnivores, niche separation can be mediated through differences in prey base, habitat selection, and activity patterns, among others. During the winters of 2010-2014, the Multi-species Baseline Initiative established 497 bait stations to monitor forest carnivores in the Idaho Panhandle and adjacent mountain ranges. We used remote camera data to determine the number of days to first detection for four mustelids: Fisher (*Pekania pennanti*), American Marten (*Martes americana*), and weasels (*Mustela erminea* and *M. frenata*). Latency to detection for Fishers did not change depending on weather a Marten had previously visited the bait station. However, Marten detection increased from 7 to 20 days when Fishers had visited the station first. A similar pattern was observed between Martens and weasels. Additionally, these four mustelids used stations at different elevations with Fishers and weasels using low elevation stations compared with Martens. These two mechanisms may allow these four species to avoid direct competition and thereby allow for overlap in distribution and occurrence.

*** Osprey Habitat Suitability in West-Central Idaho: Impacts of Prey Abundance on Osprey Breeding Success.** Zach Sanchez◊, Annie Baxter, J Tyrell Styhl, Dusty Perkins, *College of Western Idaho, 5500 E. Opportunity Dr., Nampa, ID 83687; zachalan1986@gmail.com;* Robert Miller, Marc Bechard, *Intermountain Bird Observatory, Boise State University, 1910 University Dr. Boise, ID 83725-1515*

Ospreys (*Pandion hailaetus*) are fish-eating, top apex predators of aquatic ecosystems that are adapted to human landscapes and are thus a useful sentinel species for monitoring environmental contaminants and ecosystem health. Ospreys have been a focal point of conservation and study since their extensive decline from 1950-1970. While the majority of populations in the United States have recovered, breeding densities in many areas are variable; with many areas unoccupied despite the apparent existence of quality habitat. Environmental, water and habitat characteristics, as well as prey availability, human disturbance and contaminants are known to affect Osprey nesting success. In light of increasing human population and development near Osprey breeding habitats in Long Valley Idaho, we designed a

research study in order to evaluate relationships among prey availability and Osprey nesting success. We used a multivariate generalized-linear model with model selection procedures to evaluate the relative importance of prey abundance on Osprey nesting success. Here, we present the results of our model and discuss their applications for conservation efforts and Osprey management guidelines.

Idaho Natural Heritage Program's Species Diversity Database. Angie Schmidt◊, *Idaho Department of Fish and Game, 600 South Walnut, Boise, ID 83707; angie.schmidt@idfg.idaho.gov*

The Idaho Fish and Wildlife Information System houses and manages data for the Idaho Department of Fish and Game as well as partnering agencies. The Species Diversity Database is a subset of that data management effort housing at-risk species data for the Idaho Natural Heritage Program, a NatureServe network partner. Over the past several years our team has worked towards enabling online data submission and reporting through our online observation portal. Here's a look at our database and how to utilize the data within it.

*** Power poles, Platforms, and Snags: The Habitat Suitability and Breeding Success of Ospreys (*Pandion haliaetus*) in West-Central Idaho.** J Tyrell Styhl◊, Zach Sanchez, Annie Baxter, *College of Western Idaho, 5500 East Opportunity Drive, Nampa, ID 83687; styh9361@vandals.uidaho.edu*; *zachsanchez@mycwi.cc*; *anniebaxter@mycwi.cc*; Dusty Perkins, *Department of Life Sciences, School of Science, Technology, Engineering, and Math, College of Western Idaho, 5500 East Opportunity Drive, Nampa, ID 83687; dustyperkins@cwidaho.cc;* Bryan Krouse, *Department of Geography, School of Culture, History, and Politics, College of Western Idaho, 5500 East Opportunity Drive, Nampa, ID 83687; bryankrouse@cwidaho.cc;* Rob Miller, *Intermountain Bird Observatory, Department of Biological Sciences, Boise State University, 1910 University Dr., Boise, ID* 83725*; robertmiller7@boisestate.edu*; Marc Bechard, *Raptor Research Center, Department of Biological Sciences, Boise State University, 1910 University Dr., Boise, ID* 83725*; mbechard@boisestate.edu*

Ospreys (*Pandion haliaetus*) are fish-eating, top predators of aquatic ecosystems that are adapted to human landscapes and useful sentinel species for monitoring environmental contaminants and ecosystem health. Ospreys have been a focal point of conservation and study since their extensive decline from 1950-1970. While the majority of populations in the USA have recovered, breeding densities in many areas are variable; with many areas unoccupied despite the apparent existence of quality habitat. Distance to human disturbance, prey abundance, water quality and characteristics, distance to other raptor nests, and land use and cover (LUAC) are known to affect Osprey nesting success. In light of increasing human encroachment on Osprey breeding habitat in Long Valley Idaho, we set out to evaluate relationships among nest characteristics and Osprey nesting success. We used a multivariate generalized-linear model with model selection procedures to evaluate the relative importance of LUAC and nest characteristics on Osprey nesting success. Here, we present the results of our model and discuss their applications for conservation efforts and Osprey management guidelines

*** Idaho Adopt a Scientist Program (IASP): Engaging Classrooms in Local Research and Conservation.** Zoe Tinkle◊, J. Forbey, *Boise State University, Boise, ID 83725*

There is need to inspire and train the next generation of scientists who will conserve and manage local wildlife, plants and entire ecosystems in Idaho. The Idaho Adopt a Scientist Program (IASP) was created to (1) educate teachers and their students about local research and conservation, (2) provide an opportunity for students to experience how the scientific method is used to solve real-world conservation problems in a local ecosystem, and (3) promote effective communication of science to the public of all ages. Funded by the 2015 Idaho Chapter of the Wildlife Society Management, Conservation, and Education Grant Program, the pilot year of IASP is currently underway. We provide an overview of our experience in the classroom and field with a 7th-grade class in 2015. We also describe the development and progress of the current school-year program which includes one 7th-grade and one 11th-grade classroom from schools in or near Boise, Idaho. In addition, we will discuss the use of social media and other technologies that have contributed to advancing the mission of IASP.

*** Quantifying Animal Personality along the Shy-bold Spectrum: Choice of Test Matters.** Megan Whetzel◊, *National Science Foundation Research Experience for Undergraduates Program-University of Idaho Fish and Wildlife Sciences, 875 Perimeter Drive Mailstop 1136, Moscow, ID 83843; whet2896@vandals.uidaho.edu;* Charlotte R. Milling, Miriam Hernandez, Laura A McMahon, Janet L Rachlow, *University of Idaho Fish and Wildlife Sciences, 875 Perimeter Drive Mailstop 1136, Moscow, ID 83843; cmilling@uidaho.edu; jrachlow@uidaho.edu;* Jennifer Forbey*, Boise State University Department of Biological Sciences, Science 102C, Boise State University, Boise, ID 83725; jenniferforbey@boisestate.edu;* Lisa Shipley*, Washington State University School of the Environment, 425 Heald Hall, Pullman, WA 99164; shipley@wsu.edu.*

Individual animal "personalities" are an increasingly relevant component of behavioral, ecological, and evolutionary studies. Personality can be directly related to patterns of resource selection, temporal partitioning of activities, avoidance of predation risk, and ultimately, survival and reproduction. Recent work suggests that inconsistencies across methodologies used to rank individuals on the shy-bold spectrum may be the result of greater complexity in observed behavior than previously appreciated. We assessed four behavioral measures of boldness for 26 free-ranging Pygmy Rabbits (*Brachylagus idahoensis*) in the sage-steppe of eastern Idaho. Our tests included published and unpublished variants of the handling bag docility test and time-to-emergence tests. We hypothesized that bolder animals would exhibit lower docility and shorter times to emergence, but we expected that not all behavioral metrics would perform well (i.e., exhibit low variability within individuals, relatively high variability among individuals, and covary with other metrics). Our results supported these expectations for some metrics. We observed moderate correlation between two measures of emergence as well as between one measure of emergence and docility. By identifying which metrics effectively quantify the boldness dimension for this species, we can evaluate how personality differences influence habitat selection and predator avoidance behavior. This research suggests that personality dimensions can manifest in different responses to different tests designed to measure the same trait, which could mask underlying relationships between behavior and management-relevant parameters like survival, dispersal, and reproduction.