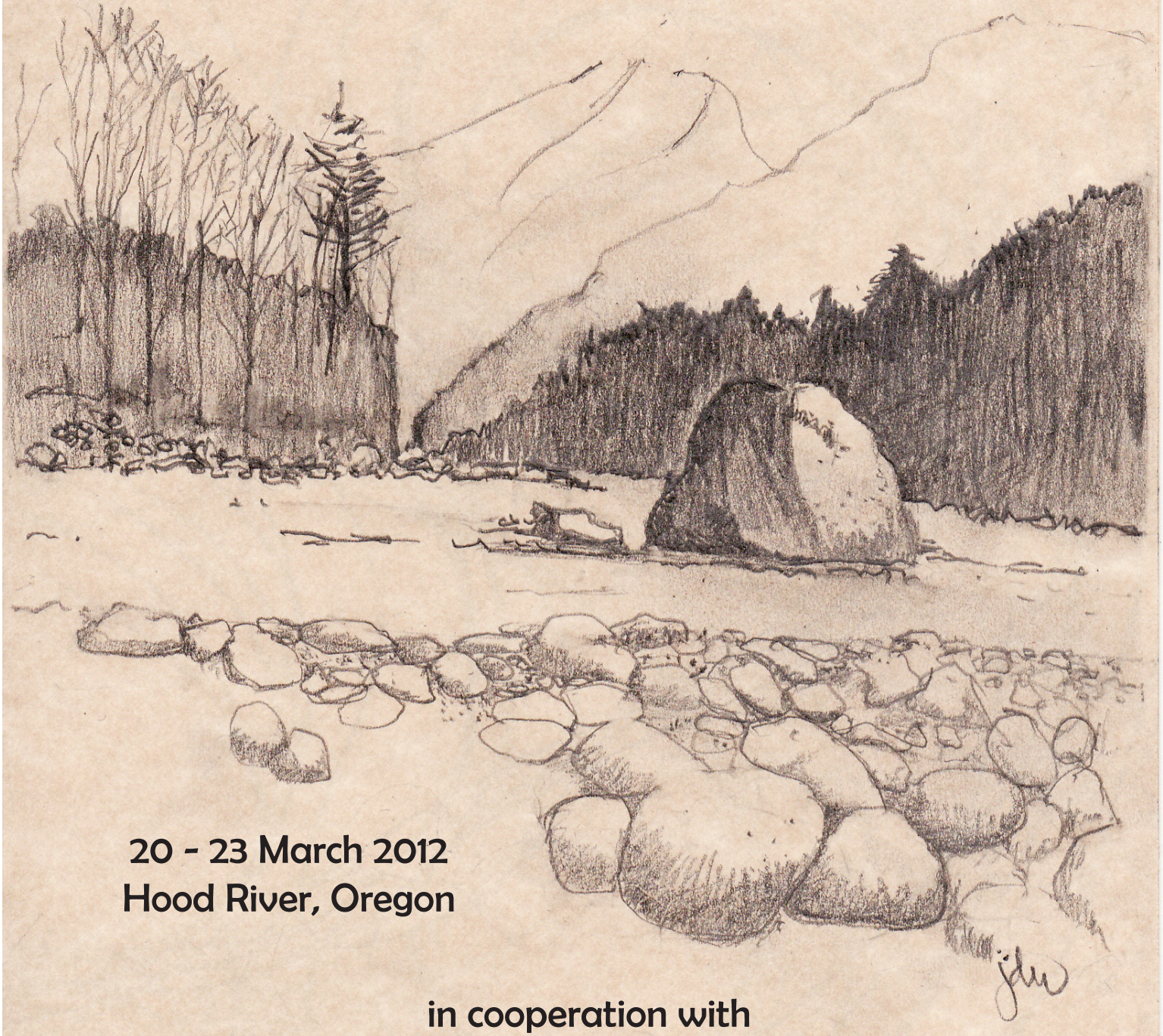
A River Runs Through It:
Riverine Systems Ecology and Restoration

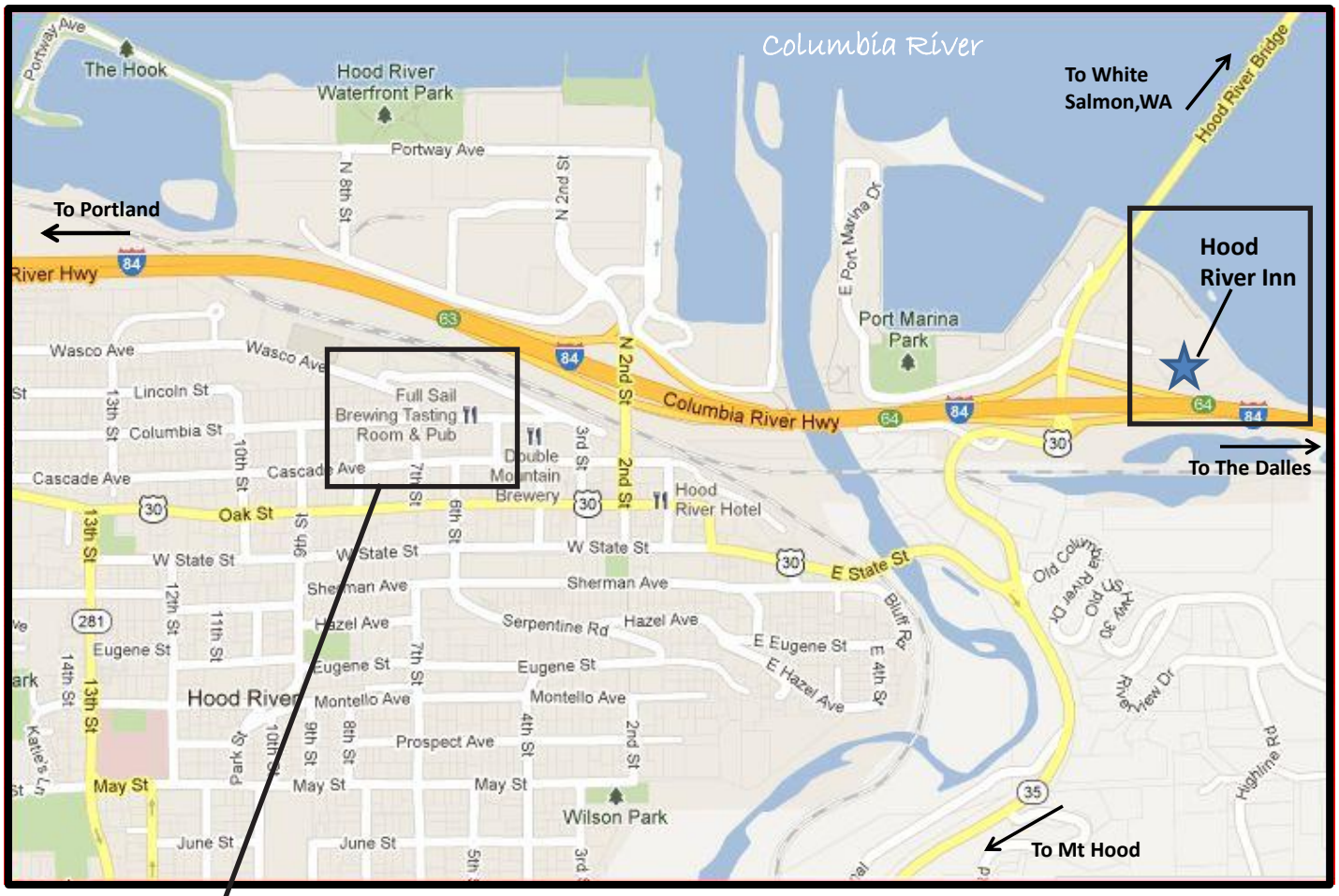
Society for Northwestern Vertebrate Biology
2012 Annual Meeting



20 - 23 March 2012
Hood River, Oregon

in cooperation with
NW Partners in Amphibian and Reptile Conservation
and
Pacific Northwest Native Freshwater Mussel Workgroup

Hood River and the Best Western Hood River Inn



NW PARC
Social at
Full Sail Brewing
Tasting Room & Pub
Tuesday 20 March
6:00 - 10:00 pm

Society for Northwestern Vertebrate Biology
2012 Annual Meeting

"A River Runs Through It: Riverine Systems Ecology and Restoration"

Welcome to the 2012 Society for Northwestern Vertebrate Biology (SNVB) annual meeting in Hood River, which coincidentally, happens to be the 10-year anniversary of when we held our last meeting in this same *Gorgeous* location!

Our location on the Columbia River brings to life the theme of this year's meeting *"A River Runs through It: Riverine Systems Ecology and Restoration"*. This river is the lifeblood of our region, connecting people and ecosystems over the course of its 2000-kilometer path through the Northwest. We are proud to be joined once again by Northwest Partners in Amphibian and Reptile Conservation (NWPARC), and to announce a new partnership with the PNW Native Freshwater Mussel Workgroup. The contributions and relevance of these groups to the fields of ecology, research, and management are evidenced by the exciting collection of workshops and presentations that have been assembled this year.

We have some of the top experts in the field presenting their work at this meeting – Pete Bisson, Jim O'Connor, Christian Torgersen, Robert Beschta, and Charlie Crisafulli – all renowned riverine biologists and ecologists who will be discussing ongoing restoration and management applications during the plenary session and banquet dinner. SNVB is proud to bring these partners to you with a message of collaboration and connectedness between the faunas of the Northwest and the biologists that manage, conserve, and represent them to the world.

Finally I'd like to thank you for attending! While Oregon VP Dave Clayton and the Planning team worked incredibly hard to put this all together, the meeting itself could not happen without you, and we appreciate you taking the time to attend, especially given the given the fiscal constraints and budgetary limitations prevalent throughout the environmental sector these days.

So kick back, enjoy the presentations and workshops, network with old and new friends, and come along on a field trip. We're glad you're here!

Brent Matsuda, President
Society for Northwestern Vertebrate Biology

St. Mark's Summit, Cypress Provincial Park, West Vancouver, BC. Photo by Kim Walters

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Ensatina and Pacific Chorus Frog, by Lindsey Thurman

Meeting Planning Committee

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Committee Members: Tara Chestnut, Janelle Corn, Cathy Flick, Tiffany Garcia, Eric Lund, Brent Matsuda, Darcy Pickard, Kathryn Ronnenberg, Nat Seavy, Kim Walters, Teal Waterstrat, Elke Wind

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Great Basin Collared Lizard, by Dave Clayton

Western Toad, by Lindsey Thurman

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Pacific Northwest Native Freshwater Mussel Workgroup Meeting Planning Committee:

Kevin Aitkin, Molly Hallock, Shelly Miller, Shivonne Nesbit, Al Smith, Cynthia Tait

Cooperation

This meeting would not have been possible without the hard work of many board members and members from the Society for Northwestern Vertebrate Biology. Thank you to all who contributed to meeting planning and session coordination. Thank you, too, to all who presented posters and presentations. We wouldn't have a meeting without you. We would also like to acknowledge and thank Northwest Partners in Amphibian and Reptile Conservation for their participation and coordination of the Conservation Genetics workshop and Wednesday's Roads and Wildlife Symposium, and the US Geological Survey's ARMI (Amphibian Research and Monitoring Initiative) for supporting the Occupancy Modeling workshop. The Pacific Northwest Native Freshwater Mussel Workgroup is also meeting with us this year, and sponsoring a Freshwater Mussel Identification workshop on Tuesday and a symposium on Wednesday afternoon. Welcome, and thank you for your participation. These meetings are only successful with a diversity of participants. Thank you to all for joining us.

Sponsors and Contributors to the 2012 SNVB Annual Meeting

The Society for Northwestern Vertebrate Biology would like to acknowledge the generosity of the following sponsors of the 2012 annual meeting:

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Pacific Northwest Native Freshwater Mussel Workgroup

ARMI Amphibian Research and Monitoring Initiative

We also wish to thank the individuals, businesses, and organizations, including Flora and Fauna Books and Mt. Adams Lodge, who provided special contributions or donated items for our raffle and auction.

Special Events

NWPARC Social — Tuesday 20 March, 6:00 - 10:00 pm, Full Sail Brewery

Northwest Partners in Amphibian and Reptile Conservation will be hosting an evening social on Tuesday March 20th at The Full Sail Brewing Tasting Room and Pub which is located on 5th Street in downtown Hood River (see map on first page of program).

SNVB Member Luncheon

Thursday 22 March, 12:30-2:10 pm, Columbia Room

There will be a build-your-own-sandwich buffet for all SNVB members who signed up for the luncheon on their registration form. Board members will provide an overview of the business dealings over the past year, a summary of some of the projects we currently have going on, and will answer questions or hear any ideas that you have for the society moving forward.

Photography Contest — Thursday 22 March, 1:00 - 6:00 pm, Lobby

We will once again hold our annual photo contest at our meeting. This year we will have photo submissions in the following four categories: **landscapes, flora and fauna, biologists in action**, and **artistic interpretation**. Photos will be displayed for viewing throughout the afternoon and during the poster session on Thursday. Don't forget to vote for your favorite photo in each category prior to the banquet where winners will be announced and prizes will be handed out. In addition, winning photographers will have the option to display their image on the SNVB website.

Silent Auction and Raffle

Thursday 22 March, 6:00-7:00 pm, Shoreline Room

Many items donated by generous sponsors and members will be on display Thursday, March 22nd during the poster session and no-host social. This silent auction is a fund raiser to support registration waivers for student participants at annual meetings and the student scholarship. So, browse the items and bid away!
This year we will also set up a raffle and will draw the winning tickets during the banquet dinner Thursday evening. Items for the raffle will also be on display during the silent auction. Tickets will be sold prior to the banquet.

Chaiten Volcano, Chile
Photo © Charlie Crisafulli

Annual Banquet

Thursday 22 March, 7:00 - 10:00 pm, Gorge Room

Join us at the annual banquet to socialize, eat good food and enjoy our raffle while we will summarize society announcements from the past year. This year we also have an exciting speaker lined up for our banquet. Charlie Crisafulli has been studying the ecology and evolution of biological communities on volcanic landscapes for over 30 years at nearby Mount St. Helens. Recently his research has taken him active volcanoes in Chile and has led to the development of an international network of volcano ecology study sites. He surely has some good stories to tell! Full details are available in the banquet section of this program.

Field Trips

Two great field trips have been arranged for Friday such that participants can attend one or both. Additional details are available at our meeting registration desk.

Herpetofauna of the Columbia Gorge

Friday 23 March, morning, time TBA
Trip Leaders Robert Weaver and Steve Wagner

Dr. Robert Weaver and Dr. Steve Wagner will lead an amphibian and reptile trip in nearby areas of the Columbia River Gorge. The species diversity in this area is very high with many potential species to be observed (depending on which direction we go) including, but definitely not limited to the: Larch Mountain Salamander (*Plethodon larselli*), Oregon Slender Salamander (*Batrachoseps wrighti*), Rubber Boa (*Charina bottae*), Ring-neck Snake (*Diadophis puncatus*), and many more.

Eco-Dynamic Winery Tour and Tasting at Klickitat Canyon Winery

Friday 23 March, afternoon
Trip Leader: Robin Dobson, Vintner and Forest Service Scenic Area Ecologist

From their website:

"Klickitat Canyon Winery is a small, family-run organic winery that creates natural wines in the Old World tradition.

We've developed a method of farming which we've named eco-dynamic farming. The premise is simple. Introduce as much native flora into your farm so that biodiversity is naturally restored and out-competes harmful pests. We also time our harvest so as not to disturb the native wildlife, such as ground nesting Western Meadowlarks. This way they may nest undisturbed in the native bunch grasses we've planted between our vine rows and eat the pests instead of our grapes. Hence our vineyard name Meadowlark Vineyard."

Columbia Gorge from the Washington side: Kathryn Ronnenberg

Meeting At A Glance

Monday 19 March

7:30 am - 5:00 pm	**Amphibians and Reptiles in My Project Area Training Workshop** (NWPARC) NRCS office in Portland, OR

Tuesday 20 March - Workshops & Northwest PARC Meeting

7:30 am	Registration opens - Hotel Lobby		
	Riverview Room	**Mountainview Room**	**Columbia Room**
8:20 - 10:00 am	**Conservation Genetics 101 Workshop** (NWPARC)	**Occupancy Modeling Workshop**	
10:00 - 10:30 am	*Break*		
10:30 - noon	**Conservation Genetics**, cont.	**Occupancy Modeling, cont.**	
noon - 1:00 pm	*Lunch* (provided for both morning workshops)		
1:00 pm - 2:50 pm	**NW PARC Annual Meeting**	**Occupancy Modeling, cont.**	**Freshwater Mussel Workshop**
2:50 - 3:10 pm	*Break*		
3:10 - 5:00 pm	**NW PARC Annual Meeting, cont.**	**Occupancy Modeling, cont.**	**Freshwater Mussels, cont.**
6:00 - 10:00 pm	***NW PARC social at Full Sail Brewery - All are welcome***		

Wednesday 21 March

7:30 am	Registration opens - Hotel lobby	
	Columbia Room	
8:30 - 8:45 am	Introductions and Welcome - Brent Matsuda	
8:45 - 9:30 am	**Plenary I:** Pete Bisson	
9:30 - 10:15 am	**Plenary II:** Jim O'Connor	
10:15 - 10:30 am	*coffee break*	
10:30 - 11:15 am	**Plenary III:** Christian Torgersen	
11:15 am - noon	**Plenary IV:** Robert Beschta	
noon - 1:00 pm	*lunch (on your own)*	
	Riverview Room	**Mountainview Room**
1:00 - 3:00 pm	**Roads & Wildlife Symposium**	**Freshwater Mussel Symposium**
3:00 - 3:20 pm	break	
3:20 - 5:00 pm	**Roads & Wildlife Symposium**, cont.	**Freshwater Mussel Symposium**, cont.
5:00 - 6:00 pm	*break*	
6:00 - 8:00 pm	SNVB/NWPARC/PNW Mussel poster session and no-host social - **Shoreline Room**	

Meeting At A Glance

Thursday 22 March

	Riverview Room Concurrent Session I	Mountainview Room Concurrent Session II	Columbia Room Concurrent Session III
8:00 am	Registration opens - Hotel lobby		
9:20 - 10:40 am	**Herps and Invasives**	**Carnivores & Small Mammals**	**Restoration**
10:40 - 11:10 am		*break*	
11:10 am - 12:30 pm	**Herp Life History**	**Carnivores & Small Mammals, cont.**	**Landscapes**
12:30 - 2:10 pm		*SNVB Member Luncheon*	
2:10 - 3:30 pm	**Amphibian Methodologies**	**Small Mammals**	**Herps & Management**
3:30 - 4:00 pm		*break*	
4:00 - 5:00 pm	**Amphibian Pathogens**	**Herps & Environmental Change**	
6:00 - 7:00 pm	Poster Session, Silent Auction, and Social (no-host bar) - **Shoreline Room**		
7:00 - 10:00 pm	Banquet & Raffle - **Gorge Room**		

Friday 23 March

Field Trips: see page 7 for details

Herpetofauna of the Columbia Gorge
morning, time TBA
Trip Leaders Robert Weaver and Steve Wagner

Photo: Lindsey Thurman

Eco-Dynamic Winery Tour and Tasting at Klickitat Canyon Winery
afternoon
Trip Leader: Robin Dobson, Vintner and Forest Service Scenic Area Ecologist

Tuesday 20 March Workshops and Meeting Schedules

7:30 am	Meeting registration and check-in opens
	NW PARC - Riverview Room
8:20 am	**Conservation Genetics 101**: Welcome and Introductions
8:30 - 10:00 am	Instructors: Dr. Steve Wagner and Dr. Noah Simon, with guest speaker case studies
10:00 - 10:30 am	*coffee break*
10:30 am - 12:30 pm	Conservation Genetics 101, continued
12:30 - 1:00 pm	*Lunch (provided)*
	NW PARC Annual Meeting - *Moderators:* Elke Wind and David Pilliod
1:00 pm	PARC National Update - Priya Nanjappa and Terry Riley
1:30 pm	Communications TT - Brandon Fessler
1:40 pm	Training TT - Kris Kendell
1:50 pm	*Invited speaker* - David Herasimtschuk - The Role of Photography in Conservation: Using compelling visual media to help promote the importance of conservation for amphibians and reptiles
2:10 pm	Headstarting/Reintroduction TT - Kris Kendell
2:20 pm	Disease TT - Steph Gervasi
2:30 pm	*Invited speaker* - Dr. Blake Hossack - Interactive effects of wildfire, forest management, and isolation on amphibian and parasite abundance
2:50 pm	*break*
3:10 pm	World Congress/Year of the Lizard - David Pilliod
3:20 pm	*Invited speaker* - Dr. David Scholnick - The physiological consequence of malarial infection in Western Fence Lizards, *Sceloporus occidentalis*
3:40 - 5:00 pm	Business meeting and group discussion
6:00 - 10:00 pm	***NW PARC social downtown at Full Sail Brewery*** *(no-host bar)*
	Occupancy Modeling Workshop - Mountainview Room - *Moderator:* Mike Adams
8:20 - 10:00 am	Introduction and Methods Overview. Instructions and demonstration of the use of the program PRESENCE.
10:00 am	*coffee break*
10:30 am - noon	Occupancy Modeling Workshop, continued
noon	*Lunch (provided)*
1:00 - 2:50 pm	Occupancy Modeling Workshop, continued
2:50 pm	*break*
3:10 - 5:00 pm	Occupancy Modeling Workshop, continued
	Freshwater Mussel Workshop - Columbia Room - *Moderator:* Al Smith
1:00 pm - 2:50 pm	Topics will include: identification techniques, life history and biology, surveying and sampling techniques, mussel restoration, species distribution; and threats, status and trends
2:50 pm	*break*
2:50 - 5:00 pm	Freshwater Mussel Workshop, continued

Pete Bisson

Pete Bisson is a senior scientist at the Forest Service's Pacific Northwest Research Station in Olympia, Washington. He worked as an aquatic biologist for the Weyerhaeuser Company for 21 years prior to joining the Forest Service in 1995. His research has included stream habitats and food webs, riparian zone management, and a variety of conservation issues related to aquatic ecosystems. He holds affiliate faculty appointments at the University of Washington and Oregon State University. Pete recently completed two terms as vice-chair of the Independent Scientific Review Panel for the Northwest Power and Conservation Council, which provides guidance to fish and wildlife recovery in the Columbia River Basin.

Your Power is Turning Our Darkness to Dawn: A Tale of Columbia River Salmon. Pete Bisson, *Pacific Northwest Research Station, Olympia Forestry Sciences Laboratory, Olympia, Washington, 98512; pbisson@fs.fed.us*.

The Columbia River is the fourth largest river in North America and historically held some of the most abundant salmon runs on earth. From early 19th century to the present, salmon and steelhead have declined from historical run sizes occasionally approaching 20 million fish to current levels of 1-2 million returning adults, and many of these fish originate in hatcheries. I trace the history of Columbia River development on salmon declines and examine how each of the so-called "Four Hs" (harvest, hatcheries, habitat loss, and hydroelectric operations) has affected natural production. In 1980, Congress created an organization now known as the Northwest Power and Conservation Council, whose responsibility includes administering what has become one of the nation's most expensive ecological restoration programs. In spite of the billions of dollars spent on recovery programs, wild salmon remain imperiled, and political and legal battles over them continue to occur. The decline of salmon in the Columbia Basin and the efforts save them constitute a fascinating case study of how humans deal with competing natural resource issues.

Photo: Pete Bisson

One of the long-gone June hogs. Photo: Oregon Historical Society.

Jim O'Connor

Jim O'Connor is a Pacific Northwest native long interested in the processes and events that shape the remarkable and diverse landscapes of the region. Following this interest with a Geological Science major at University of Washington and M.S. and Ph.D. degrees at University of Arizona, he has spent the last 20 years focused on the "science of scenery" (as ascribed to the field of geomorphology), for the last 15 years with the U.S. Geological Survey Water Science Center in Portland, Oregon.

A River Runs Through It: Dam Decommissioning in the Pacific Northwest. Jim E O'Connor, *US Geological Survey, Oregon Water Science Center, Portland, OR 97201; oconnor@usgs.gov;* Jon J Major, Kurt Spicer, *US Geological Survey, Cascades Volcano Observatory, Vancouver, WA 98683;* Chris S. Magirl, *US Geological Survey, U.S. Geological Survey, Washington Water Science Center, Tacoma, WA 98402*.

Over the last decade we have seen a fundamental change in our nation's approach to river management. The tens of thousands of dams built during the golden age of flood control and reclamation that peaked in the 1960s led to wholesale manipulation of fluvial systems. Nearly every large river in the continental U.S. was fragmented by dams. But now the trend is reversing and scores of dams are decommissioned each year. Nowhere has this been more dramatically implemented than in the Pacific Northwest, where over the last 5 years more than a dozen large dams have been removed, including Marmot Dam on the Sandy River, Oregon (October 2007), Milltown Dam on the Clark Fork River, Montana (March 2008), Savage Rapids Dam on the Rogue River, Oregon (October 2009), the Elwha River dams, Washington (September 2011), and Condit Dam on the White River, Washington (October 2011). Dam decommissioning, however, is complicated. Many dams slated for removal have been in place for decades, and the surrounding physical and biological systems have adjusted in some manner to each dam's presence. Additionally, the actual decommissioning of a dam itself is a profound environmental disturbance that propagates upstream and downstream through a variety of uncertain processes. Recent and ongoing studies in the Pacific Northwest are just now beginning to reveal some of these complexities as we embark on this bold new mission of reconnecting river ecosystems.

Marmot Dam...and the place where Marmot Dam used to be. Photos courtesy Gordon Grant, USFS.

Christian Torgersen

Christian Torgersen is a research landscape ecologist with the U.S. Geological Survey (USGS) Forest and Rangeland Ecosystem Science Center (FRESC) Cascadia Field Station (CFS) and an assistant professor in the School of Environmental and Forest Sciences at the University of Washington in Seattle. He is also has an appointment as courtesy faculty with the Department of Forest Ecosystems and Society at Oregon State University.

His research focuses on quantifying and explaining spatial heterogeneity in aquatic and terrestrial ecosystems and identifying how scale of observation influences our understanding of ecological patterns and processes. Much of his pioneering work on spatially continuous analysis of riverscapes and stream networks involves the use of geospatial applications, such as remote sensing, spatial statistics, and geographical information systems (GIS).

He received a B.A. in Geography at the University of Oregon (1993), a M.S. in Fisheries Science and Geography at Oregon State University (1996), and a Ph.D. in Fisheries Science at Oregon State University (2002).

From Headwaters to Sea: A Riverscape Perspective of the Elwha River Before Dam Removal. Christian E. Torgersen[1], Samuel J Brenkman[2], Jeffrey J Duda[1], Ethan Z Welty[1,6], George R Pess[3], Roger Peters[4], Michael L McHenry[5]; ctorgersen@usgs.gov. *[1]U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Seattle, WA 98195; [2]National Park Service, Olympic National Park, Port Angeles, WA 98362; [3]NOAA Northwest Fisheries Science Center, Seattle, WA 98112; [4]U.S. Fish and Wildlife Service, Lacey, WA 98503; [5]Lower Elwha Klallam Tribe, Port Angeles, WA 98363; [6]Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO, 80309*

Dam removal has been increasingly proposed as a river restoration technique, with several projects scheduled to occur in the western United States. In 2011, two large hydroelectric dams began to be removed from the Elwha River on Washington State's Olympic Peninsula in one of the nation's largest dam removal projects. Ten anadromous fish populations are expected to recolonize approximately 130 km of historical habitats after dam removal. A key to understanding watershed recolonization and ecosystem restoration is the collection of spatially continuous information on fish and aquatic habitats. To date, no studies have described spatially continuous fish and habitat relationships prior to dam removal, and consecutive-year studies throughout an entire river are rare. We conducted concurrent snorkel and habitat surveys in the Elwha River from the headwaters to the mouth (rkm 65 to 0) in 2007 and 2008. This "riverscape" approach was used to characterize spatial extent, assemblage structure, abundances, densities, and length classes of Pacific salmonids along a nearly continuous longitudinal gradient of 316 channel units. The longitudinal fish assemblage patterns revealed that species richness was highest below the dams, where anadromous salmonids still have access. The percent composition of salmonids was nearly identical in 2007 and 2008 for Rainbow and Cutthroat Trout (*Oncorhynchus mykiss* and *O. clarkii*, 89%; 88%), Chinook Salmon (*O. tshawytscha*, 8%; 9%), and Bull Trout (*Salvelinus confluentus*, 3% in both years). Pink Salmon (*O. gorbuscha*) were observed (<1%) in 2007 only. Spatial patterns of abundance for Rainbow and Cutthroat Trout (Pearson's correlation, r = 0.76) and Bull Trout (r = 0.70) were consistent between years despite differences in river flows in 2007 and 2008. Both multivariate and univariate analyses revealed clear differences in habitat structure along the river profile, due to both natural and anthropogenic factors. The generated fish and habitat profiles helped to visualize fish and habitat relationships and revealed unexpected spatial variations in fish abundances. This comprehensive view helped to highlight species-specific biological hotspots, revealing that 60-69% of federally threatened Bull Trout occurred near or below the dams. The riverscape approach also helped to focus future monitoring efforts, and addressed linkages between fish and aquatic habitats prior to dam removal. Spatially continuous surveys will be vital in evaluating the effectiveness of upcoming dam removal projects at restoring anadromous salmonids. These surveys are part of a larger effort to complete an atlas of riverscapes in major Olympic Peninsula rivers.

Robert Beschta

From 1974 to 1999, Dr. Beschta was involved in the teaching, research and extension programs in the Department of Forest Engineering, College of Forestry, Oregon State University. Since retirement from the College in 1999, he has continued to conduct field research across the western US and Canada during which he has authored or coauthored over 40 publications, mostly related to research on trophic cascades, riparian ecosystems, and rivers.

Trophic Cascades and the Structuring of Ecosystems in the American West. Robert L Beschta; William J Ripple, *College of Forestry, Oregon State University, Corvallis, OR 97331; robert.bescheta@oregonstate.edu.*

We investigated how large carnivores and herbivores may be linked to the maintenance of native species biodiversity through trophic cascades. The extirpation of wolves (*Canis lupus*) from Yellowstone National Park in the mid-1920s provided the opportunity to examine the cascading effects of ungulate herbivores on woody browse species in the absence of an apex predator. Channel responses to browsing-suppressed riparian vegetation in northern Yellowstone, as well as in additional national parks where studies were conducted, included accelerated erosion of floodplains and terraces, channel widening and incision, and loss of biodiversity. However, the reintroduction of wolves in 1995-96 into Yellowstone has initiated the recovery of many aspen, willow, and cottonwood communities indicating that many of the features of this trophically degraded ecosystem may be reversible. Although most of our studies have been conducted in national parks, results may have implications concerning the biodiversity of upland and riparian plant communities, as well as the character of channels and aquatic ecosystems associated with public lands in the western US. It is on these lands that introduced ungulates, and increasingly native ungulates, have heavily utilized upland and riparian plant communities to meet their foraging needs, with significant consequences to terrestrial and aquatic ecosystems.

Photo by Kathryn Ronnenberg

Banquet Speaker

Charlie Crisafulli

Charlie Crisafulli is a Research Ecologist with the USDA, Forest Service Pacific Northwest Research Station, Olympia Forestry Sciences Laboratory. He has been studying the ecology of animals and plants in the Mount St. Helens volcanic landscape and in adjacent old-growth forests for 31 years. His primary research themes are processes of succession (dispersal, establishment, population dynamics, community structure, and species interactions), and expanding lessons from Mount St. Helens to volcanoes in other regions of the world such as South America, Asia, and Alaska.

Chasing Eruptions: the Development of an International Network of Volcano Ecology Study Sites. Charlie Crisafulli. *US Forest Service, Pacific Northwest Research Station, Mount St. Helens National Volcanic Monument, Amboy, WA 98601; ccrisafulli@fs.fed.us.*

Volcanoes are widespread around the earth in both continental and marine settings. Approximately 95 percent of the earth's crust is igneous rock and volcanoes serve as conveyors delivering this material to the earth's surface. Volcanoes and volcanically-altered landscapes are compelling places showcasing dynamic earth processes and ecological responses to those processes. As such, volcanic areas provide exemplary living laboratories for studying fundamental questions in ecology regarding the assembly of biological communities, evolutionary processes, and soil development. The 1980 eruption of Mount St. Helens, Washington, USA is the most thoroughly studied volcanic landscape in the world with 32 years of intensive, multidisciplinary investigations and over 800 resulting scientific publications in the life sciences and greater than 1300 in the earth sciences. Experiences and lessons from Mount St. Helens are sought after by governments, academics, and other scientists when volcanoes erupt in other regions of the world and this had led to the incipient stages of an international volcano ecology network. Several research themes relevant to volcano ecology have emerged and are being applied at volcanoes in South America, Asia, and Alaska.

Photo © Charlie Crisafulli

Wednesday 21 March

8:00 am	Registration opens - Hotel lobby
	Plenary Session - Columbia Room
8:30 am	Introduction and Welcome - Brent
8:45 am	Plenary I: **Pete Bisson** - Your Power is Turning Our Darkness to Dawn: A Tale of Columbia River Salmon
9:30 am	Plenary II: **Jim O'Connor** - A River Runs Through It: Dam Decommissioning in the Pacific Northwest
10:15 am	*coffee break*
10:30 am	Plenary III: **Christian Torgersen** - From Headwaters to Sea: A Riverscape Perspective of the Elwha River Before Dam Removal
11:15 am	Plenary IV: **Robert Beschta** - Trophic Cascades and the Structuring of Ecosystems in the American West
noon	*Lunch* (on your own)

1:00 - 3:20 pm, Freshwater Mussel and Roads & Wildlife Symposia

Numbered abstracts begin on p. 20	Riverview Room **Roads & Wildlife** *Moderator:* Elke Wind	Mountainview Room **Freshwater Mussels** *Moderator:* Shelly Miller
1:00 pm	[54]Multi-taxa approach to investigating patterns of movement and highway permeability – Steve Wagner	[20]Conservation status of western freshwater mussels – Sarina Jepsen
1:20 pm		[29]Reproductive biology of *Anodonta californiensis* and *Gonidea angulata* in the Middle Fork John Day and Umatilla Rivers – Christine O'Brien
1:40 pm	[21]Landscape genetics meets road ecology – Denim Jochimsen	[37]Integrated decision modeling approach for estimating the response of mussel populations to hydrologic alteration in the southeastern U.S. – James Peterson
2:00 pm		[26]Host fish identification for *Anodonta californiensis* in the Yakima River basin – Alexa Maine
2:20 pm	[3]The effectiveness of vertebrate passage and prevention structures: a study of Boeckman Road in Wilsonville – Leslie Bliss-Ketchum	[47]Distribution, population status and conservation of mussels in the Upper Columbia and Missouri River basins of Montana: New findings and updates since 2010 – David Stagliano
2:40 pm		[30]Overview of the research efforts on Confederated Tribes of the Umatilla Indian Reservation (CTUIR) treaty land, northeastern Oregon – Christine O'Brien
3:00 pm	*break*	

Wednesday 21 March

3:20 - 5:00 pm, Freshwater Mussels and Roads & Wildlife Symposia continue

Numbered abstracts begin on p. 20	Riverview Room	Mountainview Room
	Roads & Wildlife *Moderator:* Elke Wind	**Freshwater Mussels** *Moderator: Shelly Miller*
3:20 pm	[4]The influence of artificial light on wildlife use of undercrossing structures – Leslie Bliss-Ketchum	[16]Population characteristics of native freshwater mussels in the mid-Columbia and Clearwater Rivers, Washingon State – Hans Helmstetler
3:40 pm	[45]Nocturnality in Black-tailed Deer as a response to human disturbance – Christopher Russell	[18]Status of freshwater mussels in California: cause for concern – Jeanette Howard
4:00 pm	[17]Assessing road influences on herpetofauna using artificial cover – Sara Henderson	[10]Between a rock and a silty place: *Margaritifera falcata* mussels and dams in the Elwha River – David Cowles
4:20 pm	[15]British Columbia's response to herpetofauna and road issues – Purnima Govindarajulu	[27]Working with watershed councils to conserve freshwater mussels: volunteer-based surveys in urban areas – Celeste Mazzacano
4:40 pm	[19]Road decommissioning on the Olympic National Forest – Betsy Howell	Discussion and synthesis
6:00 - 8:00 pm	SNVB/PARC/FWMWG Poster Session and Social (no-host bar) - **Shoreline Room**	

Photo courtesy Oregon State University Archives.

Thursday 22 March

8:00 am Registration opens – Hotel lobby

9:20 - 10:40 am, Concurrent Paper Presentation Sessions

Numbered abstracts begin on p. 20	Riverview Room	Mountainview Room	Columbia Room
	Herps and Invasives *Moderator:* Brent Matsuda	**Carnivores and Small Mammals** *Moderator:* Dave Clayton	**Restoration** *Moderator:* Darcy Pickard
9:20 am		[46]Using stochastic simulation to support carnivore management – Robert Scheller	
9:40 am	[7]Invasive and native turtles in the Pacific Northwest: Distribution, ecology, and management challenges – Bruce Bury and Brent Matsuda	[48]Current status of wolf recovery in Oregon and Washington – John Stephenson	[11]Basking with Western Painted Turtles: Habitat enhancement and stewardship – Christian Englestoft
10:00 am		[41]Wolverine distribution and ecology in the North Cascades – Catherine Raley	[36]Habitat restoration and Oregon Spotted Frogs in the Klamath basin – Christopher Pearl
10:20 am	[44]Exploring the management paradox in multi-invader communities – Jennifer Rowe	[23]Geographic ranges of the Fisher in the West Coast Distinct Population Segment – Jeffrey Lewis	[34]Creating shallow-water off-channel habitat in the Duwamish River – Elissa Ostergaard

10:40 am *break*

11:10 am - 12:30 pm, Concurrent Paper Presentation Sessions

	Riverview Room	Mountainview Room	Columbia Room
	Herp Life History *Moderator:* Elke Wind	**Carnivores and Small Mammals**, continued *Moderator:* Dave Clayton	**Landscape Management** *Moderator:* Bob Hoffman
11:10 am	[52]Aspects of ecology and life history of the Ring-neck Snake in WA – Robert Weaver	[28]Preliminary results from the Ashland Forest Resiliency Fisher Monitoring Project – Zane Miller	[2]The Willamette Confluence Preserve: Biodiversity benefits of floodplain restoration – Emily Blevins
11:30 am	[12]Combining remote-imaging and radio-telemetry to monitor amphibian activity – Brandon Fessler	[42]Models of Army Cutworm Moth and Grizzly Bear habitat in the Greater Yellowstone Ecosystem – Hillary Robison	[38]Evaluating fisheries sensitive watersheds in BC – Darcy Pickard
11:50 am	[35]Movement patterns and home range estimates of Western Toads near Snoqualmie Pass – Amber Palmeri-Miles	[8]A GIS assessment of Beaver activity – Eric Butler	
12:10 pm		[49]Habitat and distribution of tree voles based on multiple sources of data – James Swingle	[32]Aquatic-terrestrial connectivity designs in forests – Deanna Olson

12:30 pm **SNVB Member Luncheon** - 12:30 - 2:10 pm - **Shoreline Room**

Thursday 22 March

2:10 - 3:30 pm, Concurrent Paper Presentation Sessions

Numbered abstracts begin on p. 20	Riverview Room	Mountainview Room	Columbia Room
	Amphibian Methodologies *Moderator:* Tiffany Garcia	**Small Mammals** *Moderator:* Paul Hendricks	**Herps and Management** *Moderator:* Robert Weaver
2:10 pm		[40]Distribution and abundance of Red Tree Voles on the Clatsop and Tillamook State Forests in northwest Oregon – Amy Price	[43]Conservation kaleidoscope: 2012 - Year of the Lizard – Kathryn Ronnenberg
2:30 pm	[13]A novel approach for estimating occupancy of the Oregon Slender Salamander – Tiffany Garcia	[56]Thinning effects and long-term management strategies for Spotted Owl prey and other small mammals – Todd Wilson	[24]Changes in abundance of Rocky Mountain Tailed Frogs in relation to timber harvest and stream discharge – Kirk Lohman
2:50 pm	[14]Predicting occurrence of amphibians in Palouse Prairie wetlands – Erim Gomez	[33]White Nose Syndrome update and what it means to the Pacific Northwest – Patricia Ormsbee	[55]Population responses of herpetofauna to the managed flow regime of the Trinity River – Hartwell Welsh
3:10 pm	[25]Binomial mixture model as an alternative for estimating detection probability and abundance of stream-breeding amphibians – Eric Lund		[31]Riparian buffers and thinning: Effects on headwater amphibians after 5 and 10 years – Deanna Olson
3:30 pm		*break*	

4:00 - 5:20 pm, Concurrent Paper Presentation Sessions

	Riverview Room	Mountainview Room
	Herps and the Environment *Moderator:* Teal Waterstrat	**Amphibian Pathogens** *Moderator:* Tara Chestnut
4:00 pm	[53]Recent observations of the California Mountain Kingsnake in WA - Robert Weaver	[5]Ranavirus-associated die-off of American Bullfrogs – Julia Burco
4:20 pm	[6]Southern Torrent Salamanders and climate change – Gwen Bury	[22]Water mold genetic diversity and virulence on amphibian embryos – Jim Johnson
4:40 pm	[50]Elevational differences in UV-B response by the Long-toed Salamander – Lindsey Thurman	[9]The ecology of *Batrachochytrium dendrobatidis* in amphibian habitats – Tara Chestnut
5:00 pm	[1]Ecological role of *Ensatina eschscholtzii*, impacts on arthropod assemblage and carbon cycle – Michael Best	

Gray Jay, by Lindsey Thurman

6:00 pm **Poster Session, Silent Auction, and Social (no-host bar) - Gorge Room**

7:00 - 10:00 pm **Banquet and Raffle - Gorge Room - Banquet Speaker: Charlie Crisafulli**

Notes

1. Ecological Role of the Salamander *Ensatina eschscholtzii*: Direct Impacts on the Arthropod Assemblage and Indirect Influence on the Carbon Cycle in Mixed Hardwood/conifer Forest in Northwestern California. Michael L. Best, *Humboldt State University, 1 Harpst Street, Arcata, California 95521;* Hartwell H. Welsh, Jr., *U.S. Forest Service, Pacific Southwest Research Station, 1700 Bayview Dr., Arcata, California 95521*

Terrestrial salamanders are the most abundant vertebrate predator in northwestern California forests, fulfilling a critical ecological, arguably keystone, role converting invertebrate to vertebrate biomass based on their sheer numbers. The most common species of terrestrial salamander in northwestern California is the Ensatina salamander (*Ensatina eschscholtzii*) (hereafter Ensatina). In an experimental design we tested top-down effects of Ensatina on leaf litter invertebrates and the potential for these top-down effects to decrease the rate of leaf litter decomposition and thereby foster carbon sequestration. The study ran during the rainy season (November through April) over two years (2007-2009) in the Mattole River watershed. Results from the first year indicate a strong top-down effect, with a 13% decrease in litter decomposition on salamander plots compared to controls. This is attributed to Ensatina's selective removal of large detrivores (beetle and fly larva, beetles, springtails, and earwigs) enabling smaller detrivores (mites, barklice) to become more numerous. Ensatina's selective predation modifies the composition of the invertebrate assemblage by shifting the density of key functional groups (shredders), which increases carbon sequestration in Northern California forests. Results from year two indicate that these effects are ameliorated by environmental conditions, and that direct salamander impacts on invertebrates, and the related indirect effects on the capacity for carbon sequestration are influenced by water year.

2. The Willamette Confluence Preserve: Biodiversity Benefits of Floodplain Restoration in the Willamette Valley. Emilie Blevins, Leslie Bach, Jason Nuckols, Melissa Olson, Dan Bell, *The Nature Conservancy, 821 SE 14th Ave, Portland, Oregon 97214; eblevins@tnc.org*

Floodplains comprise highly productive habitat supporting high levels of biodiversity. Yet, rivers and their floodplains also provide important natural resources and services for human development. In Oregon, loss of valuable floodplain and aquatic habitat in and along rivers has been widespread. Recently, however, the importance of floodplain-river connectivity and river channel complexity for ecosystems and species has been identified, making floodplain restoration a key conservation goal. Sites such as the 1271-acre (514-ha) Willamette Confluence Preserve near the confluence of the Coast and Middle Forks of the Willamette River present a unique opportunity to restore floodplain habitat along the Willamette River. Recently acquired by The Nature Conservancy, this former aggregate mining site includes ponds, wetlands and riparian forest, as well as upland habitat. Because much of the site has been impacted by historic instream and floodplain aggregate mining, restoration will require consideration of multiple design scenarios aimed at increasing floodplain function and complexity. In addition, great potential exists for the improvement of seasonally and permanently inundated habitat for fish, birds, and herpetofauna, and ongoing research will inform future restoration and management decisions. We discuss the history and biodiversity of the site and explore the benefits and challenges associated with complex floodplain restoration projects.

3. The Effectiveness of Vertebrate Passage and Prevention Structures: A Study of Boeckman Road in Wilsonville. Leslie Bliss-Ketchum, *Environmental Science & Management Program, Portland State University, Portland, OR 97207; blissket@pdx.edu;* Catherine E. de Rivera, *Environmental Science & Management Program, Portland State University, Portland, Oregon 97207; derivera@pdx.edu;* Kerry Rappold, *Natural Resources Program Manager, City of Wilsonville, 29799 SW Town Center Loop East Wilsonville, OR 97070; rappold@ci.wilsonville.or.us.*

Wildlife collisions are a serious issue resulting in human costs from property damage, injury and death, as well as typically fatal results for wildlife. Roads fragment habitats and affect the stability and evolution of the surrounding wildlife community. One mitigation strategy for these impacts is to construct passage structures, allowing wildlife to cross under the road, avoiding direct interaction with vehicles. To minimize effects on wildlife, the City of Wilsonville included 13 under-road passage structures of four designs, as well as fencing, in the construction of Boeckman Road. This study compared the abundance, richness, and evenness of the vertebrate wildlife community, using passage structures at Boeckman Road to assess species preference for passage size and design. We also examined transects away from the road to determine if species detections in passages are representative of surrounding wildlife communities. Animal detections

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were collected using motion-detection cameras and sand tracking. Twenty-three species were detected using passages: five species of non-passerine birds, one species of reptile, three species of amphibian, and fourteen species of mammal. Two species were detected at transects away from the road that were not previously detected in passages, Beaver (*Castor canadensis*) and Nutria (*Myocaster coypus*). Total animal detections were highest at passage structures and lowest at the furthest (100M) transect, suggesting a funneling of animals. Alternately, frequently detected species may prefer to move nearer the road. Individual species detections were variable. The results of this study indicate that the Boeckman Road project is a successful mitigation of road impacts on wildlife habitat connectivity.

4. The Influence of Artificial Light on Wildlife Use of Undercrossing Structures. Leslie Bliss-Ketchum, *Environmental Science & Management Program, Portland State University, Portland, OR 97207; blissket@pdx.edu;* Catherine E. de Rivera, *Environmental Science & Management Program, Portland State University, Portland, Oregon 97207; derivera@pdx.edu;* Kerry Rappold, *Natural Resources Program Manager, City of Wilsonville, 29799 SW Town Center Loop East Wilsonville, OR 97070; rappold@ci.wilsonville.or.us*.

Artificial light severely disrupts migratory behavior in birds, sea turtles, and bats, among other species. Its effects on the movement and activity patterns of terrestrial animals, however, are largely unknown. Such information is needed to inform mitigation of habitat fragmentation in the face of expanding urbanization. Wildlife crossing structures can help mitigate habitat fragmentation by roads, but some crossing structures are proposed as dual-use (for use by foot or bike traffic as well as for wildlife) and typically would include artificial light. The undercrossing in this experiment is a bridge structure solely for water and wildlife passage that has three ~30 m long sections. On a weekly basis each section was subjected to either high [~10 foot candles (fc)], low (~5 fc), or no light; sand tracking data was collected to determine use. Light treatments were rotated in a Latin square design to account for unequal use of each section by wildlife. After three weeks all lights were turned off for one week before rotations began again. Data collection will continue this spring as water levels subside. A strong pattern of avoidance of artificial light is developing in deer mice detections and we have also noted possible similar trends for mink and voles. As data collection continues, it is not yet clear if trends will also develop in the 14 additional species detected, however given the data thus far it is clear that for some species habitat connectivity is disrupted by the presence of artificial light.

5. Ranavirus-associated Die-off of American Bullfrogs (*Lithobates catesbeianus*) Along the Columbia River Gorge. Julia Burco, Colin Gillin, Susan Barnes, Robert Bildfell. *Oregon Department of Fish and Wildlife, Wildlife Health and Population Laboratory, 7118 NE Vandenberg Ave., Corvallis, OR 97330;* julia.d.burco@state.or.us; Oregon Department of Fish and Wildlife, 17330 S.E. Evelyn St., Clackamas, OR 97015; Oregon State University, College of Veterinary Medicine, 146 Magruder Hall, Corvallis, OR, 97331

Ranavirus is an emerging infectious disease, along with chytridiomycosis, causing serious declines in amphibian population across the globe. Here we describe a recent mortality event in September of 2011 involving American Bullfrogs (*Lithobates catesbeianus*) in northwest Oregon confirmed to be associated with ranavirus infection. At least 100 bullfrogs, primarily metamorphs, were found dead or dying near Rooster Rock basin, which feeds into the Columbia River, over about a week-long period. Ranavirus disease was confirmed via PCR of internal tissues and classic signs observed on histopathology. As the bullfrog is frequently a reservoir for this virus, which often does not result in Bullfrog mortalities, potentially other local environmental factors such as recent warm temperatures and spraying for mosquitoes contributed to the lethality of the virus. We discuss the distribution and behavior of the virus in the United States as well as implications for other Oregon amphibian populations in the region.

6. Southern Torrent Salamanders and Climate Change: Initial MaxEnt and GIS Analysis. Gwen Bury, *Department of Zoology, Oregon State University, Corvallis, OR 97331, 3029 Cordley Hall, Corvallis, OR 97331; buryg@onid.orst.edu*

Headwater ecosystems in the Pacific Northwest are already challenged by many human alterations. These are likely to be exacerbated by climate change now and in the future. Southern Torrent Salamanders (*Rhyacotriton variegatus*) are highly sensitive indicators of stream disturbance. These small, endemic salamanders require cool or cold waters, among the lowest known for any amphibians. Further, they do not tolerate water loss, which restricts their dispersal in response to rapidly changing climate. I modeled the

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habitat suitability (envelope) for *R. variegatus* in northern California for 3 climate scenarios, for the years 2050 and 2080. I employed nine climate variables to summarize the habitat requirements of *R. variegatus*, including seasonality, summer maximum temperature, and annual temperature. These variables were chosen after analysis of 15 possible climate variables using the program MaxEnt. I used MaxEnt and a GIS to quantify the loss and movement of suitable habitat for *R. variegatus*.

7. Invasive and Native Turtles in the Pacific Northwest: Distribution, Ecology, and Management Challenges. R. Bruce Bury, *U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331; buryb@usgs.gov;* Brent M. Matsuda, *AECOM, 3292 Production Way, 4th Floor, Burnaby, BC V5A 4R4; brent.matsuda@gmail.com*

The Pacific Northwest has (1) Painted Turtles (*Chrysemys picta*) scattered from coastal BC south to the Willamette Valley, OR; and (2) Western Pond Turtles (*Actinemys marmorata*) either as rare or introduced (but now extirpated) in extreme southwest BC, few in WA, and more in OR. Our aquatic systems are experiencing habitat loss as well as multiple invaders that are detrimental to native biota. Native species are declining while invasive species increase. Already, invasive species of turtles comprise >80% of the turtles found in urban freshwaters of Vancouver, BC; Seattle, WA; and Portland, OR. They appear less successful in remote waters. Most are Red-eared Sliders (*Trachemys scripta*) but we have some Snapping (*Chelydra serpentina*) and Softshell (*Apalone spinifera*) turtles present with signs of breeding. Sliders are larger in size and may displace our native turtles on basking sites. In Europe, many studies indicate that introduced sliders decrease survival fitness of native pond turtles. We lack these rigorous studies in the Pacific Northwest. Based on our field observations, there are critical needs to: (1) document the current distribution and relative abundance of the invasive forms; (2) compare key population features and habitat requirements of native and invasive turtles across different habitats; and (3) initiate studies on how these co-mingled turtle communities interact, and trends in their numbers. It is time to assess the potential severity of these invasive species and to work collaboratively to develop regional action plans that help reduce and control the spread of invasive turtles in the Pacific Northwest.

8. A GIS Assessement of Beaver Activity in Urban Parks and Open Spaces in the Tualatin Hills Park and Recreation District. Eric Butler, *GIS Program, Portland Community College, 12000 SW 49th Avenue, Portland, OR 97219; eric.butler@pcc.edu*.

I collected GIS data on the presence of Beaver (*Castor canadensis*) in properties of the Tualatin Hills Park and Recreation District, Washington County, OR, in the spring of 2011. These data, including both stream conditions (including streambank condition, vegetation cover, large woody debris, Beaver and Nutria (*Myocaster coypus*) presence, and major canopy and shrub species) and points of classified Beaver sign (including dams, lodges, chews, and human mitigation installations), were used to produce weighted activity density estimates, statistical correlations, and spatial statistics for activity clusters, in pursuit of the development of a predictive habitat model for beaver in the urban ecosystem. While statistical analysis failed to isolate any habitat-selection criteria for Beaver activity, the data set produced by this survey has much unexploited potential for analysis, and also serves as a prototype for a more comprehensive study.

9. The Ecology of *Batrachochytrium dendrobatidis* in Amphibian Habitats. Tara Chestnut, Chauncey W. Anderson, *US Geological Survey, Oregon Water Science Center, 2130 SW 5th Avenue, Portland, OR 97201; chestnut@usgs.gov;* Julie D Kirshtein, *USGS National Research Program, 12201 Sunrise Valley Drive Reston, VA 20192*.

The amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), is an aquatic pathogen to amphibians implicated as one of the causal agents for global amphibian declines. *Bd* was first described in 1999, following global enigmatic declines across a spectrum of habitats ranging from heavily degraded to intact wilderness. Since *Bd* was described, research has focused primarily on the ecology of the pathogen in infected amphibians. Arguably, the most important knowledge gaps about *Bd* are its ecology in the environment outside of the amphibian host and distributional limits. We studied the ecology of *Bd* in the aquatic environment at temporal and spatial scales, and evaluated heterogeneity using an occupancy approach.

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10. Between a Rock and a Silty Place: Margaritifera falcate Mussels and Dams in the Elwha River. David L. Cowles, *Walla Walla University Department of Biology, 204 S College Avenue, College Place, WA 99324; david.cowles@wallawalla.edu;* Layla Cole, *The Nature Conservancy, 101 East Grand River, Lansing, MI 48906; laylamcole@gmail.com;* Patrick Crain, *Olympic National Park, 600 E. Park Avenue, Port Angeles, WA 98362; Patrick.Crain@nps.gov;* Molly Hallock, *Washington Department of Fish and Wildlife, 1111 Washington St SE, Olympia, WA 98501; Molly.Hallock@dfw.wa.gov;* Larry Ward, *Lower Elwha Fish Hatchery, 700 Stratton Road, Port Angeles, WA 98363; larry.ward@elwha.nsn.us.*

Most of the Elwha River drainage has been blocked by dams since 1912, which have prevented upriver migration by salmonids and downriver transport of sediment since that time. As a result, the previously robust salmonid populations in the river have collapsed to a remnant in the few kilometers of river below the lower dam. In addition, scour from moving water has moved most fine sediment downriver and the river bed has become mostly boulders and cobble in the reaches below the upper dam. The native Western Pearlshell Mussel *Margaritifera falcata*, which is common in other rivers near the Elwha, could potentially be affected by both these factors since its life cycle is closely tied to Chinook Salmon (*Oncorhynchus tshawytscha*) and it lives by burrowing into the sediment. We examined the Elwha River below the upper dam for the presence and population structure of mussels. No mussels were found between the two dams. Several small populations of mussels were in the reach below the lowest dam. Margaritifera falcata is often long-lived, and the largest individuals in these populations may predate the dams. An abundant population of smaller individuals was found near the salmon-rearing ponds which are connected to the lower river. These mussels may be native or may have been introduced with salmon fry. All the mussel populations were in danger of extirpation due to construction activities and to the heavy sediment load expected to move downriver when the dams are removed. We transplanted individuals from several key populations into a small tributary to shield them from burial in sediment. We will monitor them for the next several years as the Elwha recovers from dam removal, with the eventual goal of re-introducing them to the river.

11. Basking with Western Painted Turtles on Vancouver Island, B.C.: Habitat Enhancement and Stewardship. Christian Engelstoft, Kristiina Ovaska, *Habitat Acquisition Trust, PO Box 8552, Victoria, BC V8W 3S2; Christian@hat.bc.ca, kovaska@shaw.ca*.

The distribution of the endangered Western Painted Turtle (*Chrysemys picta*, Pacific Coast Population) in southwestern British Columbia coincides with populated areas, where the turtles face threats from urban development and other human activities. Since 2008 we have conducted surveys to delineate distribution and important habitat on Vancouver Island and the Gulf Islands. We have also worked with landowners developing management guidelines for urban and forestry lands, mitigating threats and enhancing habitat. Survey results and reports from the public suggest that the species is widely but patchily distributed in southern and eastern parts of the island and occurs both in urban/rural areas and in forested backcountry lakes. We developed management guidelines for large land owners and for residential properties with documented turtle nesting activity. Habitat rehabilitation was conducted in 2010 and 2011 and consisted of nesting habitat enhancement, set up as experiments with different substrate treatments, and installation of basking logs. Preliminary results indicate that tilling the substrate is an effective method to enhance nesting habitat at sites where vegetation in-growth is a problem; we are also investigating the effectiveness of adding sand and garden soil to the substrate in different proportions. Turtles readily used the basking logs that were added to ponds, suggesting that basking sites were in short supply. We will continue monitoring the enhanced habitats and plan to expand those treatments that are most successful.

12. Combining Remote-Imaging and Radio-Telemetry to Monitor Amphibian Activity: Mixed Techniques Reveal Refuge-Site Fidelity and Frequent Surface Presence in Terrestrial Coastal Giant Salamanders (*Dicamptodon tenebrosus*). Brandon Fessler, Jason T Irwin, Daniel D Beck, *Department of Biological Sciences, Central Washington University, 400 East University Way, Ellensburg, WA 98926; fesslerbrandon@gmail.com;* Marc P Hayes, *Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501.*

From 5 May to 10 November 2011 we used time-lapse cameras and coelomic-implant radio-transmitters to locate and monitor the activity of 11 terrestrial Coastal Giant Salamanders (*Dicamptodon tenebrosus*) (mass: 23.1-167.4 g; SVL103-183 mm) at sites in the Wenatchee National Forest, Washington. Cameras were positioned at salamander refuges, set to take images every 2 minutes for the length of a radio-tracking interval (x = 3.8 days). Over 600,000 images were produced during 220 individual camera-monitoring

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sessions. We recorded 224 discrete periods of relatively continuous salamander presence, averaging 462 ± 38.56 SE minutes (median: 425; range: 2-5, 949), with six periods lasting >24 hours. Salamanders were visible during all months of the study period. Most image sequences (75%, n = 167) showed salamanders near the entrance of a refuge (e.g., rock crevice, downed wood), often back in the crevice during the day, emerging partially or fully after dusk, and returning by dawn. Camera-recorded movements were primarily nocturnal or crepuscular; 98% (n = 77) occurred between 1923-0552 h. Both monitoring methods showed *D. tenebrosus* to exhibit a high degree of site-fidelity, with variable time-spans between returns to previously occupied refuges (<24 hours to >100 days). Our findings suggest terrestrial *D. tenebrosus* may not be as fossorial as previously believed. Although remote-cameras are standard techniques of avian and mammal research, they have only recently been applied to amphibians. Combining time-lapse cameras with radio-telemetry provided more complete observations of individual salamanders than either technique used alone, and we recommend further development of remote-imaging methods for amphibian monitoring.

13. A Novel Approach for Estimating Occupancy of the Oregon Slender Salamander (*Batrachoseps wrighti*). Tiffany S Garcia, Katie M Dugger, *Oregon State University, Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis, OR 97331; tiffany.garcia@oregonstate.edu;* Josh Johnson, Michael Rochelle, *Weyerhaeuser, 34904 Brewster Road, Lebanon OR 97355; AJ Kroll, Weyerhaeuser, WTC 1A5, Federal Way, WA 98063.*

The Oregon Slender Salamander (*Batrachoseps wrighti*) is a terrestrial amphibian species strongly associated with late-successional forests and decaying downed wood, but the reclusive nature of this species makes detection and estimating population sizes difficult. Given the life-history constraints for this species, we posit that sampling methods designed to detect and capture salamanders are either destructive to the habitats being sampled or, if not destructive, the techniques are largely ineffective. Additionally, few of these approaches use robust sampling and analytical designs that allow for the estimation of detection and temporary emigration rates, which are key variables in determining occupancy and/or population size. Our one-year pilot study employed a newly established light-touch sampling protocol and a space-for-time analytical technique to quantify occupancy rates in mature 2nd-growth forest stands. Average species-level detection probability was 0.15 (95% CL: 0.05-0.36) and average occupancy probability was 0.83 (95% CL: 0.20-0.99). None of the habitat covariates we investigated, including the amount of decayed wood and site productivity, were associated with detection probability or occupancy. These survey methods will be applied for the next two years in a survey designed to quantify Oregon Slender Salamander occupancy as a function of stand age and understory complexity. These non-destructive sampling and robust analytical techniques will be used to collect data on how the Oregon Slender Salamander responds to disturbance with changes in detection rates and site occupancy, which is information vital to conservation.

14. Ecological Models Predicting Occurrence of Amphibian Species in Palouse Prairie Wetlands. Erim Gomez, Rodney Sayler, *School of the Environment, Washington State University, PO Box 646410, Pullman, WA 99164-6410; erimgomez@gmail.com; rdsayler@wsu.edu*

Palouse Prairie has lost about 97% of its original wetland habitats to intensive farming, and is one of the most endangered grassland ecosystems in North America, making it a useful system for studying conservation of biological diversity in highly modified landscapes. We used data-mining techniques to develop ecological models to predict the occurrence of over 4000 amphibian larvae of 7 species captured in 63 wetlands along a geographic gradient extending from the eastern edge of the Palouse Prairie bioregion to Moses Lake, in central Washington. Virtually all wetlands we studied in Palouse Prairie were artificially constructed as reservoirs, conservation habitats in agricultural lands, or were associated with other development projects (e.g., mitigation for road construction, golf courses, urban settings, ditches, fish ponds). We used a variety of parameters to explore the relationships of amphibian presence with landscape context, land use, and other variables describing wetland habitats. Our ecological models reveal that only a relatively few environmental variables are needed to predict occurrence of different amphibian species with relatively high accuracy, including: a) presence or absence of introduced fish; b) wetland permanence and landscape context (e.g., surrounded by grasslands, farm fields, or urban areas); and c) broad biogeographic factors. These models provide evidence for the interactions of both historical biogeographic patterns and contemporary wetland features in determining amphibian communities in Palouse Prairie wetlands and they suggest conservation efforts that would most benefit several amphibian species of conservation concern.

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15. British Columbia's Response to Herpetofauna and Road Issues. Purnima Govindarajulu, *Ministry of Environment, PO Box 9338 Stn Prov Govt, Victoria, British Columbia V8W 9M1; Purnima.Govindarajulu@gov.bc.ca;* Elke Wind, *E. Wind Consulting, Nanaimo, British Columbia V9R 1N2, and Barb Beasley, Ucluelet, B.C., V0R 3A0*

Almost every one of British Columbia's 20 amphibian and 12 reptile species have "roads" listed as a potential threat to some degree. While direct mortality on roads is a primary mechanism of this threat, roads can also contribute to declines through habitat fragmentation, increasing sedimentation and pollution, and also by acting as attractants and sink habitats. Techniques to mitigate and manage these threats are not well understood. In response to this, a diverse group of individuals from government, non-government, and academia came together at a BC Herpetofauna and Roads Workshop in February 2011 in Nanaimo, BC. The group discussed and brainstormed priorities and strategies for responding to herpetofauna and road issues throughout BC. The most pressing problems identified by the workshop participants were the knowledge gaps and the lack of policy and awareness. These problems span all the phases of a road project from the lack of baseline herpetofauna information and environmental assessment policy that would most affect the project planning phase, to the inadequacy of Best Management Practices and Guidelines to inform the project implementation phase, to the lack of effectiveness monitoring in the project maintenance phase. Priority recommendations were for inventory, monitoring and research to address these knowledge gaps and the development of policy, guidelines and best management practices. As a result of the workshop, a BC Herpetofauna and Road Ecology Working Group has been established to promote collaboration in achieving these priorities and new projects are underway to mitigate the effects of roads on herpetofauna.

16. Population Characteristics of Native Freshwater Mussels in the Mid-Columbia and Clearwater Rivers, Washington State. Hans Helmstetler, *44203 E. Alderbrook, West Richland WA 99353; hhelmstetler@hotmail.com;* David L Cowles, *Walla Walla University Department of Biology, 204 S. College Avenue, College Place WA 99324; David.Cowles@WallaWalla.edu*

Freshwater mussel populations in the Columbia River are thought to have declined in abundance and changed in species composition in recent years. We surveyed the 118 km of river between Vernita Bridge and Wallula Gap and found only two small aggregations of Floaters (*Anodonta* spp.) and no Western Pearlshell Mussels (*Margaritifera falcata*), a formerly dominant species. One of the Floater aggregations appears to have been nearly extirpated, while the other aggregation appears to be stable. Sparsely scattered individual Floaters were found in the McNary Reservoir but did not show evidence of recruitment. Two populations of Western Pearlshell Mussels were studied in the Clearwater River in Jefferson County, WA for comparison. The Clearwater populations were large, densely aggregated, composed of diverse size classes, and showed little evidence of mortality. Mussel tissues from each site were analyzed for lipid content and levels of arsenic, mercury, and organochlorine pesticides. The highest lipid content and mercury concentrations were found in mussels from the Clearwater River. Arsenic and organochlorine pesticide concentrations were highest in mussels in the Columbia River. Overall, the mussel aggregations within the Columbia River were small, scattered, and provided a marked contrast to the flourishing mussel beds in the Clearwater River. These results suggest that Columbia River mussel populations have both declined and changed in species composition.

17. Assessing Road Influences on Herpetofauna Using Artificial Cover. Assessing Road Influences on Herpetofauna Using Artificial Cover. Sara Henderson, *Environmental Science & Management Program, Portland State University, Portland, OR 97207; sara2@pdx.edu;* Leslie Bliss-Ketchum, *Portland State University Portland, OR 97207; blissket@pdx.edu;* Catherine E. de Rivera, *Environmental Science & Management Program, Portland State University, Portland, OR 97207; derivera@pdx.edu*.

Roads have negative impacts on wildlife populations. In particular, roadkill affects populations of small, slower moving amphibians and reptiles. A lesser studied and understood influence is road avoidance behavior. We aim to evaluate the influence of roads on the abundance and community composition of amphibians and reptiles and the spatial pattern of road effects on community structure and species abundance. Five study areas were selected from within a wetland complex including the Tualatin River National Wildlife Refuge in Sherwood, OR and the Coffee Lakes Wetland in Wilsonville, OR. Sites were chosen based on habitat similarities as well as a gradient of road speed limits. General habitat conditions

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and road width were held constant. Twenty-five cover boards were randomly placed within a 50-m by 50-m area at stratified distances from the road. Boards are checked on a weekly basis and the number of individuals is recorded. Supplemental trapping using funnel traps and/or pit traps will be conducted to determine how representative cover board detections are of the herptile community. The age of the roads will be taken into consideration during analysis. Analysis will determine if there are correlations between species detections and distance from the road within sites as well as if/how the strength of those correlations differ across sites. Our results will help inform how to include road size and proximity into management plans for amphibian and reptile species as well as provide greater understanding of road impacts beyond roadkill on the herptile community.

18. Status of Freshwater Mussels in California: Cause for Concern. Jeanette Howard, *The Nature Conservancy, 201 Mission St 4th Floor, San Francisco, CA 94105; jeanette_howard@tnc.org;* Joseph Furnish, *U.S. Forest Service, Pacific Southwest Region, 1323 Club Dr, Vallejo, CA 94592; jfurnish01@fs.fed.us.*

A strategic survey design was applied to assess the conservation status of the three genera of western freshwater mussels in California: the California Floater *Anodonta californiensis* (Family Unionidae), a regionally sensitive aquatic bivalve mollusk; the Western Ridged Mussel *Gonidea angulata*; and the Western Pearlshell *Margaritifera falcata* (Margaritiferidae). There is a growing concern that populations of all may be in steep decline. The strategic survey method concentrated on locatable historical sites to enhance chances of locating the dwindling number of extant populations. A total of 400 historical records were compiled from published, unpublished and museum records, which together comprised 113 separate, locatable sites. During this project 58 of the 113 historical sites in California were resurveyed and mussels were found at 43% (n = 25) of the sites. Although mussels usually occurred in low numbers, dense mussel beds still remain in the Klamath and Pit Rivers. Based on this survey of specific historical and recent sites, we conclude that all three genera of native freshwater mussels are declining throughout the state and should be considered for greater protection. Most individuals were found at historical sites, indicating that species have persisted in spite of precipitous declines in abundance at most sites. *Anodonta* appears to have been extirpated from southern California.

19. Road Decommissioning on the Olympic National Forest. Betsy L Howell, *US Forest Service, Olympic National Forest, Olympia, WA 98512; blhowell@fs.fed.us.*

Since the early 1990s, the Olympic National Forest has decommissioned approximately addressed the continuing decline of road maintenance funds to manage roads, as well as the recognition that much of our transportation system presented resource risks. The RMS evaluated each of the forest's 2,250 miles (3,620 km) of roads using the following criteria: aquatic risk, access needs, future uses, wildlife concerns, and high-value watersheds. Specific criteria associated with the aquatic risk rating included looking at geologic hazards, stream crossings, proximity to fish habitat (potential sediment delivery), amount of road within 50 feet (15.2 m) of a stream, and upslope hazards. Specific criteria used to evaluate the wildlife risk rating included the amount of road within 0.25 miles (0.4 km) of a known Northern Spotted Owl (*Strix occidentalis caurina*), Marbled Murrelet (*Brachyramphus marmoratus*), or Bald Eagle (*Haliaeetus leucocephalus*) activity center. Although both ratings showed approximately 1/3 of forest roads presenting high or very high risks for fish and wildlife resources, the driver for which roads are actually decommissioned is generally based on potential negative impacts on fish and fish-bearing streams. While previous evaluations of risk focused on threatened and endangered species, future examinations may consider other terrestrial species (listed or not) and concepts such as connectivity and creating resilient landscapes in the face of uncertain changes in climate. Funding for decommissioning has come from various programs including the Salmon Enhancement Recovery Funding Board, Challenge Cost Share, Legacy Roads, and Jobs in the Woods.

20. The Conservation Status of Western Freshwater Mussels. Sarina J Jepsen, *The Xerces Society for Invertebrate Conservation, Portland, OR 97232; sarina@xerces.org;* Jennifer Zarnoch, *Columbia Land Trust, Vancouver, WA 98661; jzarnoch@columbialandtrust.org.*

Recent estimates suggest that imperiled taxa comprise more than 78% of the North American freshwater mussel fauna, making freshwater mussels one of the most highly endangered groups of animals on the continent. Western North America hosts only eight of the nearly 300 species of freshwater mussels in

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North America, and the conservation status of these eight species has been largely unknown. To address this issue, we surveyed biologists and malacologists from state and federal agencies, universities, tribes, non-governmental organizations, private consulting firms and museums. We requested all distribution records and anecdotal or empirical information relating to population status and trends of the Western Pearlshell (*Margaritifera falcata*), Western Ridged Mussel (*Gonidea angulata*), California Floater (*Anodonta californiensis*), Winged Floater (*A. nuttalliana*), Oregon Floater (*A. oregonensis*), Western Floater (*A. kennerlyi*), Yukon Floater (*A. beringiana*) and Woebegone Floater (*A. dejecta*). We discovered that there is a paucity of historical abundance data for any of the western freshwater mussels. We mapped approximately 4,800 distribution records and examined the historical and current distribution of each species and synthesized all information relating to population status or trends. We concluded that the Western Pearlshell, Western Ridged Mussel, California Floater and Winged Floater are vulnerable to extinction, and the Yukon Floater, Western Floater, and Oregon Floater are Currently Stable. The Woebegone Floater is probably not a valid species.

21. Landscape Genetics Meets Road Ecology. Denim M Jochimsen, *Department of Biological Sciences, University of Idaho, PO Box 443051, Moscow, ID 83844-3051; denimj@uidaho.edu.*

Roads are eminent features of most landscapes that generate a range of ecological effects. Construction results in immediate habitat loss and decreased suitability of the surrounding area for many taxa. Vehicles inflict an excessive number of fatalities, while generating noise, light, and pollutants that may deter some species from crossing the road surface. Ultimately, these combined effects contribute to fragmentation, thereby limiting wildlife movement. This raises a conservation concern, as isolated populations are likely to lose genetic diversity due to inbreeding and drift, and may consequently suffer decreased fitness or increased risk of extinction. Herpetofauna possess a variety of traits that increase their susceptibility to road effects, and research suggests that roads pose a substantial threat to a number of populations. It is encouraging that there are a variety of efforts that may serve to mitigate these negative effects, but the key for managers is to be able to effectively place them. The field of landscape genetics offers tools that can be used to determine the degree of impact that roads have on local populations, to facilitate the identification of problem areas or potential areas for conflict given a planned construction project, and to evaluate the success of crossing structures or other efforts in reestablishing gene flow. This presentation will provide a summary of how these techniques can be used, with particular focus on a current project aimed at providing recommendations for the management of Midget Faded Rattlesnakes (*Crotalus [oreganus] concolor*), a species of concern, in the state of Wyoming.

22. Water Mold Genetic Diversity and Virulence on Amphibian Embryos. Jim Johnson, Susan Brady, R Steven Wagner, *Department of Biological Sciences, Central Washington University, Ellensburg WA 98926; wagners@cwu.edu;* Kori Ault, *Forest Genetics and Biotechnology, Oregon State University, Corvallis, OR, 97331.* (Presented by R. Steven Wagner)

Water molds, mainly *Saprolegnia* sp. and related taxa, can infect and kill amphibian embryos. We analyzed the genetic diversity of water molds associated with embryos of three different amphibian species, which included *Rana cascadae, Anaxyrus [=Bufo] boreas*, and *Pseudacris regilla*, at a pond in the central Washington Cascades. Using ITS sequences, 11 distinct phylotypes were recovered which had sequence differences ranging between 4-28%. Many of these associates represent new taxa never before described in association with amphibian embryos. Our results also suggest that water mold communities differ with respect to amphibian species and change over time as amphibian embryos age. In order to understand if genetically different water molds vary in their virulence on amphibian embryos, we exposed two different northwest amphibians, *Lithobates [=Rana] pipiens* and *Rana cascadae*, to three different *Saprolegnia* species. *S. anisopora* was the most virulent, followed by *S. ferax* in reducing survival of embryos with no observable pathogenic effects of *S. diclina* for the duration of the experiment. Both *S. anispora* and *S. ferax* caused surviving amphibian embryos to hatch earlier, they were smaller for *L. pipiens* and larger for *R. cascadae*. Overall, the number of water molds associated with amphibian embryos is diverse and they vary in virulence amphibian species.

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23. The Geographic Ranges of the Fisher in the West Coast Distinct Population Segment: How They Reflect and Influence Fisher Conservation. Jeffrey C Lewis, *Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501; Jeffrey.Lewis@dfw.wa.gov;* Roger A Powell, *Department of Biology, North Carolina State University, Raleigh, NC 27695-7617; newf@ncsu.edu.*

In its West Coast Distinct Population Segment, the Fisher (*Martes pennanti*) is warranted but precluded for federal listing as a threatened or endangered species under the Endangered Species Act, and as such it is federally listed as a candidate species. In 2004, the US Fish and Wildlife Service identified "the present or threatened destruction, modification or curtailment of the species' habitat or range" as a factor in its warranted-but-precluded decision. As a valuable furbearer, an effective predator, and a charismatic mesocarnivore, the Fisher has benefited from conservation efforts initiated well before it was petitioned for listing as a threatened or endangered species. We will show how the historical, most-contracted, and current geographic ranges reflect past population-management and land-management practices (e.g., overexploitation, development of lowland landscapes), and how these ranges reflect conservation efforts on the Fisher's behalf (e.g., protection from commercial trapping, reintroductions). We will also show how these ranges (1) provide meaningful benchmarks for Fisher conservation success; (2) indicate challenges as well as opportunities for Fisher conservation; and (3) indicate a need (or lack of need) to formally list the Fisher as a threatened or endangered species.

24. Changes in Abundance of Rocky Mountain Tailed Frogs (*Ascaphus montanus*) in Relation to Timber Harvest and Stream Discharge. Kirk Lohman, *US Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin 54603; klohman@usgs.gov*.

Rocky Mountain Tailed Frogs (*Ascaphus montanus*) are a common amphibian in many forested streams in the Northern Rockies. Several studies have investigated the abundance of tailed frogs in relation to timber harvest practices and have shown population declines in areas where clear-cut logging has occurred, presumably as a consequence of either increased stream temperature or sedimentation. The Mica Creek Experimental Watershed in northern Idaho was established by the Potlatch Corporation to examine the effects of contemporary timber harvest practices on water quality and biotic conditions in streams. Tailed frog densities have been estimated annually in control and treatment watersheds the past 15 years. In relation to pretreatment conditions, no major changes have been observed in either adult or tadpole abundance. These results suggest that little or no change in tailed frog densities has resulted from timber harvest activities. Tadpole numbers in both control and treatment watersheds were depressed in years following large spring run-off events (1997, 2002, 2008, 2011), whereas greater densities were seen in years following extended periods without high-flow events (1999-2000, 2004-2007), suggesting that flow regime is likely a major determinant of tailed frog abundance. As a consequence of the substantial interannual variability associated with large spring runoff events, infrequent monitoring may not provide adequate information to assess subtle disturbance effects in watersheds.

25. Evaluating a Binomial Mixture Model as an Alternative to Mark-Recapture Surveys for Estimating Detection Probability and Abundance of Cryptic Stream-Breeding Amphibians. Eric M Lund, Aimee P McIntyre, *Washington Department of Fish and Wildlife, Olympia, WA 98501; eric.lund@dfw.wa.gov;* Jay E Jones, *Weyerhaeuser Company, Federal Way, WA 98063;* Marc P Hayes, Timothy Quinn, *Washington Department of Fish and Wildlife, Olympia, WA 98501;* Andrew J Kroll, *Weyerhaeuser Company, Federal Way, WA 98063*.

Traditional tools for estimating population size, such as mark-recapture estimators, may be impractical for sentinel taxa, many of which are cryptic and occur at low population densities. We used simulated and empirical data and a binomial mixture model for unmarked individuals to estimate detection probabilities and abundance for two amphibian genera, giant (*Dicamptodon*) and torrent (*Rhyacotriton*) salamanders. Simulation results indicated that precision of detection probability estimates improved as the number of sites and sampling occasions increased. Variability of estimated population sizes decreased with higher detection probability, although species abundance had little effect on the precision of detection probability estimates. We evaluated the effects of stream temperature and stream order on detection probability using field data collected from forested streams in Washington, USA. Detection probability estimates ranged from 0.07-0.65 for giant salamanders and 0.06-0.67 for torrent salamanders. Giant salamander detection probability was positively associated with stream temperature regardless of stream order, and was higher

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in second- and third-order streams than first-order streams. Detection probability for torrent salamanders varied with stream temperature, order, and the interaction of those covariates, with detection increasing with temperature for second- and third-order streams but showing a flat or decreasing trend for first-order streams. Taken together, our results indicate that the use of binomial mixture models for unmarked individuals is a feasible and less costly alternative to traditional mark-recapture techniques for estimating detection probability and abundance for taxa that are cryptic or occur at low densities.

26. A Host Fish Identification for *Anodonta californiensis* in the Yakima River Basin. Alexa Maine, *Central Washington University, Resource Management Graduate Program, Ellensburg, WA 98926.*

The importance of freshwater mussels in stream ecosystems is apparent in their remarkable ability to effectively cycle nutrients and improve water quality. Listed as a federal species of concern and a candidate species for listing in the state of Washington, the California Floater Mussel (*Anodonta californiensis*) has potentially significant ecological benefits. This study identifies a suite of suitable host fish species for this mussel, filling a significant data gap for *A. californiensis* and building a pathway for successful conservation efforts. Using a combination of artificial larval infection of potential host fish in a laboratory setting and field observation techniques, two fish species, Speckled Dace (*Rhinichthys osculus*) and Torrent Sculpin (*Cottus rhotheus*), were confirmed as hosts for A. californiensis. Two more fish species, Three-spine Stickleback (*Gasterosteus aculeatus*) and Redside Shiner (*Richardsonius balteatus*), were identified as potential hosts for A. californiensis, but confirming either species as a host will require further tests. Previous conservation efforts for A. californiensis may have fallen short without the knowledge of suitable host fish; however, the information obtained from this study can help to develop a holistic watershed management approach that focuses on A. californiensis and its suite of fish hosts in a community context rather than a species-specific strategy.

27. Working with Watershed Councils to Conserve Freshwater Mussels: Volunteer-based Surveys in Urban Areas. Celeste Mazzacano, *The Xerces Society for Invertebrate Conservation, 628 Northeast Broadway, suite 200, Portland, OR 97232; celeste@xerces.org;* Amy Lodholz, *Johnson Creek Watershed Council, 1900 Southeast Milport Road, suite B, Milwaukie, OR 97222; amy@jcwc.org*.

Freshwater mussels may constitute the largest living macrofaunal biomass in streams, but in many watersheds almost nothing is known about their populations, status, and distribution. Because their life history is closely tied to native fish, and because these highly threatened animals play critical ecological roles in aquatic habitats, a better understanding of freshwater mussels is needed to guide stream management decisions. Xerces Society is working with Johnson Creek Watershed Council and City of Gresham Watershed Division to conduct an extensive assessment of freshwater mussels inn Johnson Creek and selected tributaries, using volunteer-based survey protocols developed by Xerces. Stream reaches are surveyed in one-day events in which volunteers are trained in mussel survey techniques, identification, and ecology. Volunteers then conduct presence-absence surveys at predefined transects, recording mussel species, abundance, and shell length (a proxy for age), as well as stream substrate composition and surrounding land use. Most participants had almost no prior knowledge of freshwater mussels, but were extremely engaged in the surveys, and the protocols were accessible for both adults and children. This project helps fill gaps in our current understating of native mussel distribution and status, and has identified reaches where the invasive Asian Clam (*Corbicula fluminea*) is present. Volunteer-based surveys are proving an effective way to gain more knowledge about native mussels in the watershed, as well as a valuable outreach and education tool. Data from this project are being used for direct mussel conservation and to support ongoing watershed-wide biodiversity assessments, conservation projects, and habitat management planning.

28. Preliminary Results from the Ashland Forest Resiliency Fisher Monitoring Project. Zane Miller, Craig Thompson, *USFS Pacific Southwest Research Station, Fresno, CA 93710 zmiller@fs.fed.us, cthompson@fs.fed.us;* David Clayton, *Rogue River-Siskiyou National Forest, Medford OR 97530; dclayton@fs.fed.us.*

The Ashland Forest Resiliency Project is a 7,000 acre landscape scale fuel reduction project located in Southwestern Oregon. The area is a municipal watershed for the City of Ashland; it is also located in a NWFP late-successional reserve, Northern Spotted Owl (*Strix occidentalis caurina*) designated Critical Habitat, and it is the extreme northeastern range of the NW CA/SW OR population of the Pacific Fisher

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(*Martes pennanti*). While these types of vegetation treatments have been spreading across the west, little research has been done on the effects of fuels reduction projects to fisher individuals and populations. This project is being conducted in conjunction with similar work in the southern Sierras Mountains by the Pacific Southwest Research lab. We will discuss preliminary data on the pre-treatment fisher home ranges, and habitat use, as well as some potential responses to initial treatments.

29. A Study of the Reproductive Biology for *Anodonta californiensis* and *Gonidea angulata* in the Middle Fork John Day and Umatilla Rivers, Oregon. Christine O'Brien, *Browns River Environmental Consultants, 130 Sesame Street, Waynesville, NC 28785; christine.amblema@gmail.com;* Donna Nez, David Wolf, Melissa Van Pelt, Jessica Calhoun, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fish & Wildlife Program, 46411 Ti'Mine Way, Pendleton, OR 97801; brimbox@gmail.com*.

In 2003, a freshwater mussel status survey was conducted in the Umatilla River. The results of this survey indicated Margaritifera falcata had been extirpated and Gonidea angulata and Anodonta californiensis were only found in small numbers in the lower Umatilla River. Sustainable harvest of freshwater mussels remains a treaty right for the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). In 2005, CTUIR started focusing their efforts on restoring mussel populations to the Umatilla River. This approach by CTUIR is guided by the Umatilla River Vision, a strategy for the production of First Foods. In an effort to implement a recovery plan for the mussel populations in the Umatilla River, the reproductive biology, which is currently lacking for *A. californiensis* and *Gonidea angulata* would need to be addressed. In 2005, a study was started to determine when the mussels release their glochidia and to identify what host fish are utilized. *Anodonta californiensis* and *G. angulata* released their glochidia in June and July when the average daily water temperatures remained above 11°C. Laboratory host fish experiments identified the Longnose Dace (*Rhinichthys cataractae*), Shortnose Dace, and Margined Sculpin (*Cottus marginatus*) as hosts for *A. californiensis*, and the Margined Sculpin and Shorthead Sculpin (*C. confusus*) as hosts for *G. angulata*. Wild caught fish were inspected for encysted glochidia from early June to late July. *Anodonta californiensis* glochidia were found encysted on a variety of fish species, but speckled dace had the highest number of fish with attached glochidia. *Gonidea angulata* glochidia were only found attached to sculpin collected in late July.

30. Overview of the Research Efforts on Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Treaty Land, Northeastern Oregon. Christine O'Brien, *Browns River Environmental Consultants, 130 Sesame Street, Waynesville, NC 28785; christine.amblema@gmail.com;* Jayne Brimbox, Donna Nez, David Wolf, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fish & Wildlife Programs, 46411 Ti'Mine Way, Pendleton, OR 97801; brimbox@gmail.com;* Karen Mock,*Utah State University, Wildland Resources Department, 5230 Old Main Hill, Logan, UT 84322; karen.mock@usu.edu;* Tamao Kasahara, *Utah State University, College of Natural Resources, 5210 Old Main Hill, Logan, UT 84322*

Freshwater mussels are culturally important to northwestern Native Americans and are a vital component of intact salmonid ecosystems. In 2003, a survey of the Umatilla River indicated most of the freshwater mussel population had disappeared. Sustainable mussel harvest remains a treaty right for many Pacific Northwestern tribes, including the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). In 2005, CTUIR started focusing their efforts on restoring mussel populations to the Umatilla River. The objective of this talk is to summarize the scientific findings of the first six years of research. The approach taken by the CTUIR is guided by the Umatilla River Vision, which is a strategy for the production of First Foods. The restoration project includes distributional surveys, genetic studies, habitat characterizations, relocation trials, and reproductive biology studies.

31. Riparian Buffers and Thinning: Effects on Headwater Amphibians After 5 and 10 Years. Deanna H Olson, Jeffery Leirness, Patrick Cunningham, *Pacific Northwest Research Station, USDA Forest Service, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us*; E Ashley Steel, *Pacific Northwest Research Station, USDA Forest Service, 400 N. 34th St., Suite 201, Seattle, WA 98103*.

The Density Management and Riparian Buffer Study was initiated in 1994 to assess: 1) upland forest density management approaches to accelerate development of late-successional forest characteristics in managed federal forests; and 2) the efficacy of alternative riparian buffer widths along headwater streams, in the context of upland thinning, to retain key aquatic resources. Instream- and streambank-dwelling

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amphibians were monitored as part of the riparian component, using a before/after/control methodology. We analyzed animal counts along 45 stream reaches at 8 study sites, distributed from the foothills of Mount Hood to Coos Bay, Oregon, from data collected in one year pre-treatment and years 1, 2, 5 and 10 post-treatment. Using linear regression, we sought the simplest model to explain the variability in post-treatment animal abundances at the reach scale, after accounting for pre-treatment counts. Bank models analyzed all amphibians, all terrestrial-breeding amphibians, *Plethodon dunni* and *P. vehiculum*. Instream models analyzed all vertebrates, all amphibians, stream-breeding amphibians, *Dicamptodon tenebrosus*, and *Rhyacotriton* species. Streambank models included buffer treatment, survey area, stream width, pre-treatment count, and no. days post-treatment. Instream models also included survey method, hand sampling or electrofishing. Along banks, pre-treatment counts alone were adequate to explain variation in amphibian numbers, but there was support for a negative effect of the narrowest buffer for all groups analyzed except *P. vehiculum*. For all species groups analyzed instream, more complex relationships resulted, with important covariates including pre-treatment counts, stream width, and buffers. Decreasing counts over time in reaches with the narrowest buffer were evident.

32. Aquatic-terrestrial Connectivity Designs in Forests: Funnels and Chains Across Landscapes. Deanna H Olson, Kelly M Burnett, *USDA Forest Service, Pacific Northwest Research station, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us.*

We further develop a managed forest landscape connectivity design that targets headwater streams to create a web of connection across the landscape, likely benefiting numerous forest-dependent species. In managed forests, stream-riparian management zones are used as foraging, breeding, and dispersal habitat by a wide variety of species with both aquatic and terrestrial affiliations. Overland dispersal of organisms between watersheds serves to connect populations of many taxonomic groups among basins across forested landscapes. Small streams and their associated riparian areas are useful points within a landscape for linking basins across ridgelines because such headwaters are frequent and are in relatively close proximity to adjacent drainages. Riparian management designs that serve to "funnel" organisms to headwater areas where "chains" of habitat across ridgelines are provided may aid landscape-scale population connectivity. Landscape management considerations for placement of headwater linkage areas include: 1) targeting connections at landscape nodes where three discrete watersheds ("triads") join; 2) maintaining north-south, east-west, and elevational habitat connectivity in the face of climate change; 3) incorporation of place-based disturbance regimes such as headwater debris-flow-prone areas; 4) targeting connectivity areas to address sensitive species conservation strongholds; and 5) geometric considerations at the forest-stand scale of a single project or proposed timber sale, including managing habitats to connect adjacent forest ownerships, such as to connect corners of checkerboard landscape blocks along diagonals. At finer spatial scales, management approaches for habitat "funnels" along riparian zones and "chains" across ridgelines include retention or restoration of forest structural components and green tree retention.

33. White Nose Syndrome Update and What It Means to the Pacific Northwest. Patricia C. Ormsbee, *Willamette National Forest, USDA Forest Service, 3106 Pierce Parkway, Suite D, Springfield, Oregon 97477; pormsbee@fs.fed.us;* Tom J. Rodhouse, *Upper Columbia Basin Network I&M Program, National Park Service, 63095 Deschutes Market Rd. Bend, Oregon 97701; Tom_Rodhouse@nps.gov*

White Nose Syndrome (WNS) continues to devastate populations of hibernating bats in the eastern U.S. and Canada. New data has shed light on the origin of *Geomyces destructans*, the fungus responsible for WNS, and on the level of mortality it has caused. There is no foreseen "cure" for WNS, and mortality levels have triggered species status reviews by the US Fish and Wildlife Service as a precursor to potential federal listing for several bat species most affected by WNS. One of these species, the Little Brown Bat (*Myotis lucifugus*), also occurs in the Pacific Northwest, and recent data analysis indicates a stable population in the region. State and federal agencies have initiated a collaborative effort to prepare as best we can for WNS to reduce the potential for a new WNS epicenter, prioritize were to focus management efforts, and how to respond should WNS arrive in the Pacific Northwest.

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34. Creating Shallow Water Off-channel Habitat in the Duwamish River: Techniques and First- Year Fish Use. Elissa Ostergaard, *King County Department of Natural Resources, Water and Land Resources Division, 201 S. Jackson Street, Suite 600, Seattle,WA 98104; elissa.ostergaard@kingcounty.gov*

The Duwamish River flows into Puget Sound near downtown Seattle, and is the most urbanized river in Washington state. Rearing habitat is limited for threatened Chinook Salmon (*Oncorhynchus tshawytscha*) in the Duwamish River transition zone, where smolts spend several months during their migration from freshwater to saltwater. Limited opportunities for restoration exist in the transition zone. The North Wind's Weir project was completed in 2010, and involved removing contaminated sediment and other fill dirt to create almost 2 acres (0.8 ha) of mud flats. Invasive plants were removed from the banks, which were then planted with native trees and shrubs. Emergent marsh vegetation was planted and protected with fences to exclude geese. Large logs were anchored in place to provide cover for small fish. First-year fish and invertebrate sampling showed diverse fish use and limited invertebrate colonization. First-year salmonid diversity was comparable with that of first-year salmonids at older nearby habitat restoration projects.

35. Movement Patterns and Home Range Estimates of Western Toads (*Anaxyrus boreas*) Near Snoqualmie Pass, Washington. Amber F Palmeri-Miles, Jason T Irwin, *Central Washington University, 400 East University Way, Ellensburg, WA 98926; palmeria@cwu.edu*.

Western Toads (*Anaxyrus [= Bufo] boreas*) are good candidates for anuran movement studies because they migrate among breeding sites, summer foraging ranges, and overwintering sites, and travel long distances relative to their size. We used radio telemetry to describe movement patterns and estimate home range size of Western Toads near Snoqualmie Pass, WA. We tracked twenty-five toads for various durations from 9 July 2009 to 15 July 2011 (x = 160 days, range: 20-383). Toads were outfitted with radio transmitters (BD-2N or BD-2T, Holohil Inc.) mounted on polyethylene tubing waist belts. Each toad was tracked 1-3 times per week until they reached an overwintering site; tracking resumed the following spring. Once a toad was located, GPS location and habitat data were collected. Western Toads show great capacity for movement (e.g., >3.5 km in a week). These toads use a wide variety of habitats varying from swamps to man-made structures and roadside ditches. We observed strong seasonal and annual site fidelity, with multiple toads revisiting sites which they had previously occupied. Data from ten toads tracked from summer range to overwintering or longer were used for minimum home range analysis. Estimates of Western Toads' home ranges were 0.002-1.346 km^2 (x = 0.23, SE = 0.13). We did not observe a correlation between home range size and mass (r^2 = 0.016, p = 0.73). Due to Western Toads' capacity for movement and strong site fidelity, studies of their movement patterns should be incorporated into management decisions in hopes of better protecting this species.

36. Habitat Restoration and Oregon Spotted Frogs (*Rana pretiosa*) in the Klamath Basin, Oregon. Christopher A Pearl, Michael J Adams, *US Geological Survey Forest & Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis OR 97331; Christopher_Pearl@usgs.gov; Michael_Adams@usgs.gov*

Oregon Spotted Frogs (*Rana pretiosa*) have declined in much of their range. Information is needed on the potential for habitat restoration to bolster populations. We worked with a private landowner to monitor a reintroduced population of *R. pretiosa* after riparian restoration along Crane Creek, near Fort Klamath, Oregon. We released 84 marked frogs into constructed ponds at the upstream end of the system in October 2007. Breeding counts over a 1-kilometer core reach from 2008-2011 were 18, 13, 7, and 17 *R. pretiosa* egg masses, respectively. Habitats used for breeding over those years shifted from being along the cold creek to warmer constructed ponds. We detected few juveniles (<10) in the first year post-restoration (2008); we found 60 - 200 juveniles in the following 3 years. Adult frogs have broadened their distribution across the study area, with several frogs moving about 1 km from their introduction site. At least 23 of the founding frogs were recaptured in years after the reintroduction. An invasion by Bullfrogs (*Lithobates catesbeianus*) in 2010 complicates prediction of future status of *R. pretiosa* at this site, but there is opportunity to remove this cohort. We review implications of our findings for other restoration projects, particularly how an amphibian associated with warmer waters can be accommodated in a cold, spring-driven system.

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37. An Integrated Decision Modeling Approach for Estimating the Response of Mussel Populations to Hydrologic Alteration in the Southeastern US. James T Peterson, *US Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit, 104 Nash Hall, Oregon State University, Corvallis, OR 97331; jt.peterson@oregonstate.edu;* Colin P Shea, *Tennessee Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN 38505; cshea@tntech.edu.*

The southeastern United States has experienced severe, recurrent drought, rapid human population growth, and increasing agricultural irrigation during recent decades, resulting in greater demand for its water resources. During the same time period, freshwater mussels in the Region have experienced substantial declines. This pattern is typified by the Apalachicola, Chattahoochee, and Flint (ACF) river basins, where demand for water from ever growing of the Atlanta Metropolitan Area and increased agricultural irrigation in the Coastal Plain has altered streamflows throughout the basin. We developed a landscape-scale approach to predict the effects of flow alteration and stream fragmentation on the distribution and persistence of freshwater mussels. The approach models the dynamics of mussel populations in individual stream segments using empirical estimates of meta-demographic rates (colonization, extinction, reproduction). The ecological models were linked to hydrologic models to predict the persistence of mussel species under current and future water use. Evaluation of model performance under current water use indicated that the accuracy of mussel distribution estimates was strongly influenced by the assumptions about host fish population dynamics and the mechanisms influencing mussel recruitment. While it is clear that seasonal streamflows and water quality affect mussel populations, remaining uncertainty about biological dynamics make it difficult to predict with certainty the effects of water management decisions. Thus, we developed an adaptive framework, where targeted monitoring is used to iteratively improve our understanding of the ecological mechanisms.

38. Evaluating Watershed Condition: Development of a Robust Framework for Monitoring Fisheries Sensitive Watersheds. Darcy Pickard, Marc Porter, Katherine Wieckowski, Simon Casley, *ESSA Technologies Ltd., 600 - 2695 Granville St. Vancouver, BC, Canada V6H 3H4.* Lars Reese-Hansen, Richard Thompson, *BC Ministry of Forests, Lands, and Natural Resource Operations, PO Box 9338, Stn Prov Govt Victoria, BC, V8W 9M1. Derek Tripp, 105-44 Anderton Avenue, Courtenay, BC, V9N 2G8.*

Values associated with fish and their habitat can be recognized in British Columbia through the designation of "fisheries sensitive watersheds" (FSW) under the Forest and Range Practices Act's Government Actions Regulation (and the Oil and Gas Activities Act's Environmental Protection and Management Regulation). A FSW designation requires the respective sectors to operate such that they do not adversely impact aquatic habitat values necessary to fish. Assessing watershed condition, and understanding the effectiveness of watershed designations under these regulations, is critical to the future management and maintenance of key values hosted in these watersheds. Watershed condition depends on the interaction of processes in the upslope, riparian, and stream channel subsystems. We use a combination of remote-sensed and field data to evaluate these three subsystems within a watershed. Repeatable rapid biological assessment protocols were developed to collect key field data at a broad spatial scale with limited budgets. A pilot sampling design and associated data collection were undertaken within candidate FSW's in the Skeena Region's Lakelse drainage in 2010-2011. Monitoring designs, sampling strata, sampling protocols and analytical methods evaluated as part of this project are intended to lead towards completion of a standardized methodology of both remote-sensed (GIS) and field-based monitoring of watershed condition for application to FSWs (and other similar high value watersheds) across the province.

40. Distribution and Abundance of Red Tree Voles on the Clatsop and Tillamook State Forests in Northwest Oregon. Amy L Price, Jason S Mowdy, Jim K Swingle, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; a__price@hotmail.com;* Eric D Forsman, *USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331; eforsman@fs.fed.us.*

The US Fish and Wildlife Service recently concluded that the Red Tree Vole (*Arborimus longicaudus*) warrants listing as a Threatened species in the northern part of its range in Oregon. However, there is little information on the actual abundance of the species on most of the state and private lands in northwest Oregon. In October 2011, we initiated a survey of Red Tree Voles on randomly selected sites on state lands on the Clatsop and Tillamook State Forests in northwest Oregon. As of January 2012 we completed

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surveys on 34 randomly selected plots and found evidence of Tree Voles at only one plot, which was in a mature forest (127 yrs old) near Tillamook. To date, our survey suggests that Tree Voles are largely absent from most of the Clatsop and Tillamook State Forests except for small isolated populations in relict forests that were not burned or harvested in the early to mid-1900s. We hope to survey at least another 40 random plots on the study area before concluding the study in 2013.

41. Wolverine Distribution and Ecology in the North Cascades Ecosystem: Preliminary Results. Catherine M Raley, Keith B Aubry, *US Forest Service, Pacific Northwest Research Station, Olympia, WA 98512; craley@fs.fed.us*; John J Rohrer, *US Forest Service, Okanogan-Wenatchee National Forest, Methow Valley Ranger District, Winthrop, WA 98862*; Eric C Lofroth, *British Columbia Ministry of Environment, Victoria, BC V8W9M1*; Scott H Fitkin, *Washington Department of Fish and Wildlife, Winthrop, WA 98862*.

The Wolverine (*Gulo gulo*) is one of the rarest and least-known mammals in North America and, in 2010, the U.S. Fish and Wildlife Service designated the Wolverine as a candidate species for listing under the Endangered Species Act within the contiguous U.S. Given this decision and perceived threats to the Wolverine's primary habitat from global warming, the distribution and ecology of Wolverines in the North Cascades ecosystem is critically important for informing rangewide conservation efforts. To develop a reliable understanding of the Wolverine's distribution, genetic affinities, and habitat ecology in this region, we initiated a satellite-based telemetry study in the North Cascades of Washington in 2006 and then expanded our study area into southern British Columbia in 2009. To date, we have captured 9 Wolverines and outfitted 8 of them (6 females and 2 males) with satellite collars. We have documented the presence of 2 additional animals in our study area using run-pole remote camera stations designed to obtain individually diagnostic photos of Wolverine throat and chest blazes. Activity areas (100% MCP of locations during any single monitoring period of 3 to 8 months) were 536–1,968 km^2 for females and 1,150–2,991 km^2 for males. Genetic analyses revealed that our study animals have mitochondrial DNA haplotype C, and are genetically distinct from those occurring elsewhere in the western United States. Thus, it appears that the North Cascades Wolverine population is connected geographically with Wolverine populations in Canada, rather than those in the northern Rocky Mountains of Idaho, Montana, or Wyoming.

4**2. Models of Army Cutworm Moth and Grizzly Bear Habitat in the Greater Yellowstone Ecosystem and Investigations of Phenology Using Remotely Sensed Data.** Hillary L Robison, Peter F Brussard, *Program in Ecology, Evolution, and Conservation Biology, Mailstop 314, University of Nevada, Reno, Reno, NV 89557; hillaryrobison@gmail.com, brussard@biodiversity.unr.edu*; Charles C. Schwartz, *US Geological Survey, Northern Rocky Mountain Science Center, Interagency Grizzly Bear Study Team, 2327 University Way, Suite 2, Bozeman, MT 59715; chuck_schwartz@usgs.gov.*

Army Cutworm Moths (*Euxoa auxiliaris*) are an important food for Grizzly Bears (*Ursus arctos horribilis*) in the Greater Yellowstone Ecosystem (GYE). The moths migrate from low elevations in the Great Plains and Intermountain West to high elevations in the GYE where they aggregate in talus and are consumed in the millions by bears from July through September. Moths are the only major bear food in the GYE for which there is no method to monitor its availability to bears. Moth sites are scattered in wilderness and no model exists to inform where sites may occur. Additionally, in years when deep snow accumulates, the moths' talus and meadow habitat may remain covered in snow and be unsuitable. Our objectives were to model moth and bear habitat and phenology at these sites. First we used GLMs to model the characteristics of moth sites used by bears (n = 301) and of available sites (n = 1000). We considered 18 variables in four different models and refined them using stepwise AIC. We conducted cross-validation, evaluated model fit, and mapped the models using ArcGIS. Second, we combined environmental and climate data with remotely sensed AVHRR data to model phenology (i.e., green-up) in high elevations. We analyzed data using ERDAS Imagine, ArcGIS, and multiple linear regression. The best habitat model showed that elevation, geology, and Landsat imagery describe areas moths and bears use and predict areas bears may search for moths. The results of the best phenology model predicted green-up with respect to biweekly mean temperature and biweekly precipitation. The model explained 53% of the variation in these data, which is on par with other similarly-scaled studies.

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43. Conservation Kaleidoscope: 2012 - Year of the Lizard. Kathryn L. Ronnenberg, Deanna H. Olson, *US Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; kronnenberg@fs.fed.us; dedeolson@fs.fed.us;* Priya Nanjappa, *Association of Fish and Wildlife Agencies, Washington, DC*; Terry Z. Riley, *Partners in Amphibian and Reptile Conservation, Fort Collins, CO*; Alvin R. Breisch, *Partners in Amphibian and Reptile Conservation, Altamont, NY*; Teal Richards-Dimitrie, *Humboldt State University Sponsored Programs, Arcata, CA 95521*; David Dimitrie, *Green Diamond Resource Company, Korbel, CA 95550*.

In an era of sound bites, instant communication, and short public attention spans, how can we encourage a focus on the long-term goals of species and habitat conservation? The ongoing, herpetofauna-oriented 'Year of…' campaigns, beginning with the international Year of the Frog in 2008, and continuing with the Year of the Turtle (2011), now the Year of the Lizard (2012), and the planned Year of the Snake (2013) present a rotating image of herpetological conservation, one taxon at a time. Focusing on a single, annually-changing taxon piques public interest and allows partner organizations to grapple with and market one set of topics. Each year involves different partners and reaches out to different publics. Scientifically, it allows the campaign to emphasize taxon-specific issues. For instance, Year of the Turtle had a heavy emphasis on conservation and trade issues; Year of the Lizard has a stronger emphasis on research and education; and Year of the Snake likely will be even more closely focused on education. Highlights of the Year of the Lizard can be found at www.yearofthelizard.org, and include bimonthly newsletters, photo contest and associated monthly calendar, State of the Lizard report, and more.

44. Exploring the Management Paradox in Multi-invader Communities. Jennifer C Rowe, Tiffany S Garcia, *Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331; jennifer.rowe@oregonstate.edu*.

Novel interactions that arise within multi-species invaded communities present a unique challenge to management. Oregon wetlands are heavily altered by aggressive invasives, including Reed Canarygrass (*Phalaris arundinacea*) and the American Bullfrog (*Lithobates catesbeianus*). Native amphibians are threatened by the Bullfrog, a competitor and predator that is tolerant of bare-ground habitats, but use Reed Canarygrass for oviposition substrate and protective cover. Reed Canarygrass eradication could therefore negatively affect native amphibians (1) directly, by reducing vegetative cover, and (2) indirectly, by facilitating Bullfrog invasion. To explore these mechanisms, we documented amphibian biodiversity and vegetative cover at 29 Willamette Valley sites enrolled in the Wetlands Reserve Program. Preliminary results suggest a caveat to our original prediction; Bullfrogs occurred at a greater proportion of sites infested with Reed Canarygrass (Pearson chi-squared = 2.57; P = 0.11), while threatened Red-Legged Frog (*Rana aurora*) abundance was lower at these sites (Two-sample t-test; t = 2.056; P = 0.049). Model selection using Akaike Information Criterion indicated that the presence of non-native fish is a strong predictor of both Bullfrog and native anuran abundance. Native Pacific Chorus Frogs (*Pseudacris regilla*) and Red Legged Frogs were negatively associated with non-native fish (Welch's t-test; t = 4.58; P < 0.001 and t = 1.91; P = 0.07, respectively), whereas invasive Bullfrogs were positively associated (t = 2.75, P = 0.01). This study elucidates the synergistic stressors placed on native amphibians in invaded habitats and emphasizes the importance of holistic approaches to invasive species control, as interaction outcomes between multiple invaders are difficult to predict.

45. Nocturnality in Black-tailed Deer as a Response to Human Disturbance. Christopher Russell, *4422 76th Street SW Mukilteo, WA 98275; chris.r07@gmail.com*.

Human disturbance is a selective pressure creating profound effects on the behavior of many species of wildlife. Ungulates experience high levels of human interactions both with urbanized habitats and the implementation of hunting seasons. I hypothesized that a transition from being primarily diurnal to nocturnal would be observed in the Columbia Black-tailed Deer (*Odocoileus hemionus columbianus*) in response to increased amounts of vehicular traffic. Remote cameras coupled with observation work were used in the data collection process to assess if more nocturnal activity occurred along high activity roadways. Disturbance categories were categorized as low, medium, and high with observational data showing more nocturnality in low disturbance areas. Camera data showed no significant differences between diurnal and nocturnal activity along the disturbance categories. The two sets of data collected resulted in different trends, but both show some implications of the effects of disturbance on wildlife behavior.

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46. Disturbance Regimes, Competing Objectives, and the Limits to Science: Using Stochastic Simulation to Support Carnivore Management. Robert M Scheller, *Portland State University, Department of Environmental Sciences and Management, PO Box 751, Portland, OR 97207; rmschell@pdx.edu*.

Disturbances may affect the management of carnivore populations, particularly if their habitat needs are specialized or their habitat fragmented. Wildfire, insect outbreaks, harvesting, and fuels management can all reduce habitat quality for carnivores and further fragment available habitat. Climate change could exacerbate these effects if the risk of large or severe disturbances increases. I will present a case study from the Sierra Nevada of California, where crown-replacing wildfires threaten Fisher (*Martes pennanti*) habitat over broad areas. Proposals to thin vegetation to reduce wildfire risks have been controversial because fuel treatments would also adversely affect Fisher populations but may provide protection from the most severe fires. Simultaneously, climate change may increase the risk of wildfire to Fisher habitat. The effects of wildfires and fuels management on Fisher habitat and population size were simulated using multiple models. The simulated immediate negative effects of fuel treatments were compared to the longer-term positive effect of fuel treatment. Results indicated that the positive effects of fuel treatments on Fisher populations are generally larger than their negative effects, because fuels treatments reduced the probability of large wildfires. Analysis of such trade-offs are increasingly imperative as management seeks to optimize multiple goals (e.g., maintain habitat, reduce fire risk, produce timber) and is simultaneously constrained by the risk of large climate change effects. However, there was large uncertainty in our projections due to stochastic disturbances and population dynamics, demonstrating the difficulty of projecting carnivore populations in systems characterized by large, infrequent, stochastic disturbances.

47. Distribution, Population Status and Conservation of Mussels in the Upper Columbia and Missouri River Basins of Montana: New Findings and Updates since 2010. David M Stagliano, *Montana Natural Heritage Program, 1515 East 6th Avenue, Helena, MT 59620; dstagliano@mt.gov*.

Three years of SWG-funded, state-wide mussel surveys (2007-2010) has greatly expanded our knowledge of the distribution and population status of the six mussel species occurring in Montana; three natives (Western Pearlshell, *Margaritifera falcata*; Fatmucket, *Lampsilis siliquoidea*; and Giant Floater, *Anodonta grandis*) and three introduced species (Black Sandshell, *Ligumia recta*; Mapleleaf (*Quadrula quadrula*); and Creek Heelsplitter, *Lasmigona compressa*). We compiled survey and historical information into a database of >1330 mussel sites from 94 of the 100 4th-code watersheds in the state. Due to this work, significant range reductions and the poor viability of many Western Pearlshell populations were documented and this species was added to the MT species of concern list in 2008, and became a USFS Region One sensitive species in 2011. During these initial stratified surveys, reaches were chosen opportunistically based on accessibility, previous mussel sightings and suitable mussel habitat. Aquascopes were used for shallow water transects, while SCUBA was used for deeper water (>1 m). Mussel data recorded were standardized by time (CPUE, man-hour) and distance (mussels per 50 m). Rivers with excellent populations of native mussels include the Wild and Scenic stretch of the Missouri River, the Marias River, the Clearwater River and smaller tributaries to the Big Hole, Beaverhead, Clark Fork and Kootenai Rivers. We documented the first records of the Giant Floater in the Yellowstone River Basin at three tributary sites, but no evidence in the mainstem. Likewise, the introduced Mapleleaf has high densities in the Tongue River, but was not found live in Yellowstone River. Since 2010, we have been strategically surveying and determining viability of new populations of Western Pearlshells. We will present case studies from our newest research projects focusing on population analysis, USFS biological evaluations, host fish relationships and translocations of the Western Pearlshell.

48. Current Status of Wolf Recovery in Oregon and Washington. John Stephenson, *US Fish and Wildlife Service, La Grande Field Office, La Grande, OR 97850; John_stephenson@fws.gov*.

In the mid-1990s, the U.S. Fish and Wildlife Service reintroduced Gray Wolves (*Canis lupus*) to central Idaho and Yellowstone National Park as part of an effort to recover a wolf population in the northern Rocky Mountains. The wolf population in that area grew rapidly and has now expanded into eastern Washington and Oregon. I will provide an update on the status of wolf recovery in the Pacific Northwest, where things stand today, how we got here, and what to expect in the coming years.

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49. Habitat and Distribution of Tree Voles Based on Multiple Sources of Data. James K Swingle, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; jimmy.swingle@gmail.com*; Eric D Forsman, *USDA Forest Service, Pacific Northwest Research Station, Corvallis Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331; eforsman@fs.fed.us*; Brian L Biswell, *USDA Forest Service, Pacific Northwest Research Station, Olympia Forestry Sciences Laboratory, 3625 93rd Ave. SW, Olympia, WA 98512; bbiswell@fs.fed.us*.

We used data from many different sources (museum specimens, notes from field naturalists, owl pellets, and surveys by federal agencies, state agencies, and our own field surveys) to describe the distribution, habitat associations, and relative abundance of Red Tree Voles (*Arborimus longicaudus*). In Oregon, Red Tree Voles were most abundant in the west-central Cascades and the central and southern Coast Ranges and were relatively uncommon in the north Coast Ranges and north Cascades. Densities of tree vole nests indicated that, even in areas where they were most abundant, they occurred at low densities compared to other Microtines. In the north Coast Ranges, voles were mostly restricted to remnant stands of old forest, mostly in state parks. Tree Voles were rare above 1400 m elevation. In California north of the Klamath River, Red Tree Voles occurred in Del Norte and Humboldt Counties, and the western edge of Siskiyou County. In the majority of their range, Tree Voles fed primarily on Douglas-fir (*Pseudotsuga menziesii*) but in the northern portion of the Sitka Spruce (*Picea sitchensis*) zone they fed almost exclusively on Sitka Spruce and Western Hemlock (*Tsuga heterophylla*). Sex ratios and habitat associations in samples of collected specimens were biased by the method of capture. Tree climbers collected a disproportionate number of females whereas voles captured in pitfall traps were mostly males, and voles captured by loggers had an approximately equal sex ratio. Tree climbers captured voles primarily in young forest whereas loggers and pitfall traps captured more voles in old forest.

50. Elevational Differences in UV-B Response by the Long-toed Salamander (*Ambystoma macrodactylum*). Lindsey L Thurman, Tiffany S. Garcia, *Oregon State University Dept. of Fisheries and Wildlife, 104 Nash Hall, Corvallis, OR 97333; lindsey.thurman@oregonstate.edu*.

Freshwater ecosystems provide important ecological services, yet are disproportionately susceptible to environmental stressors including contaminants, hydroperiod alteration, and increasing levels of ultraviolet-B (UV-B) radiation. Amphibian species differ considerably in their resistance to UV-B damage, thus it is expected that variation also occurs between populations of a single species. High-elevation populations of the Long-toed Salamander (*Ambystoma macrodactylum*) can be exposed to 20 times the UV-B radiation exposure levels relative to low-elevation populations. We compared the behavioral and physiological defense mechanisms for combating UV-B radiation in high and low elevation populations to determine differences in UV-B response along an elevational gradient. We first explored the oviposition behaviors of salamanders from 6 populations in the Cascade Range and Willamette Valley of Oregon. Examination of oviposition site choice revealed that females at high-elevation sites have modified their oviposition behavior to effectively reduce embryonic UV-B exposure to levels similar to their low-elevation counterparts (Welch's t-test; $t = 2.16$, $p < 0.05$). In addition, we examined population differences in photolyase activity, a photoreactive enzyme that repairs UV-B induced damage to cellular DNA. Photolyase levels were compared between high and low elevation populations to determine if embryonic Long-toed Salamanders at high elevation have employed a compensatory physiological response to elevated UV-B exposure levels. Together, these studies provide a diverse assessment of characteristics that have allowed Long-toed Salamanders to cope with increasing UV-B radiation and persist in stressful montane environments.

52. Aspects of the Ecology and Life History of the Ring-neck Snake (*Diadophis punctatus*) in Washington State. Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926; weaverro@cwu.edu*.

In the Pacific Northwest, the Ring-neck Snake (*Diadophis punctatus*) is found primarily in western Oregon and along the eastern slopes of the Cascades. Disjunct populations persist in southeastern Washington, adjacent Oregon, into central and southeastern Idaho. In Washington State it is more common within the Columbia River Gorge of Skamania and Klickitat Counties and increasingly less abundant as you move northward into Yakima and Kittitas Counties. Within this range it is associated with Oregon White Oak (*Quercus garryana*) savannah, as well as transitional zones of Big Sagebrush (*Artemesia tridentata*) and Douglas-fir (*Pseudotsuga menziesii*) and Ponderosa Pine (*Pinus ponderosa*) forest.

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For this study, snakes were collected by hand (and road-cruising) from 2003-2011. During this time, 152 individuals of *D. punctatus* were observed active on the surface during 0900-1800 hrs (or under cover objects) at temperatures usually below 25.0°C, from April to early October, with no snakes found at night. In terms of diet, juveniles fed on invertebrates, while the largest females fed on snakes (*Thamnophis* spp., *Hypsiglena chlorophaea*, and *Contia tenuis*). In the southern portion of its range in Klickitat County in terms of relative abundance, one snake was encountered for every 4.6 hrs of searching. In Yakima and Kittitas Counties, snakes were encountered once every 11.2 hrs. While *D. punctatus* is considered secure and not threatened, outside of the Columbia River Gorge it appears to be one of the rarer snakes in Washington State. In some areas, habitat destruction and road-mortality may impact populations and should be further evaluated.

53. Recent Observations of the California Mountain Kingsnake (*Lampropeltis zonata*) in Washington State. Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926; weaverro@cwu.edu*.

The California Mountain Kingsnake (*Lampropeltis zonata*) is found from Baja California, Mexico north into California and southwestern Oregon. It reaches its northern-most distribution within the Columbia River Gorge National Scenic Area of Skamania and Klickitat Counties, Washington State. In Washington State it is closely associated with Oregon White Oak (*Quercus garryana*) Savannah, and open Douglas-fir (*Pseudotsuga menziesii*) and Ponderosa pine (*Pinus ponderosa*) forest. While it may be locally abundant in California, the secretive nature of *L. zonata* has resulted in few observations in Washington State, and this species is considered critically imperiled and vulnerable to extinction. While surveying for other species of snakes in the Columbia River Gorge, individuals of *L. zonata* were occasionally encountered. For most observations I recorded the time of day (or night), air and substrate temperatures, and GPS position of snakes. Live snakes were not disturbed or handled (except to remove off the road). However, dead-on-road (DOR) snakes were collected and analyzed for both stomach content and reproductive condition. Since 2006, nearly 30 individuals of *L. zonata* have been observed, or reported to me. While all observations have been recorded within the known range of *L. zonata*, this increase in the number of observations leads me to believe this species is far more abundant than previously thought. Additionally, the relative ease of finding individuals while road-cruising may allow for the first ecological study of *L. zonata* in Washington State, and such data will aid in management decisions and the conservation of this species.

54. Pre-construction and Construction Monitoring of Vertebrates Along the I-90 Snoqualmie Pass Corridor: a Multi-taxa Approach to Investigating Patterns of Movement and Highway Permeability. Steve Wagner, Kristina Ernest, Daniel Beck, Paul James, *Department of Biological Sciences, Central Washington University, 400 E. University Way, Ellensburg, WA 98926; wagners@cwu.edu*.

The I-90 Snoqualmie East project attempts to accommodate highway permeability by incorporating crossing structures for use by multiple taxa. In order to provide a baseline to assess the effectiveness of structures, guide structure design aspects (e.g., microhabitat), and mitigate for construction impacts, we have been monitoring movement of low-mobility species (defined as those with relatively small daily movements and home ranges, low dispersal capability, or restrictive habitat requirements) within highway corridor. Our focal taxa included fish (trout and salmon), amphibians (frogs, toads, salamanders), reptiles (alligator lizards, *Elgaria* spp.), and small mammals (Pikas, *Ochotona princeps*). We used a variety of techniques to capture, mark, and track individuals, assess habitat, and collect genetic tissue samples. Our results suggest the patterns of movement and crossing structure habitat use varies greatly among taxa. The highway is permeable to some amphibians but not all, we have detections of Cascades Frogs (*Rana cascadae*) using below-grade structures for movement to either side of highway but not for Western Toads (*Anaxyrus boreas*). Fish crossing seems to more stream-dependent than species-influenced. More terrestrial species, Pikas and alligator lizards, were not documented to cross the highway but both use adjacent habitat. Overall connectivity for low mobility species has not been completely interrupted by the interstate, but crossings seem to be infrequent depending on taxon.

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55. Population Responses of Herpetofauna to the Managed Flow Regime and Altered Riverine Environments of the Trinity River, Northwest California. Hartwell H Welsh, Jr., Donald T Ashton, *US Forest Service, Pacific Southwest Research Station, 1700 Bayview Dr., Arcata, CA 95521; hwelsh@fs.fed.us; ashton.don@gmail.com*; James R Bettaso, *US Fish and Wildlife Service, East Lansing Field Office, 2951 Coolidge Road, Suite 101, E. Lansing, MI 48823; James_Bettaso@fws.gov*.

Research on herpetofauna in the Trinity River of northwest California has been a focus of work at the Forest Service's Pacific Southwest Research Station since the 1990s. A dam was installed on the mainstem Trinity in 1963, with hypolimnetic (cold water) flows from this dam increased in 2000 by the Secretary of the Interior. Our long-term efforts in this system have enabled us to document changes in distributions, behaviors, and demographic parameters of several species that would likely go un-noticed if this research were conducted over a shorter time span. We review evidence of repeated cohort collapses and shifting patterns of development and metamorphosis in the Foothill Yellow-legged Frog (*Rana boylii*) on the mainstem Trinity. On the dammed and regulated mainstem, the Western Pond Turtle (*Actinemys marmorata*) exhibits thermoregulatory behavior and growth characteristics that differ dramatically from turtles on the undammed south fork; data that suggests the strong possibility of future impacts on population fitness in the altered thermal regime. The Bullfrog (*Lithobates catesbeianus*) has invaded and expanded below the Trinity Dam, where it breeds in relict mine tailing ponds and other permanent lentic water bodies that exist over a forty-mile stretch downriver of the dam. The distribution and abundance of this non-native predator correlates with declines in the mean number of native amphibian species along this same reach. Independent surveys conducted in 1990 and repeated in 2003 also indicate declines in amphibian and reptile species richness and relative abundances that are consistent with this downward trend.

56. Thinning Effects and Long-term Management Strategies for Spotted Owl Prey and other Forest-Dwelling Small Mammals. Todd M Wilson, Eric D Forsman, *US Forest Service, Pacific Northwest Research Station, 3200 Southwest Jefferson Way, Corvallis OR 97331; twilson@fs.fed.us*.

Thinning has become the tool of choice for creating late-seral habitat and improving the overall health and function of forests in the Pacific Northwest. Most forest-floor small mammals have shown early and positive responses to thinning. In contrast, thinning generally reduces abundances of arboreal rodents, including two major prey species of Northern Spotted Owls (*Strix occidentalis caurina*)—Northern Flying Squirrels (*Glaucomys sabrinus*) and Red Tree Voles (*Arborimus longicaudus*). This decline in abundance is hypothesized to be the result of reduced protection from predators (Flying Squirrels) or a combination of reduced protection, lack of canopy connectivity and fewer nest substrates (Red Tree Voles). The long-term benefits of some thinning treatments appear positive for arboreal rodents, but may not be realized for several decades or more. Site-specific management strategies to reduce negative short-term effects on arboreal rodent populations include (1) extra emphasis on accelerating mid-story regeneration following thinning; (2) designing thinning prescriptions that retain protective cover, connectivity, and nest substrates; and (3) creating defensible buffers to protect forests at high risk of catastrophic disturbance. Ultimately, a regional strategy for thinning may be needed to ensure that the current ecological role played by arboreal rodents continues as we transition towards having more forests with late-seral characteristics on the landscape. Empirical models are currently being built and tested for both Flying Squirrels and Red Tree Voles that may assist with such a strategy.

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Juan de Fuca Trail, west coast of Vancouver Island.
Photo by Kim Walters

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Conservation Genetics of the Native Cascade Red Fox (*Vulpes vulpes cascadensis*) in Southern Washington: Preliminary Results. Jocelyn Akins, Mark Statham, Ben Sacks, *Canid Diversity and Conservation Laboratory, One Shield Ave, University of California, Davis, CA 95616; jakins@ucdavis.edu*; Mason Reid, *Mt Rainer National Park, 55210 238th Ave E, Ashford, WA 98304*; Keith Aubry, *Pacific Northwest Research Station, United States Department of Agriculture Forest Service, 3625 93rd Ave. SW, Olympia, WA 98512*.

Climate change threatens biodiversity worldwide but especially in montane biomes where sensitive ecotypes occur. The Cascade Red Fox (*Vulpes vulpes cascadensis*) is one of 3 montane subspecies that are an evolutionarily divergent group, descended from the oldest lineage of North American red foxes. It represents a unique lineage within the montane group, as its own subspecies and restricted to the upper montane, subalpine and alpine zones of the Washington Cascade Range. Climate change appears to be the driver of precipitous declines in its distribution and abundance, as may be the case with the Sierra Nevada Red Fox (*V. v. necator*), Wolverine (*Gulo gulo*), and Pika (*Ochotona princeps*). Proximate threats that accompany climate, including habitat loss and encroachment by predators and competitors, both of which can result in small population size and genetic isolation and lead to loss of genetic diversity and an increase of inbreeding, may be causing the decline of this unique fox. We are currently surveying populations in southern Washington to assess vulnerability and extinction risk, and evaluate potential causes of their decline. Scat, hair, and tissue samples (N = 150) were collected from 2009 to 2011, employing baited camera stations, snow tracking, and trails transects. Samples were preliminarily analyzed using mitochondrial DNA and 14 microsatellite markers. We will present results on distribution, ancestry, genetic diversity, and connectivity. This project will provide a conservation assessment for the subspecies, and help to understand the effects of climate change on alpine and subalpine habitat specialists.

Turtle Mapping Project: Western Pond Turtle (*Actinemys marmorata*) and Painted Turtle (*Chrysemys picta*) in Northwestern North America. Kimberly Barela, *OSU Department of Agriculture and Science, U.S. Forest Service, Pacific Northwest Research Station, and Oregon State University, 3200 SW Jefferson Way, Corvallis, OR 97331; barelak@onid.orst.edu*; Deanna H Olson, *US Forest Service, Pacific Northwest Research Station, and Oregon State University, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us*

Habitat fragmentation is a significant threat to wildlife, especially long-lived animals with low reproductive rates. Freshwater and terrestrial turtles hold an ecological and cultural importance to society. Many species are in danger of becoming extinct due to habitat encroachment, over-exploitation, and general lack of knowledge including information about their geographic distribution. The purpose of our study was to compile turtle localities to contribute to status assessments, with a focus on the Painted Turtle (*Chrysemys picta*) and the Western Pond Turtle (*Actinemys marmorata*) in the northwestern North America. We compiled data from 10 U.S. state and Canadian provincial jurisdictions, consolidated duplicate records, mapped the locality points, assessed discrete locations, and analyzed distribution patterns temporally and spatially. A distribution map depicting Painted Turtle observation dates by decade showed that 1,666 of 1,854 (90%) observation points were recorded in the last 30 yrs. Of these total points, 764 (41%) were located on U.S. federal lands and 29 were in Canadian provinces. To address discrete localities, we applied a 500-m proximity tool, because this distance coincides with known overland dispersal capability. We found 795 points were within 500 m of another point, hence 1,059 discrete points resulted from this criterion. For Western Pond Turtles, we have compiled 3,080 localities, accounting for duplicate points, and additional analyses are ongoing. Our occurrence maps and spatiotemporal patterns can be used to advance new efforts toward northwestern North America turtle conservation and research.

Effects of Introduced Brook Trout (*Salvelinus fontinalis*) on the Distribution of Coastal Tailed Frog Tadpoles (*Ascaphus truei*) in a Headwater Stream, Crater Lake National Park. *Rebekah A Bergkoetter, Department of Biology, Southern Oregon University, Ashland, OR 97520; bergkoetr@students.sou.edu;* David K Hering, *Crater Lake National Park, Crater Lake, OR 97604*; Andrew M. Ray, *US Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT 59715*; Michael S Parker, *Department of Biology, Southern Oregon University, Ashland, OR 97520*.

Non-native Brook Trout (*Salvelinus fontinalis*) have been introduced widely throughout high elevation watersheds of western North America, including historically fishless streams and lakes. In Crater Lake National Park, brook trout are now common in most cold headwater streams. To assess potential negative

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effects of Brook Trout on resident Tailed Frog (*Ascaphus truei*) populations, we measured tadpole densities and size distribution above and below a naturally occurring fish barrier in Trapper Creek, a small first-order stream. Tadpoles were collected during late summer/early autumn using area-constrained searches at three sites above and below the barrier. Tadpole density was significantly lower below the barrier, suggesting a strong negative effect of trout predation. Tadpole length-frequency distributions were also significantly different, with smaller size categories dominating above the barrier. A shift to larger size classes downstream suggests that smaller size classes may be more susceptible to trout predation, and that upstream refuges are important in conserving Tailed Frog populations in Crater Lake NP.

A Mathematical Approach to Predicting Harbor Seal Haul-out. Jonathan D Cowles, *720 SW Evans Ave, College Place, WA 99324; jonathan.cowles@gmail.com*; Shandelle M Henson, *Department of Mathematics, Andrews University, Berrien Springs, MI 49104*; James L Hayward, *Department of Biology, Andrews University, Berrien Springs, MI 49104*.

The Marine Mammal Protection Act mandates abundance estimates of marine mammals which enable managers to maintain optimal population size. Abundance estimates of Harbor Seals (*Phoca vitulina*) are usually conducted via aerial surveys, which are corrected for estimated seals in the water to create a total population estimate. Our study aims to increase the accuracy and repeatability of the surveys by understanding the effect that environmental variables, such as tide, current, solar elevation, and time of day, have on seal haul-out. Data were collected on Protection Island National Wildlife Refuge over two 14-day tidal cycles in July 2010. Hourly seal counts were taken and disturbances that caused seals to flush into the water were recorded. A suite of mathematical models based on different combinations of environmental factors were created and parameterized, with the best model being chosen using information theoretic model selection techniques. The best model was based on tide, current, and time of day and was able to explain >45% of haul-out behavior. Comparison to a previous modeling study revealed that the resulting models are site-specific, as seals respond differently to environmental variables at each haul-out site. While not portable, the model enables future haul-out at a given site to be predicted, allowing managers to time future surveys during periods of similar haul-out. In addition, the models aid in the creation of a local correction factor without the need for telemetry data.

Thermal Regimes and the Distributions and Abundances of Native Bull Trout and Nonnative Brook Trout Prior to Dam Removal in the Elwha River Ecosystem. Jason Dunham, Steven Clark, David Hockman-Wert, Nathan Chelgren, *USGS Forest and Rangeland Ecosystem Science Center, Corvallis, OR 97331*; Sam Brenkman, *Olympic National Park, Port Angeles, WA 98362*; Michael Heck, Robert Hoffman, *USGS Forest and Rangeland Ecosystem Science Center, Corvallis, OR 97331*.

In anticipation of the Elwha River dam removals, we monitored the presence and abundance of fishes with a focus on threatened native Bull Trout (*Salvelinus confluentus*) and nonnative Brook Trout (*Salvelinus fontinalis*). We are interested in understanding how these species influence each other, how they will respond to changes in the river's floodplain and colonization by salmon after more than a century of isolation, and what habitats are most important for these species. Fifty-nine study sites within the system include locations below both dams, between the dams, and upstream of the dams. In 2009 and 2010, we conducted a combination of electrofishing and daytime snorkel surveys to estimate probabilities of detection, presence, and abundance, and modeled relationships between these estimates and habitat conditions and the potential for biotic interactions among species. We also analyzed water temperatures to evaluate their sensitivity to atmospheric versus hydrological influences. Preliminary results suggest that temperatures in larger mainstream and fluvial floodplain channels are less sensitive to atmospheric influences, whereas tributaries are highly sensitive. In contrast to these habitat types, parafluvial floodplain channels show high variability in their sensitivity. The relationship between floodplain habitats and thermal sensitivity, and the influence of temperature on fish has helped us understand the presence and interaction of Bull Trout and Brook Trout in the Elwha River ecosystem, and set the stage for future evaluations of how the river, its thermal regime, and its fish fauna may respond to changes related to dam removal.

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Managing Rare Vertebrate Species on Federal Lands in Oregon and Washington: The Interagency Special Status/Sensitive Species Program. Lara Drizd, Kelli J Van Norman, Robert D Huff, *USDI Bureau of Land Management, Oregon State Office, PO Box 2965, Portland, OR 97208; ldrizd@blm.gov*; Carol S. Hughes, *USDA Forest Service, Region 6, P.O. Box 3623, Portland, OR 97208*.

The Interagency Special Status/Sensitive Species Program (ISSSSP) is a regional level program created in October 2004, covering all USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) lands in Oregon and Washington. The main objective of the FS and BLM sensitive species policies is to avoid actions that lead to loss of species viability or Threatened and Endangered listing under the US Endangered Species Act. There are 96 "Sensitive" vertebrates, not including fish, for which the FS and BLM must assess the potential impacts from any agency action and promote species conservation. There are an additional 12 "Strategic" vertebrate species that could meet agency Sensitive species criteria, but there is some question surrounding the NatureServe rank, taxonomy, or occupancy and habitat status on federal lands, such that management of the species as Sensitive would be difficult or unwarranted. Altogether there are currently 58 bird, 16 amphibian, 4 reptile, and 30 mammal species. To assist agency botanists and managers in evaluating potential project impacts and managing for the conservation of these species, the ISSSSP employs surveys, research, and monitoring, develops conservation planning documents and tools, and coordinates work groups. Over the last seven years, ISSSSP has worked with many partners and funded numerous projects to fill knowledge gaps. These have included inventories to determine species distributions, development of habitat models, population monitoring, genetics and taxonomy, data management, species fact sheets, and conservation assessments, strategies, and agreements. Project results and conservation tools are available from the ISSSSP website - http://www.fs.fed.us/r6/sfpnw/issssp/.

Northern Leopard Frog Recovery in Alberta, Canada: Making Stewardship Part of the Answer. Kris Kendell, *Alberta Conservation Association, 101-9 Chippewa Road, Sherwood Park, Alberta T8A 6J7; kris.kendell@ab-conservation.com*.

Alberta Conservation Association is part of a provincial recovery team for the Northern Leopard Frog (NLF) (*Lithobates pipiens*) in Alberta. The team is guided by Alberta Fish and Wildlife and team members and associated organizations are responsible for implementation of actions and strategies that are outlined in the NLF recovery plan to restore and maintain the species for future generations. Stewardship initiatives have been one of the key actions designed to meet the objectives of the recovery plan. In response to identified habitat threats at select NLF sites, we implemented five stewardship projects, ranging from the installation of solar-powered and gravity-fed cattle watering systems to fencing projects. These projects aimed to mitigate the negative impacts from cattle on important NLF habitat. All sites were managed by landholders that were interested in, and receptive of, the implementation stewardship on their properties. We also developed and installed NLF interpretive signs at an easily reached public NLF site and created a habitat stewardship brochure that presents practices that serve to make agriculture more productive and sustainable, while protecting, enhancing and creating habitat for amphibians. We believe that landholders can play an important role in alleviating habitat threats that affect the NLF in Alberta. Through the implementation of cooperative stewardship agreements and awareness, landholders can improve habitat for the NLF as well as realize economic benefits though improved water quality and increased productivity of their lands.

Field Observations of Breeding Aggregations of Coastal Tailed Frogs in North-western British Columbia. Alexis McEwan, *University of Northern British Columbia, Prince George, BC V2N4Z9*; Melissa A. Todd, *BC Ministry of Forests, Lands and Natural Resource Operations, Coast Area, Nanaimo, BC V9T4R5; Melissa.Todd@gov.bc.ca*; Lis Rach, *TerraNiche Environmental Solutions, Smithers, BC V0J2N1*; Kristal Golob, Chris Johnson, *University of Northern British Columbia, Prince George, BC V2N4Z9*; Doug Steventon, *BC Ministry of Forests, Lands and Natural Resource Operations, Skeena Region, Smithers, BC V0J2N0*.

Reported field observations of breeding Tailed Frogs are limited; most document single pairs in amplexus in flowing headwater streams. We report here on autumn aggregations of breeding and non-breeding frogs in wet micro-sites situated from 10 to 35 metres away from flowing streams. Between October 17 and November 1, 2011, during field work for a study of Coastal Tailed Frog (*Ascaphus truei*) terrestrial habitat requirements in north-western British Columbia, we encountered aggregations of frogs at two study sites located 75 km apart. Both sites were located 70-80 metres upstream of operational forest roads, within 50-m-wide, intact Western Redcedar-Western Hemlock (*Thuja plicata-Tsuga heterophylla*)

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old forest riparian buffers, adjacent to recently clear-cut forest. Thirty-nine (39) individuals were captured in a 9 m^2 area at the Kleanza watershed site, centred 12.8 m from the larval stream on a complex of moss-covered ephemeral channel, Devil's Club (*Oplopanax horridus*) seepage sites, and accumulations of coarse and fine downed woody material. Six (6) amplexing pairs were observed in shallow (<6 cm standing water) seepage sites; 3 pairs were clustered together. Eight (8) individuals were captured in a 6-m^2 area at the Gosling watershed site, centred 30.6 m from the larval stream in a dry gully with scattered Devil's Club-Skunk Cabbage (*Lysichiton americanus*) seepage sites and large accumulations of coarse and fine woody debris. One (1) amplexing pair was observed in a shallow seepage site. Frogs fitted with radio-transmitters remained at the aggregation sites during the monitoring period. Observations are suggestive of aggregate over-wintering at these locations. We plan to conduct a more structured investigation of autumn distributions in the coming year.

Bioaugmentation as a Treatment Against Chytridiomycosis in Southwestern Leopard Frog Species. Emily E Nebergall, Jerri Bartholomew, *Department of Microbiology, Oregon State University 202 Nash Hall, Corvallis, OR 97331; nebergae@onid.orst.edu*; Tiffany S Garcia, *Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall Corvallis, OR 97331*; Michael J Adams, *USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331*.

The Chiricahua Leopard Frog, *Lithobates [=Rana] chiricahuensis*, was listed as a threatened species in 2002. These frogs have disappeared from much of their native range and are now only rarely observed in the wild. Chytridiomycosis, caused by the fungal agent *Batrachochytrium dendrobatidis* (*Bd*), is a primary driver of these extirpations and continues to plague reestablishment efforts, which rely on lab-raised captive breeding populations. Management of *Bd* in *L. chiricahuensis* is necessary if reestablishment is to succeed. Naturally occurring antifungal bacteria on the skin of some amphibian species promote resistance to *Bd*; amplifying the presence of these bacteria via a treatment process called bioaugmentation can prevent *Bd* mortality in susceptible amphibians. To test the efficacy of this treatment in *R. chiricahuensis*, a syntopic proxy species *Lithobates [=Rana] yavapaiensis* was treated with the known bioaugmentation agent *Janthinobacterium lividum*. No significant protection from *Bd* was observed. To develop a *L. chiricahuensis*-specific treatment, swabs were collected from wild frogs in Arizona and New Mexico. Bacterial colonies were isolated from these swabs and screened for *Bd* inhibition in vitro. Sequencing of inhibitory isolates revealed the presence of the nonpathogenic biocontrol organism *Pseudomonas fluorescens* (*PuF*). A single *PuF* isolate was selected based on superior in vitro inhibitory activity for use in a *Bd* challenge study with *L. chiricahuensis* (experiment in progress). This is the first attempt to use *P. fluorescens* to control disease in wild amphibians.

Fragments of Mollusk Shells to Make Tools and Ornaments: Investigation of Archaelogical Findings in Eastern Oregon. Donna Nez, Gene Shippentower, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fish & Wildlife Programs, 46411 Ti'mine Way, Pendleton OR 97801.;Donnanez@ctuir.com;* Christine A. O'Brien, *Browns River Environmental Consultants, 130 Sesame Street, Waynesville NC 28785; Christine.amblema@gmail.com*.

The focus of this project was to determine what types of mollusk shells were historically used by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). In 2009, a project to catalog shell material collected from Umatilla, Oregon located at the Mid-Columbia Archeology Society site (35UM35-1973) was started. Freshwater and marine mussels were important to CTUIR tribal members because they used their shells to make tools and ornamentation. The mussels were also consumed as food during the winter months. A total of 7,243 shell and shell fragments have been cataloged. Most of the material inspected was identified as the Western Pearlshell [Bivalvia:Unionidae *Margaritifera falcata*] and only nine shells had evidence they were used to make ornamentation. Eight shell fragments were identified as the Western Ridgemussel [Bivalvia:Unionidae *Gonidea angulata*] and two were identified as Anodonta spp. Several small snail shells found were made into beads. Nine oyster shells were also uncovered at the site. These findings suggest that shells from the Western Pearlshell were utilized the most for consumption and/or making tools and ornaments

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Glochidial Shell Descriptions for *Anodonta californiensis, A. oregonensis, A. nuttilliana*, and *Gonidea angulata* Using Scanning Electron Microscopy. Christine O'Brien, *Browns River Environmental Consultants, 130 Sesame Street, Waynesville, NC 28785; christine.amblema@gmail.com*; Jayne Brimbox, Donna Nez, *Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Fish & Wildlife Programs, 46411 Ti'Mine Way, Pendleton, OR 97801; brimbox@gmail.com*

Glochidial shell descriptions are lacking for many freshwater mussel species, especially for the western mussel species. This study describes the glochidial shell morphology for four freshwater mussel species found throughout the western US. *Anodonta californiensis*, *A. oregonensis*, and *A. nuttilliana* are fairly large hooked subtriangular glochidia. Their shell sizes range from 210 to 325 µm. These shell descriptions are very similar to mussels from the subfamily Anodontine found in the eastern US. Gonidea angulata glochidia are without hook, white, sub-triangular in shape, and averaged 170.7 µm in length and 171.3 µm in height. *Gonidea angulata*, a monotypic species, exhibit glochidia shell descriptions that most resemble those of Elliptoideus sloatianus, a monotypic species, found in the southeast US.

Middle School Students Conduct Conservation Research by Tracking Toads. Amber F Palmeri-Miles, Jason T Irwin, *Central Washington University, 400 East University Way, Ellensburg, WA 98926; palmeria@cwu.edu*; Trish D Griswold, Lisa A Browitt, *Walter Strom Middle School, 2694 State Route 903 Cle Elum, WA 98922*.

Sixth, seventh, and eighth-grade students from Walter Strom Middle School in Cle Elum, Washington, were an integral part of a Master's of Science project at Central Washington University (CWU) examining movement patterns and home range of Western Toads (*Anaxyrus boreas*) near Snoqualmie Pass, WA. Students who participated in a "watershed club" as part of CWU's National Science Foundation GK-12 Yakima WATERS program had the opportunity to conduct fieldwork and collect real data. These students learned to use Telonics TR-4 or Communication Specialist Inc. R1000 receivers with Telonics RA-17 directional antenna to track Western Toads. Toads were outfitted with radio transmitters mounted on waist belts made of polyethylene tubing. Approximately once a month, active participants in the watershed club were selected to conduct fieldwork. These students used radio telemetry to locate toads in various habitats throughout three seasons in all weather conditions. Western Toads show great capacity for movement (e.g., >3.5 km in a week), use a wide variety of habitats and show strong seasonal and annual site fidelity. Estimates of Western Toads' home ranges were found to be 0.002- 1.346 km^2. Due to the long duration of this study (2 yrs) students were able to observe differences in seasonal habitat selection and movement patterns. In addition to collecting data, students have been filmed and interviewed while conducting fieldwork. A documentary is being assembled that will be used to educate community members about the importance of wildlife conservation and demonstrate Walter Strom Middle School's connection with local environmental issues.

Longear Sunfish Nest Site Selection and Response to Perceived Harm in a Potomac River Tributary. Stephen M Selego, *104 Nash Hall, Oregon State University, Corvallis, OR 97331-4501; sselego@gmail.com*; James T Anderson, *322 Percival Hall, West Virginia University, Morgantown, WV 26506-6125; jim.anderson@mail.wvu.edu*.

Male individuals of the fish family Centrarchidae have complex nest construction and guarding behaviors that vary with environmental conditions. We sought to determine which environmental variables had the greatest effect on nesting behavior in Longear Sunfish (*Lepomis megalotis*). We conducted visual surveys of nesting areas in the Cacapon River, West Virginia, USA and recorded characteristics of all located nests and of the guarding males. We also measured environmental characteristics at random sites. Response to perceived harm was measured experimentally as the distance that first induced flight behavior, the time of abandonment, and the distance to refuge. Both site selection and response to harm were analyzed using a priori general linear models and Akaike's Information Criterion (AICc) scores. Longear Sunfish exhibited preference for nest sites: males nested closer to other nesting males, closer to shore, and in shallower water than would be expected if nesting occurred randomly. Response to perceived harm was greatest in smaller males nesting in shallow water and far from cover objects. Reduction in energy expenditure, related to presence of upstream cover and the frequency of nest reuse, did not appear to be the greatest determinant of nest site selection. Rather, we propose that nesting behavior is influenced by protection from perceived threats within the environment, including human traffic on the river. Therefore,

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the presence of boats and fishermen on rivers may reduce the quality of fish nest sites and increase the vulnerability of parents and offspring to natural predators.

Fisher Surveys in Southwestern Oregon. Jeff Stephens, *Bureau of Land Management, 3040 Biddle Road, Medford, OR 97504; j2stephe@blm.gov*

For the past 10 years the Medford District BLM has been surveying for Fisher (*Martes pennanti*) in SW Oregon using photographic bait station methods. Originally, our focus was on the population gap between the extant Klamath population and the reintroduced south Cascade population and whether Interstate 5 represents a potential impermeable barrier. Recently, we have directed some of our survey effort to expanding the known Fisher range across the district, while also using hair snares and scat detection dogs to obtain genetic samples. Surveying higher elevation sample units later in the season has presented some interesting challenges, most notably, trying to limit damage to the camera sets by Black Bears (*Ursus americanus*) and reduce the associated survey costs.

Archaeological Evidence for the use of Freshwater Mussels in the Upper Willamette Valley Oregon. Alexander E Stevenson, *ICF International Jones & Stokes, Inc 710 Second Avenue, Suite 550, Seattle, WA 98104; astevenson@icfi.com*; Kurt Perkins, *ICF International Jones & Stokes, Inc 615 Southwest Alder St. Suite 200, Portland, OR 97205*.

Freshwater mussels are available in most waterways of the Willamette Valley above Willamette Falls but they are rare in archaeological sites in the region. Prior to 2009, only three archaeological sites in the Upper Willamette Valley were reported to contain freshwater mussels. None of these sites had undergone formal scientific analysis and they lacked radiocarbon dates or other chronologic association. During the Oregon Department of Transportation's replacement of the Buena Vista Ferry, just southwest of Salem, archaeologists discovered two new sites that contained direct evidence of exploitation of freshwater mussels by Native Americans in the region. Ten radiocarbon dates suggest the sites were used between approximately 500 years before present (BP) and 330 BP. Formal analysis of the mussel remains identified only a single specimen identifiable to genus (*Gonidea* sp.). The remaining mussel remains were highly fragmented, which precluded identification. These and other analyses of cultural materials from the sites has shed light on a relatively undocumented portion of Native American diets in the Upper Willamette Valley. The data from the Buena Vista Ferry project suggest that freshwater mussels were an important part of the Native American diet prior to Euro-American entry into the area.

The Kalum Coastal Tailed Frog Study in North-western British Columbia. Melissa A Todd, *BC Ministry of Forests, Lands and Natural Resource Operations, Coast Area, Nanaimo, BC V9T4R5; Melissa.Todd@gov.bc.ca*; Alexis McEwan, Chris Johnson, *University of Northern British Columbia, Prince George, BC V2N4Z9*; Purnima Govindarajulu, Kathy Paige, *BC Ministry of Environment, Victoria, BC V8W9M1*; Doug Steventon, Anne Hetherington, *BC Ministry of Forests, Lands and Natural Resource Operations, Skeena Region, Smithers, BC V0J2N0*.

In British Columbia, Coastal Tailed Frogs (*Ascaphus truei*) can spend a substantial part of their adult life away from streams in cool, moist micro-sites and habitats closely associated with old growth and mature second growth forest. Most research to support Tailed Frog habitat management in BC has concentrated on the larval life-history stage, limiting our understanding of the sensitivity of frog populations to terrestrial disturbance. We are investigating characteristics of terrestrial habitats occupied by post-metamorphic Tailed Frogs at 15 research sites distributed across 5 watersheds in north-western British Columbia. We are using radio-telemetry to examine patterns of terrestrial habitat use and movement by adult frogs. To date, we have fitted 11 males and 6 females with radio-transmitters as part of a use-availability study. Of those, 7 males and 4 females were monitored for the nominal life-span of the transmitters (10-14 days). All frogs are permanently marked for long term population assessment. Riparian and upland habitats have been characterized and microclimate monitored intensively through the growing season and extensively through winter. Larval surveys are conducted to assess relative abundance adjacent to adult habitats, and larval voucher specimens collected for an examination of genetic connectivity in the study area. Inventory has expanded the known breeding range over 10 km further inland (east) from the nearest previously documented occurrence. Results will contribute to evaluating the effectiveness of strategic conservation areas (Wildlife Habitat Areas) and developing operational riparian best management practices for small headwater streams.

Observations on the Prey Capture Strategies of Terrestrial Coastal Giant Salamanders (*Dicamptodon tenebrosus*). Robert E Weaver, Brandon Fessler, Noah Simons, Dale Jansons, R Steven Wagner, *Department of Biological Sciences, Central Washington University, Ellensburg WA 98926; weaverro@cwu.edu*.

Terrestrial feeding behavior within salamanders may involve lingual and/or jaw prehension. In some cases, the tongue can be projected at a high rate of speed (e.g., some plethodontid salamanders). Feeding bouts can be analyzed using high speed video with regards to locating prey, prey capturing and handling, as well as swallowing and the timing of these events can be measure with respect to prey type and size. The feeding behavior of larval *Dicamptodon* tenebrosus has been previously reported, but little is known about such behavior in terrestrial adults. Here, we report our initial observations on the feeding behavior of terrestrial adult *D. tenebrosus*. Nine terrestrial phase *D. tenebrosus* (mean snout-vent length = 105 mm) were collected near Snoqualmie Pass, Kittitas County Washington State, and maintained using standard husbandry practices. Feeding sequences were filmed at high-speeds (420-1000 frames/second) using a Casio Exlim EX-ZR100 digital camera. Salamanders were filmed feeding upon two prey types, earthworms and crickets. Our initial observations indicate terrestrial *D. tenebrosus* use either lingual or jaw prehension (or both), depending on prey type. During some sequences, the tongue may be protruded a maximum of 1.25 cm past the tip of the mandible, briefly contacting prey, then it is retracted and the jaws used to secure prey. Typically, the lower mandible contacts the prey item first, with the maxilla coming into contact shortly thereafter. Swallowing involves depression of the hyoid, but in some feeding sequences, inertial feeding is used.

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