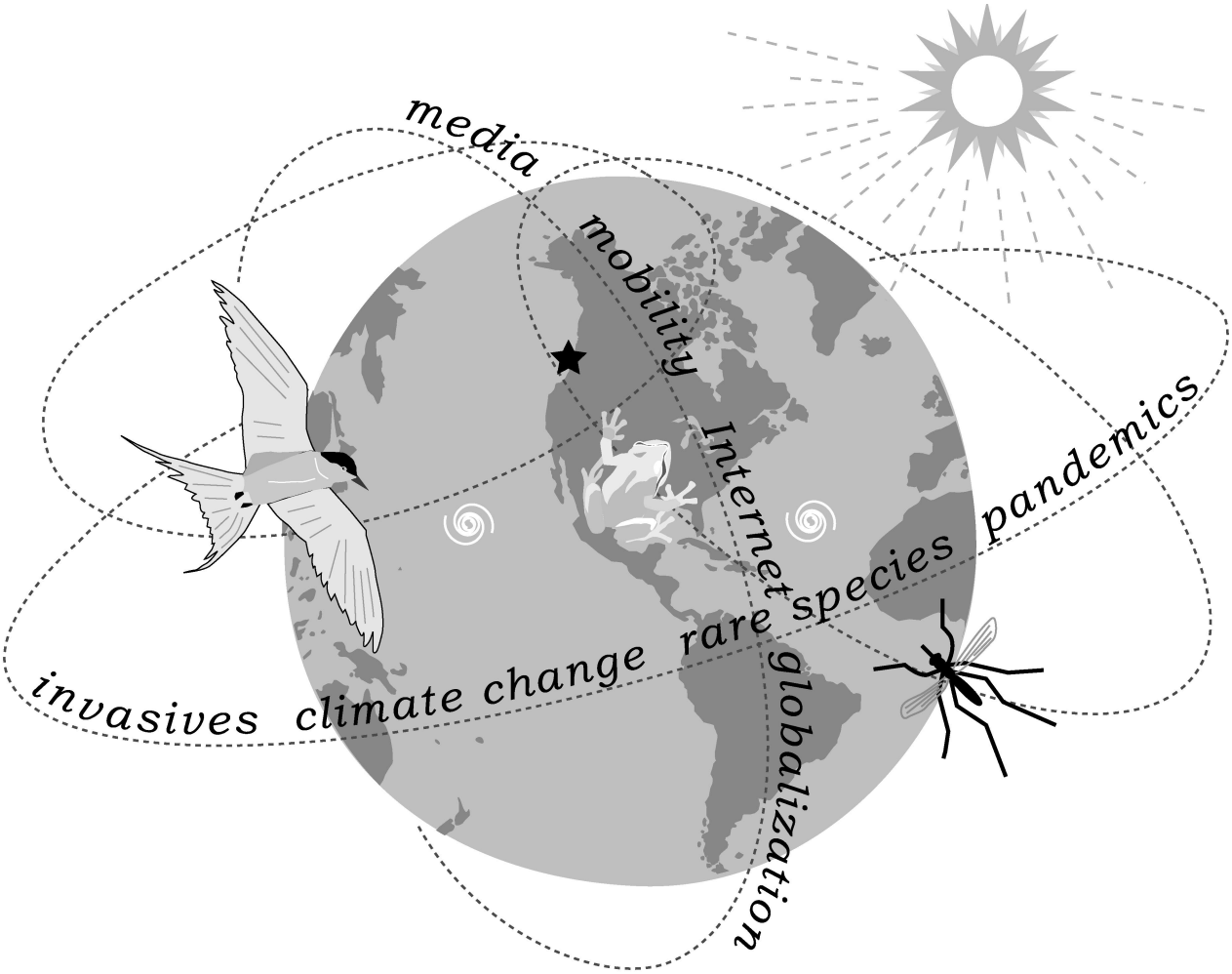
The 2007 Joint Annual Meeting
of
The Society for Northwestern Vertebrate Biology
in conjunction with
Northwest Scientific Association and
Northwest Lichenologists

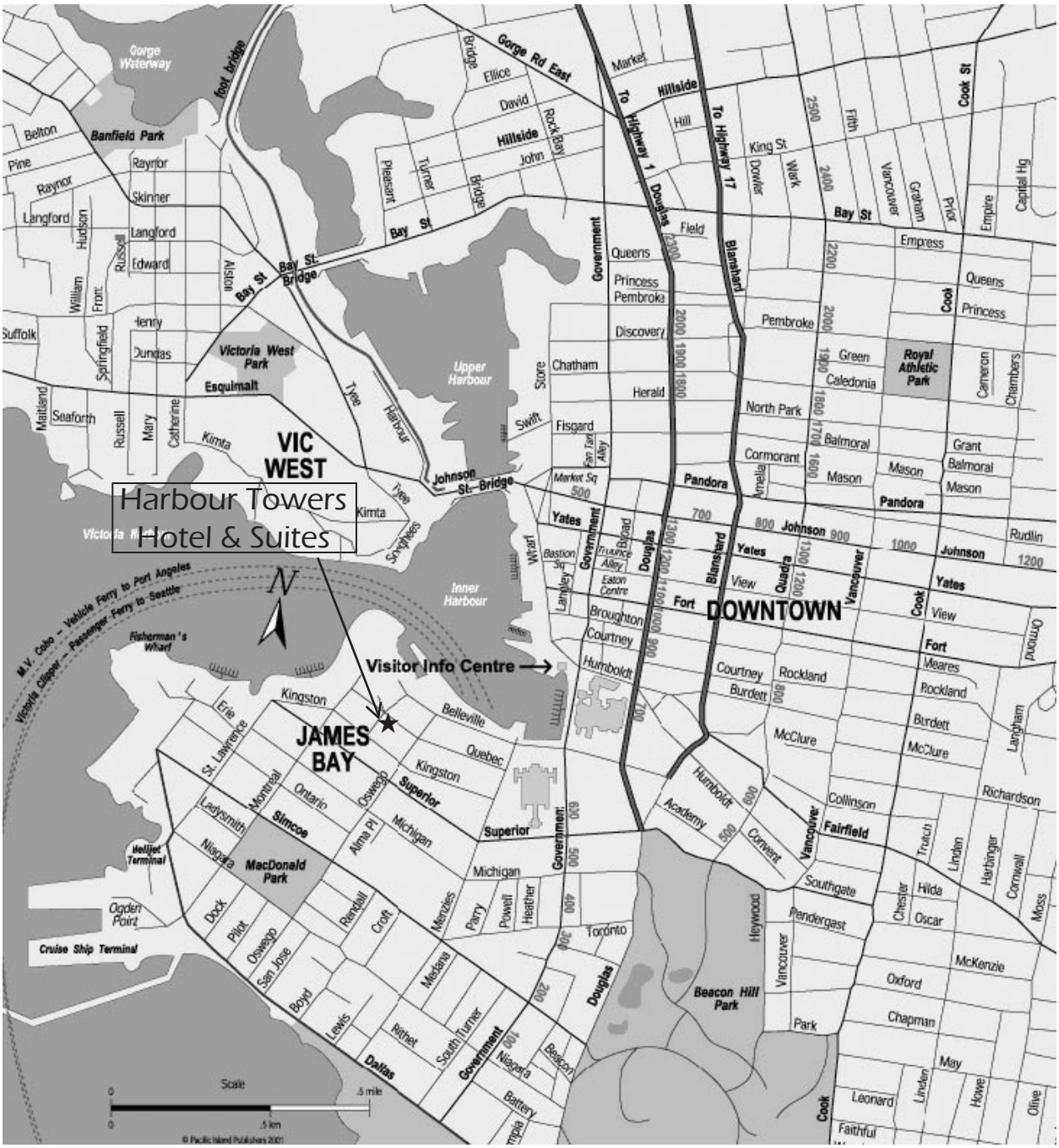
"Preparing for the Unpredictable: Conservation and Communication Needs in the 21st Century"



Victoria, British Columbia, Canada
21 - 24 February 2007

logo design: Kathryn Ronnenberg

Downtown Victoria



GETTING TO AND FROM VICTORIA, BC

There are many ferry options from the US to Victoria (Seattle, Bellingham, Anacortes, and Port Angeles), but only some allow vehicles. For those coming from Seattle, the **Victoria Clipper** is a passenger-only ferry and has one sailing a day (8:00 am), so **please reserve early**. The hotel is close to the US-based ferry terminals in Victoria - a short 5-minute walk, or complimentary hotel shuttle ride (based on availability). Those walking off the ferry from Swartz Bay, can conveniently catch a city bus to downtown and walk to the hotel from there. For those bringing their cars, there is a four-story parkade at the hotel, at a cost of $7/day.

For a **map of the city**, and information on ferry schedules please visit the following web sites:
The City of Victoria - *http://www.city.victoria.bc.ca/*
The Ferry Traveler - *http://www.ferrytravel.com/*

The 2007 Joint Annual Meeting of The Society for Northwestern Vertebrate Biology in conjunction with Northwest Scientific Association and Northwest Lichenologists

"Preparing for the Unpredictable: Conservation and Communication Needs in the 21st Century"

Welcome!

Hello All!

Glad you could make it to Victoria! Hopefully you enjoyed a very pleasant boat ride to your hotel doorstep, or a short walk or drive if you are among the lucky folks who live here year-round. To all the folks who had to struggle with out-of-county/province travel, and approvals, and extra bureaucracy to get here; STOP, take a deep breath…and let it all go… because you're here now, and now is when it gets good! If you've not been here before, say hello to a resident Victorian, which shouldn't be too difficult, and find out about all the places you don't want to miss. Be prepared to be wowed!

It's been a few years since the Northwest Scientific Association, Northwest Lichenologists and the Society for Northwestern Vertebrate Biology have met together at an annual conference, so we were due for a get-together, and it is upon us. By now you've seen some of what's in store, but there's more, much more, just look inside. We will have plenary sessions with some incredible speakers (Tyrone Hayes, Daniel Simberloff, Nancy Baron, and Richard Hebda) on Thursday and Friday, followed by 18 sessions ranging from lichen ecology to fire ecology to snake ecology, and from geomorphology to climate change and amphibian diseases. You will not be disappointed by a lack of diversity. You'll also see workshops and field trips, music and dining, and many opportunities to hang with friends and make some new ones. You won't see much time for sleep, so sleep next week. Also, say hello to the volunteers and members of the planning committee who pulled this whole thing together; they've worked hard and they're glad you came. Hope you have fun, learn something new, make new friends, and expand your horizons in any number of ways. We look forward to catching up with you this week.

Jeff Lewis, President
Society for Northwestern Vertebrate Biology

Steve Rust, President
Northwest Scientific Association

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Meeting Planning Committee

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Committee Members: Isabelle Deguise, Christian Engelstoft, Dave Fraser, Laura Friis, Purnima Govindarajulu, Bob Gray, Eric Lofroth, Brent Matsuda, Terry McIntosh, Kari Nelson, Kristiina Ovaska, and Sylvia Wood

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Program Layout: Kathryn Ronnenberg

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Sponsors and Contributors to the 2007 Annual Meeting

The Society for Northwestern Vertebrate Biology, Northwest Scientific Association, and Northwest Lichenologists would like to acknowledge the generosity of the following sponsors of the 2007 annual meeting:

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We also wish to thank the individuals, businesses, and organizations who provided special contributions or donated items for our raffle and auction.

Symposium - Panic, Pandemics, and Poisons (Salon B; 10:30 am - 5:30 pm)

Emerging infectious diseases and toxics are pressing issues for wildlife professionals. This one-day symposium will provide current information regarding the implications of emerging infectious diseases and toxics for wildlife and ecosystem management, wildlife and human health perspectives, media representation of the issues, and recommended safe practices to avoid exposure and/or spread. Experts in emerging infectious diseases and toxics will present their research on the following topics: Avian Influenza, West Nile Virus, Chronic Wasting Disease, Hantavirus, Chytridiomycosis, Herbicide/Amphibian Interactions (Glyphosate and Atrazine), and Insecticide poisoning in birds of prey. We will also discuss the accuracy of media presentations, public perception and effectiveness of government policies.

Workshop - Graphic Design and Communication Skills for Science Publishing and Presentations (Salon A; 8:30 am - 4:00 pm)

Effective communication is essential for wildlife researchers and managers for teaching, publishing, funding and grant proposal writing, litigation issues, and for gaining support by local lobbyists, politicians, and the general public. This six-part workshop on graphic design and communication skills for oral presentations, printed materials, posters, and cartography for scientific publications and presentations will help improve your communication skills. Part of the workshop will include an opportunity for an expert critique of participant's work.

Special Events

Reception and Poster Session I (with live entertainment)

Wednesday 21 Feb.
7:30-10:00 pm

Njiva Marimba play the uplifting rhythms of the Shona-style music from Zimbabwe. The group is made up of nine local youth who have been playing marimba for more than six years. Their teachers include members of Victoria's well known Marimba Muzuva, and Zimbabwean musicians Garadziva Chicamba and Musikewa Chindoza. As well as taking turns on base, baritone, tenor and soprano marimbas, band members also play the West African djembe drum and traditional Zimbabwean hoshos (or shakers). Some songs are accompanied by gumboot dancing.

Photo Contest

Thursday 22 Feb.

Submissions will be accepted in the following categories (1) Vertebrates, (2) Invertebrates, (3) Flora, (4) Landscape or Habitats, (5) Biologists in Action, and (6) Fine Art on nature-related topics. The first 5 categories are limited to Pacific Northwest & BC subjects. Submissions will be on display all day on Thursday, Feb 22nd, in the Mezzanine. There are prizes for winners of each category & for Best-In-Show, which will be awarded that evening at the banquet. All awards are by peoples' choice, so make sure to vote!

Silent Auction and Raffle

Thursday 22 Feb.

Numerous items donated by generous sponsors and members will be on display Thursday February 22nd in the Mezzanine for registrants to bid on in the annual silent auction. As well, there will be a short raffle that evening at the banquet that will contain a variety of interesting books, tickets, and memorabilia.

Field Trips

Journey into the Night - Red-legged Frogs & Owls

(Friday 23 Feb., 6:00 - 9:00 pm)

Join us for an evening of auditory birding and frogging. The dusk start off will be led by Vicky Young, looking for owls when they are most vocal. We hope to visit some previously active Western Screech-owls sites, and possibly Barred Owl sites. Make sure to wear warm clothes and bring a headlamp or flashlight. In addition to listening for owls, Purnima Govindarajulu will help us "look" for mating Red-legged Frogs in two lakes in the Highlands Parks near Victoria. Even if the temperature is barely above freezing, the romancing in the woods will affirm the approach of spring and the joys of field work to come.

Special Species of Vancouver Island - From Marsh to Mountain Top

(Saturday 24 Feb., 8:00 am - 2:00 pm)

Leader Darren Copley will take you on an adventure to look for a few of the Vancouver Island specialty species (both native and introduced) and visit a couple of the natural history hotspots along the way. We will be looking for endemic species such as MacCoun's Meadowfoam and species that have been introduced here such as Eurasian Skylark and European Wall Lizard. On the way, we will be visiting some of the best natural history sites on southern Vancouver Island such as Martindale Flats, Cattle Point, and the sand dunes of Island View Beach.

Lichens and Bryophytes of Salt Spring Island

(Saturday 24 Feb., 9:00 am - 4:00 pm)

Catch a ferry with Terry McIntosh to beautiful Salt Spring Island where, as time allows, we will visit as many habitats types possible, including coastal open terraces to steep Garry oak meadows.

Northwestern Naturalist: A Note From the Editor

We will be having an important discussion at the business meeting scheduled for the lunch hour on Friday, Feb. 23, during our annual meeting in Victoria, BC. The topic will be whether we want to provide open access to our journal on our own website.

Meeting At A Glance

Wednesday 21 February

8:30 am - 4:00 pm	**Communications Workshop** (Salon A) *Workshop Leader: Kathryn Ronnenberg*
10:30 am - 5:30 pm	**Pandemics Symposium** (Salon B) *Organizer: Tara Chestnut*
5:30 - 7:30 pm	Board Meetings (SNVB & NWSA)
7:30 - 9:00 pm	Registration opens and laptops available for loading talks (Mezzanine)
7:30 - 10:00 pm	**Reception** (Mezzanine and East Harbour Ballroom) *Njiva Marimba* plays 7:30 - 9:00 pm
8:00 - 9:00 pm	**Poster Session I** (Salon B and Mezzanine)

Thursday 22 February

7:30 am	Registration opens (Mezzanine)
8:00 - 8:15 am	**Introductions & Welcome** (East Harbour Ballroom)
8:15 - 9:30 am	**Plenary Session I: Tyrone Hayes and Daniel Simberloff** (East Harbour Ballroom)
9:30 - 10:00 am	Coffee break

	Salon B Concurrent Session I	Salon A Concurrent Session II	Room 203 Concurrent Session III
10:00 am - noon	**Wildlife Movements &Habitat Linkages** *Leonard Sielecki*	**Conservation & Wildlife Diseases** *Bryce Maxell*	**Wetland Ecology and Management** *Drew Kerr*
noon - 1:30 pm	Lunch		
1:30 - 3:30 pm	**Marine Species at Risk** *Alan Burger*	**Riparian Management** *Doug DeGross*	**Cryptogams & Mollusks** *Terry McIntosh*
3:30 - 4:00 pm	Coffee break		
4:00 - 5:00 pm	**Monitoring Rare & Elusive Species** *Marc Hayes*	**Human Dimensions** *Dave Peterson*	**Geomorphology** *Richy Harrod*
5:00 - 6:00 pm	**Poster Session II** (Mezzanine and Salon B)		
6:00 - 10:00 pm	**Banquet - Daniel Simberloff**, raffle, auction results, awards		

Meeting At A Glance

Friday 23 February

7:30 am	Registration opens (Mezzanine)
8:00 - 8:15 am	**Meeting Reminders and Announcements** (East Harbour Ballroom)
8:15 - 9:30 am	**Plenary Session II: Nancy Baron & Richard Hebda** (East Harbour Ballroom)
9:30 - 10:00 am	Coffee break

	Salon B Concurrent Session I	Salon A Concurrent Session II	Room 203 Concurrent Session III
10:00 am - noon	**Invasive & Opportunistic Species Management** *Purnima Govindarajulu*	**Predator & Prey** *Jeff Lewis*	**Fire Ecology** *Bob Gray*
noon - 1:30 pm	Lunch (SNVB/NWSA member lunch)		
1:30 - 3:30 pm	**Amphibia/Reptilia** *Aimee McIntyre*	**Species Status & Listing** *Leah Ramsay*	**Forest Dynamics** *Lori Daniels*
3:30 - 4:00 pm	Coffee break		
4:00 - 5:00 pm	**Planning for Climate Change** *Kristiina Ovaska*	**Birds of Prey** *Tara Chestnut*	**Forest Dynamics** *Lori Daniels*
6:00 - 9:00 pm	**Field Trip I:** Journey Into the Night - Owls and Red-legged Frogs, *with Purnima Govindarajulu and Vicky Young*		

Saturday 24 February

8:00 am - 3:00 pm **Field Trip II:** Special Species of Vancouver Island - From Marsh to Mountain Top, *with Darren Copley*

9:00 am - 4:00 pm **Field Trip III:** Lichens and Bryophytes of Salt Spring Island, *with Terry McIntosh*

Wednesday 21 February

Graphic Design and Communication Skills for Science Publishing and Presentations Workshop **(Salon A) Kathryn Ronnenberg, Workshop Leader**

8:30 - 9:00 am	**Introductory Talk: Nancy Baron**, Science Outreach Director for COMPASS, the Communication Partnership for Science and the Sea, and lead communications trainer for the Aldo Leopold Leadership Program.
9:00 - 10:20 am	**Graphic Design Session I:** Coming to Terms with the Basics of Graphic Design Technology and Techniques
10:20 -10:40 am	Coffee break
10:40 - noon	**Graphic Design Session II:** Color Blind Design, and Design Considerations for Cartography
noon - 1:00 pm	Lunch (provided), and time for participants to load sample files for critique
1:00 - 2:20 pm	**Graphic Design Session III:** Designing Posters and Slides
2:20 - 2:40 pm	Coffee break
2:40 - 4:00 pm	**Graphic Design Session IV:** Constructive critique of participant examples, questions, and wrap-up of any topics from previous sessions

Panic, Pandemics, and Poisons Symposium

(Salon B) Tara Chestnut, Organizer

10:30 - 11:00 am	**Opening: Origins - Craig Stephen DVM Phd** Center for Coastal Health
11:00 - 11:30 am	**Avian Flu -** Jane Parmley, DMV PhD, Center for Coastal Health
11:30 - noon	**West Nile Virus -** Bonnie Henry MD, BC Center for Disease Control
noon - 12:30 pm	**Birds/Insecticides -** John Elliot, PhD, Canadian Wildlife Service
12:30 - 1:00 pm	Lunch (provided)
1:00 - 1:45 pm	**Chronic Wasting Disease -** Helen Schwantje DMV, BC Ministry of Environment
1:45 - 2:30 pm	**Hantavirus -** Luis Ruedas PhD & Laurie Dizney PhD Candidate, Portland State University
2:30 - 2:45 pm	Break
2:45 - 3:30 pm	**Chytriodiomycosis -** Cherie Briggs PhD, University of California Berkeley
3:30 - 4:15 pm	**Atrazine -** Tyrone Hayes PhD, University of California Berkeley
4:15 - 5:00 pm	**Glyphosate -** Rick Relyea PhD, University of Pittsburgh
5:00 - 5:30 pm	**Closing, Solutions -** Craig Stephen DMV PhD, Center for Coastal Health
5:30 - 7:30 pm	Board Meetings (SNVB & NWSA)
7:30 - 9:00 pm	Registration opens and laptops available for loading talks (Mezzanine)
7:30 - 10:00 pm	**Reception** (Mezzanine and East Harbour Ballroom) *Njiva Marimba* plays 7:30 - 9:00 pm
8:00 - 9:00 pm	**Poster Session I** (Salon B and Mezzanine)

Tyrone Hayes

Plenary Session I and "Panic, Pandemics, and Poisons" Symposium speaker

Tyrone Hayes' research focuses on the role of steroid hormones in amphibian development and he conducts both laboratory and field studies in the U.S. and Africa. The two main areas of interest are metamorphosis and sex differentiation, but he is also interested in growth (larval and adult) and hormonal regulation of aggressive behavior. Tyrone's work addresses problems on several levels including ecological, organismal, and molecular questions. In his work on metamorphosis, Tyrone studies a local toad (*Bufo boreas*). Studies examine the effects of temperature on developmental rates, interactions between the thyroid hormones and steroids, and hormonal regulation of skin gland development. He also examines the effects of tadpole density on developmental rates and measuring metamorphic rates and hormone levels of tadpoles in the field and in the laboratory. Tyrone's work on sex differentiation involves the African clawed frog (*Xenopus laevis*), the Japanese kajika (*Buegeria buegeri*), and the Pine Barrens treefrog (*Hyla femoralis*). While Xenopus serves as a good model because of its availability, the latter two species have genetically distinguishable sexes. He can therefore examine early events in gonad differentiation, steroid enzyme activities, steroid receptors, etc., knowing the genetic sex of the individual larvae.

Currently, Tyrone is also examining the effects of exogenous steroids on gonadal differentiation and the potential role of endogenous steroids. His main goal is to synthesize ecological/evolutionary, organismal/physiological, and biochemical/molecular studies to learn how an animal translates changes in its external environment to internal changes, how these internal changes are coordinated, what molecular mechanisms are involved, and in turn, how changes at the molecular level affect an animal's ability to adapt to the changes in its external environment.

PESTICIDES, ENDOCRINE DISRUPTION, ENVIRONMENTAL STRESS, DISEASE AND AMPHIBIAN DECLINES: MAKING THE CONNECTIONS **Tyrone B. Hayes,** *Molecular Toxicology, Group in Endocrinology, Energy and Resources Group, Museum of Vertebrate Zoology, and Department of Integrative Biology, University of California, Berkeley, CA 94720-3104*. **tyrone@berkeley.edu**

The herbicide, atrazine is a potent endocrine disrupter that chemically castrates and feminizes exposed male amphibians. Further, when combined with other pesticides, exposure results in a hormonal stress response that leads to retarded growth and development, and immuno-suppression. The immuno-suppression results in increased disease rates and mortality. These effects have been demonstrated in the laboratory and in the field. Though many factors likely contribute to amphibian declines, pesticides likely play an important role even in populations that appear to decline for other reasons, such as disease. Current studies examine interactions between pesticides and other environmental stressors including extreme temperatures, desiccation, both factors also linked to agricultural activity. Pesticides like atrazine are ubiquitous, persistent contaminants. Effects of exposure have been shown in every vertebrate class examined (fish, amphibians, reptiles, and mammals) via common mechanisms. These observations demonstrate the critical impact that pesticides have on environmental health and ultimately public health. Given the EPA's current position regarding endocrine disruption: "The Agency's ecological risk assessment does not suggest that endocrine disruption, or potential effects on endocrine-mediated pathways, be regarded as a regulatory endpoint at this time." (Environmental Protection Agency, "Interim Reregistration Eligibility Decision for Atrazine," January 2003, Pg. 73, accessed December 11, 2006), we must also consider effective routes to address these issues.

Daniel Simberloff

Plenary Session I and Banquet Speaker

Daniel Simberloff is the Nancy Gore Hunger Professor of Environmental Studies at the University of Tennessee. He received his A.B. and Ph.D. degrees from Harvard University. His 350 publications center on ecology, biogeography, evolution, and conservation biology, and much of his recent research focuses on causes and consequences of biological invasions. His research projects are on insects, plants, birds, and mammals. At the University of Tennessee he directs the Institute for Biological Invasions (http://invasions.bio.utk.edu/resources/index.html). He was instrumental in formulating presidential Executive Order 13112 on invasive species, and he serves on the IUCN Invasive Species Specialist Group and the IUCN Species Survival Commission. He has served on the federal Invasive Species Advisory Committee, the National Science Board, and the Board of Governors of the Nature Conservancy, and is a past president of the American Society of Naturalists. He currently edits or serves on the editorial boards of Biological Invasions, BioScience, Biodiversity and Conservation, and other journals. He is the translator of "Killer Algae," Alexandre Meinesz's book on the invasion of the Mediterranean by *Caulerpa taxifolia*. In 2006 he received the Eminent Ecologist Award of the Ecological Society of America.

PLENARY

WE CAN WIN THE WAR AGAINST INVASIVE SPECIES - HIGH TECH AND LOW TECH SUCCESS STORIES. Dan Simberloff. Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN 37996; dsimberloff@utk.edu.

Massive publicity on impacts of biological invasions has led to fatalism - we can't seem to do much except slow this juggernaut slightly, so why bother? This pessimism is unwarranted! Often invaders are eradicated or managed for the long term at low densities, but these cases are frequently unpublicized. Some entail sophisticated, high-tech biology, but others use crude, scorched-earth methods. There is no scientific or technical reason why most invaders cannot be successfully managed. More consistent research funding is required, but a bigger problem is generating political and social support to organize an effective, comprehensive operational structure, including an early-warning/rapid-response system.

BANQUET

IVORY TOWER VS. MUDDY BOOTS - DO GENERAL LAWS BENEFIT CONSERVATION BIOLOGY? Dan Simberloff. *Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN 37996*; **dsimberloff@utk.edu.**

Academic ecology has come to be dominated by the quest for general laws, a trend that is spreading into conservation biology. This development in conservation biology is furthered by the growth of conservation genetics. In fact, the issues conservationists deal with on the ground are highly contingent and idiosyncratic, and general laws provide very limited guidance in most cases. They can even lead policymakers badly astray. The fact that the biological research needed to solve most conservation problems has a quite local domain and often rests on intensive study of natural history does not mean conservation biology is doomed to be a weak science. To be useful, it will simply have to be a very different science from, say, theoretical physics. There are many conservation success stories, and the major conservation failures much more frequently result from sociological, political, and economic factors than from insufficient biological understanding.

Nancy Baron

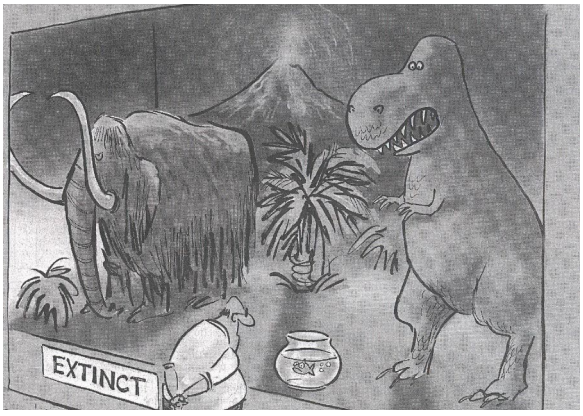
Plenary Session II and "Graphics and Communications" Workshop introductory speaker

Nancy Baron is Science Outreach Director for COMPASS, the Communication Partnership for Science and the Sea. She is also the lead communications trainer for the Aldo Leopold Leadership Program. A former national parks biologist and director of education for the Vancouver Aquarium, she has won numerous national science-writing awards. Nancy was a "Field Notes" columnist for the Vancouver Sun and a host for various Discovery TV programs. She has written for many publications including Canadian Geographic, the Georgia Straight, Saturday Night, Equinox, the Globe and Mail, Los Angeles Times and Science. Lone Pine published her field guide, Birds of Coastal British Columbia in 1997. From her perch at the National Centre of Ecological Analysis and Synthesis in Santa Barbara, California, Nancy leads the communication of socially relevant conservation studies and helps scientists have greater impact. She will share what she has learned by bridging the worlds of science and journalism.

For more information about the Aldo Leopold Leadership Program, visit www.leopoldleadership.org. To learn more about /COMPASS, go to www.compassonline.org.

JOURNALISTS ARE FROM VENUS, SCIENTISTS ARE FROM MARS: BRIDGING THE WORLDS OF SCIENCE AND JOURNALISM

Media coverage shapes public awareness and policy opinions about pressing conservation issues. While scientists play a critical role both as a resource for journalists and as a valuable information source for the public, they are often frustrated with how their work is portrayed in the press. How can scientists engage with print, broadcast and electronic journalism professionals to achieve positive, effective results? Nancy Baron, a biologist and expert in science communication will provide a behind-the-scenes look at how the press decides what to cover, the challenges of reporting on conservation issues, and what it takes to get your message across. You'll gain practical advice about interacting with reporters, tips for honing your interview skills, and do's and don'ts of dealing with the press. Nancy has spearheaded the communication of some of the most widely reported marine conservation science studies. Most recently, she worked with Boris Worm et al. on the November 3, 2006 study in Science, "Impacts of Ocean Biodiversity Loss on Ecosystem Services," aka "the collapse of wild seafood by 2048." Nancy will share insights into high profile conservation science stories deconstructing what went right, what went wrong, and why.



Richard Hebda

Plenary Session II and "Planning for Climate Change" session speaker

Richard Hebda has a Ph D. in Botany from the University of British Columbia and has been a Curator (Botany and Earth History) at the Royal British Columbia Museum for more than 25 years and an adjunct faculty member (Biology, Earth and Ocean Sciences, Environmental Studies) at the University of Victoria for more than 20 years. He curated the recent Dragon Bones (Chinese dinosaurs) and Climate and Climate Change exhibits at the Royal BC museum. He was the first faculty coordinator of the Restoration of Natural Systems Program and the University of Victoria and the Province of B.C.'s expert advisor on Burns Bog (eventually purchased as a globally unique wetland ecosystem). His research areas include understanding vegetation and climate history of British Columbia, Ethnobotany of BC First Nations, climate change and its impacts, restoration of natural systems and processes, ecology and origins of Garry oak and alpine ecosystems and botany of grasses. Richard Hebda, with his graduate students, is author of 80+ scientific papers; 200+ popular articles mainly on bulbs and native plants; (co) author of three books and major reports, (co)editor of three books. He appears often on TV and radio and in newspaper interviews.

PREPARING FOR THE UNCERTAINTIES OF CLIMATE CHANGE: BEYOND KYOTO, A CONCEPTUAL FRAMEWORK FOR CARBON STEWARDSHIP. Richard J Hebda. Royal British Columbia Museum, 675 Belleville Street, Victoria, BC V8W 9W2; rhebda@royalbcmuseum.bc.ca

Climate change is underway. Temperatures are rising. Drought, heavy rainfall and powerful storms appear to be increasing in frequency and intensity. In British Columbia, evident ecological responses may include the Mountain Pine Beetle out-break, Dothistroma needle blight intensification and western redcedar dieback. Regardless of future reductions in greenhouse gas emissions, ecosystems, human communities and economies will be transformed as temperatures rise to mean values unseen for tens of millions of years. Climate impact models of the Royal British Columbia Museum reveal major species shifts and imply widespread long-lasting ecosystem changes and conversions. Carbon Stewardship Analysis (CSA) offers a conceptual framework for focusing on preparation for inevitable ecological stresses in addition to reducing emissions. CSA involves recognition and assessment of the full spectrum of values of the three components of the carbon triangle: ancient carbon (fossils fuels), living (species/biomass), and dead (non-living organic matter). By focusing on Essential Ecosystem Characteristics, we can build ecosystem resilience to limit catastrophic ecological transformations and extinctions. CSA analyses raise the question whether dead carbon (= wood) resulting from the Mountain Pine Beetle epidemic might be best left on the ground, or whether the conversion of landscapes to biofuel production and the relatively minor ancient carbon offsets might come a too great a cost too the biodiversity and resilience of the living carbon of global ecosystems. There is an urgent need to improve understanding of ecosystem processes, species distribution and ecology and build capacity in ecological expertise; a return to a "boots not suits" approach of landscape and resource management.

Thursday 22 February

7:30 am	Joint Annual Meeting registration opens	Mezzanine
8:00 - 8:15 am	Introductions & Welcome	East Harbour Ballroom
8:15 - 9:30 am	**Plenary Session I:** **Tyrone Hayes & Daniel Simberloff**	East Harbour Ballroom
9:30 - 10:00 am	Coffee break	

10:00 - noon, Concurrent Paper Presentation Sessions

Time	Salon B	Salon A	Room 203
10:00 am - noon	**Wildlife Movements & Habitat Linkages** *Moderator:* Leonard Sielecki	**Conservation & Wildlife Diseases** *Moderator:* Bryce Maxell	**Wetland Ecology and Management** *Moderator:* Drew Kerr
10:00 am - 10:20 am	Vertebrate mortality at BC wildlife rehab centres – Sara Dubois	Partners for amphibian and reptile conservation (PARC) – Dede Olson	Towards formation of a Pacific Northwest Peatland Forum – John Christy
10:20 am - 10:40 am	Movement patterns in fragmented landscapes – Isabelle Deguise	Evolutionary arms race – Steven Wagner	Wetland restoration sites – Janet Rhoades
10:40 am - 11:00 am	Impacts of animal-vehicle collisions – Bill Harper	Non-native fish, disease and frog recovery – Vance Vredenburg	Wetland mitigation alternatives utilized by WSDOT– Brooke Hamilton
11:00 am - 11:20 am	Red squirrel dispersal – Karl Larsen	Pathophysiology – Christopher Gaulke	Wetland mitigation in Alberta – Ian Rudland
11:20 am - 11:40 am	Preventing amphibian mortality on highways – Barbara Beasley	Demography and chytrid infection – Susan Belmont (S. Wagner)	Wetland loss compensation in Alberta – Rick Shewchuk
11:40 am - noon	Western rattlesnake habitat – Lita Gomez	Mosquito blood meals for monitoring wildlife diseases – Bruce Leighton	Wetland management for wildlife in King County – Klaus Richter

noon - 1:30 pm **Lunch**

Thursday 22 February
1:30 pm - 5:00 pm Concurrent Paper Presentation Sessions

Time	Salon B	Salon A	Room 203
1:30 pm - 3:30 pm	**Marine Species at Risk** *Moderator:* Alan Burger	**Riparian Management** *Moderator:* Doug DeGross	**Cryptogams & Mollusk** *Moderator:* Drew Kerr
1:30 pm - 1:50 pm	Marine bird abundance changes – John Bower	Differentiating *Ascaphus truei* at sexual maturity – Frithiof Waterstrat	Cryptogam monitoring – Diane Haughland
1:50 pm - 2:10 pm	Marine species at risk in northern BC – Barbara Lucas (G. Jamieson)	Watershed characteristics and stream condition – Jana Compton	Biological crust recovery – Terry McIntosh
2:10 pm - 2:30 pm	Olive ridley sea turtles on the Pacific Coast – Jean Jang	Habitat relationships of amphibians and RMZs – Virgil Hawkes	Lichens from the San Juan Islands – Katherine Glew
2:30 pm - 2:50 pm	Marbled murrelet marine protected areas – Alan Burger	Herpetofauna and the river continuum – Hart Welsh	Bryophytes from the San Juan Islands – Judith Harpel
2:50 pm - 3:10 pm	The CUA2 – Krista Royle	Patterns of tailed frog tadpole distribution – Jason Jones	Mt. Adams lichens – Riley
3:10 pm - 3:30 pm	Tracking marine species at risk – Nicholas Brown (T. Gaydos)	Impacts of fine sediments on western toads – Sylvia Wood	Freshwater mussels – Allen Sullivan
3:30 - 4:00 pm	**Coffee break**		
4:00 pm - 5:00 pm	**Monitoring Rare & Elusive Species** *Moderator:* Marc Hayes	**Human Dimensions** *Moderator:* Rex Crawford	**Geomorphology** *Moderator:* Richy Harrod
4:00 pm - 4:20 pm	Taylor's checkerspot translocations – Mary J. Linders	Front country campground assessment – GretchenVolker	Coastal landform classification of WA state parks – Anthony Gabriel
4:20 pm - 4:40 pm	*Sorex* live-trapping methodology – Eric Stromgren	Shoots with roots – Charlene Forrest	Ice age floods research – Ryan Karlson
4:40 pm - 5:00 pm	Millipede diversity and abundance – Brent Matsuda	Agriculture in Japanese-American relocation camps – Karl Lillquist	Dendrogeomorphology of a rockfall slope – Andrew Perkins
5:00 - 6:00 pm	**Poster Session II**		**Mezzanine & Salon B**
6:00 - 10:00 pm	**Banquet: Daniel Simberloff, raffle, auction results, awards**		

Friday 23 February

7:30 am	Registration opens (closes at noon)	Mezzanine
8:00 - 8:15 am	Meeting Reminders and Announcements	East Harbour Ballroom
8:15 - 9:30 am	**Plenary Session II:** **Nancy Baron and Richard Hebda**	East Harbour Ballroom
9:30 - 10:00 am	Coffee break	

10:00 - noon, Concurrent Paper Presentation Sessions

Time	Salon B	Salon A	Room 203
10:00 am - noon	**Invasive & Opportunistic Species Management** *Mod:* Purnima Govindarajulu	**Predator & Prey** *Moderator:* Jeff Lewis	**Fire Ecology** *Moderator:* Bob Gray
10:00 am - 10:20 am	Impacts of introduced predators – Heather Major	US - Canada carnivore conservation – Jeff Lewis	Temporal variation in fire – Lori Daniels
10:20 am - 10:40 am	Introduced bullfrog control – Purnima Govindarajulu	Hair snare sampling of fisher and marten – Tzeidle Wasserman	Quantifying spatial variation in fire regimes – Jed Cochrane
10:40 am - 11:00 am	Broom removal and grazing pressure of white-top aster – C. Engelstoft	Landscape selection by fishers – Richard Weir	Western spruce budworm dynamics – Ze'ev Gedalof
11:00 am - 11:20 am	Factors affecting nest predation by ravens – William Webb	Wolverine habitat selection – Eric Lofroth	Coastal Douglas-fir fire history – Marian McCoy
11:20 am - 11:40 am	Spartina control and clapper rail – Drew Kerr	Population connectivity of black bear – Samuel Cushman	Fire effects on snowberry-rose plant association – Brenda Guettler
11:40 am - noon	Inland sand dune communities – Ryan Haugo	Vancouver Island marmot recovery – Andrew Bryant	Erosion control after Deer Point Fire – Dickinson

noon - 1:30 pm **Lunch (SNVB/NWSA member lunch)**

Friday 23 February
1:30 pm - 5:00 pm Concurrent Paper Presentation Sessions

Time	Salon B	Salon A	Room 203
1:30 pm - 3:30 pm	**Amphibia/Reptilia** *Moderator:* Aimee McIntyre	**Species Status & Listing** *Moderator:* Leah Ramsay	**Forest Dynamics** *Moderator:* Lori Daniels
1:30 pm - 1:50 pm	Diet of terrestrial forest amphibians – Casey Richart	Species status and listing issues – Dede Olson	Tree-ring analysis of Garry oak – David Jordan
1:50 pm - 2:10 pm	Indirect effects of UV-B on amphibian competition – Tiffany Sacra Garcia	San Juans biogeography and floristics – David Giblin	Climate and western hemlock looper – Shane McCloskey
2:10 pm - 2:30 pm	Oregon spotted frog demography – Nathan Chelgren	Recovery of golden paintbrush – Theodore Thomas	Coastal forest dynamics – Trudy Kavanagh
2:30 pm - 2:50 pm	Mark-recapture with spot pattern recognition – Michelle Lester	Reserve planning for marbled murrelets – J. Cragg (T. Chatwin)	Regeneration and recruitment after fine-scale disturbances – J. Passmore
2:50 pm - 3:10 pm	Animal colour patterns – Leigh Anne Isaac	Olympic marmot distribution and habitat – Suzanne Griffin	Interior BC forest biodiversity – Dustin Oaten
3:10 pm - 3:30 pm	Immobility in snakes – Patrick Gregory	Chipmunk identification – David Nagorsen	Biodiversity in old-growth ecosystems – Robin Lesher
3:30 - 4:00 pm	**Coffee break**		
4:00 pm - 5:00 pm	**Planning for Climate Change** *Moderator:* Kristiina Ovaska	**Birds of Prey** *Moderator:* Tara Chestnut	**Forest Dynamics** *Moderator:* Lori Daniels
4:00 pm - 4:20 pm	The Canadian global climate model – Gregory Flato	Urban Cooper's hawk – Andrew Stewart	Garry oak dendroecology – Shyanne Smith
4:20 pm - 4:40 pm	Disequilibrium in future ecosystems – Richard Hebda	Goshawk resource selection – William Harrower	Ecosystem restoration on Patos Island, Washington – Robert Gray
4:40 pm - 5:00 pm	Climate change and colonial seabirds in BC – Mark Hipfner	Suitability modeling for goshawks – Erica McClaren	Large woody debris – Sonya Powell
6:00 - 9:00 pm	**Field Trip I: Journey Into the Night – Owls and Red-legged Frogs** *with Purnima Govindarajulu and Vicky Young*		

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DIFFERENTIATING *ASCAPHUS TRUEI* AT SEXUAL MATURITY. **April B Barreca,** *PO Box 833, Bend, OR 97709***; Frithiof T Waterstrat** *PO Box 17592 Seattle, WA 98127***; Marc P Hayes,** *2636 59th Ave NW Olympia, WA 98502***; frithbaby@yahoo.com**

Field determination of sex in coastal tail frogs (*Ascaphus truei*) is typically done by looking for some degree of a cloacal tail, which is the equivalent of a penis, in males. As males mature, they also display secondary sexual characteristics some of which are frequent in other anurans: nuptial pads; enlarged forearms; and textured patches on the forearms, chin, chest, and digits of the front feet. As field determination of mature females represents a default (i.e., lack of appearance of the characteristics used to identify males), we were interested in the degree of correspondence between external sex determination and actual maturity (based on gonadal examination) for both sexes. Using a large collection obtained during the Old-growth Study in western Washington during the 1980s, we externally determined the sex of each frog, scoring or measuring the aforementioned sexual characteristics. We then dissected frogs to verify our determination, and scored gonadal development and measured gonadal size to indicate degree of maturity. We could not unambiguously distinguish males until a body size of 31 mm snout-vent length (SVL) was reached. Using this default size to also identify females significantly misestimates female size at maturity; based on gonadal data, the females we examined matured at 39.5 mm SVL, which is substantially larger. We discussed the implications of our findings for field researchers faced with determining sex and maturity in A. truei.

DITCH THE FENCE OR FENCE THE DITCH? LEARNING HOW TO PROTECT AMPHIBIANS FROM TRAFFIC ON PACIFIC RIM HIGHWAY, VANCOUVER ISLAND. **Barbara A Beasley.** *P.O. Box 927, Ucluelet, B.C. V0R 3A0***; beasley@island.net.**

Highway 4 crosses the Long Beach Unit of Pacific Rim National Park Reserve and fragments wetland and riparian habitats used by amphibians for breeding and over-wintering. Each spring and fall, amphibians move between habitats on rainy nights. Since 2001, community volunteers and Parks Canada staff have assisted in surveying the highway for amphibian road-kills ("SPLATS"). Of 978 roadkills (N = 26 surveys), Red-legged Frogs (*Rana aurora*) comprised 33%; Pacific Treefrogs (*Pseudocris regilla*), 32%; Northwestern Salamanders (*Ambystoma gracile*), 26%; Roughskinned Newts (*Taricha granulosa*), 6%; Western Redbacked Salamanders (*Plethodon vehiculum*), 2%; and Wandering Salamanders (*Aneides vagrans*) comprised 1%. In 2005, we installed three 90-m sections of temporary fence and pitfall traps on each side of the highway where several species were found to suffer concentrated mortality. In fall of 2005 and 2006 and spring 2006, I trapped 1419 amphibians (N = 5570 trap nights) and released them on the other side of the road. The majority were Northwestern Salamanders (45%) and Red-legged Frogs (42%). A comparison of the number killed in unfenced sections of the highway to the number caught at the fences will be used to estimate the magnitude of the effect of traffic on the migrating populations. Options for permanent mitigation measures and useful information gained from monitoring animals on the road will be discussed.

MARINE BIRD ABUNDANCE CHANGES IN NORTHWESTERN WASHINGTON AND SOUTHERN BRITISH COLUMBIA INSHORE WATERS. **John Bower, Marc Auten, Brian Cary, Caanan Cowles, Rainy Diehl, Kevin Dixey, Holly Donovan, Adam Emmett, Cassidy Grattan, Johanna Hobart-Crane, Alex Karpoff, Lydia Miller, Nicole Mills, Hannah Paden, Adam Peck-Richardson, Don Poe, Sandlin Preecs, Suzanne Sanborn, Marci Staub, Mark VanderVen.** *Fairhaven College, Western Washington University, 516 High St., Bellingham, WA 98225-9118***; jbower@cc.wwu.edu**

Marine bird abundance for the southern Strait of Georgia and adjacent waters was first assessed in the 1978-79 Marine Ecosystems Analysis Puget Sound Project (MESA). Since MESA, the most comprehensive census work has been the Puget Sound Ambient Monitoring Program's (PSAMP) biannual aerial surveys. PSAMP has reported dramatic declines in abundance for several species, however conclusions are limited by geographic, methodological and/or temporal considerations. Since 2003 we have conducted a study that repeats important components of the 1970's MESA study to better document changes in NW Washington marine bird abundance. We conduct monthly marine bird censuses from approximately 150 land-based sites and three ferry routes from fall through spring,

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censusing along the coastline from Whidbey Island in the south to Tsawwassen in the north. Results from our ongoing study indicate an approximately 25% decline in the total number of marine birds since the 1970's. Species showing consistent temporal and geographic abundance declines of over 50% include Surf Scoter, Western Grebe, Brant, Greater Scaup, Common Murre, Red-necked Grebe, and Marbled Murrelet. Species showing consistent increases in abundance include Pigeon Guillemot, Common Loon, Harlequin Duck, Bald Eagle, and Double-crested Cormorant. These results support most PSAMP results, and will provide comprehensive data for marine bird census efforts in the future. In this talk I will provide details on the changes in marine abundance, as well as discuss reasons for the changes we are seeing.

RECOVERY OF VANCOUVER ISLAND MARMOTS: A PROGRESS REPORT. **Andrew A Bryant.** *Marmot Recovery Foundation, 2043 Minto Avenue, Nanaimo, BC V9X 1R7; 250-754-1356*; **andrewbryant@shaw.ca**

The Vancouver Island marmot (*Marmota vancouverensis*) is a critically endangered mammal that is endemic to Vancouver Island, British Columbia, Canada. The species is naturally rare because of the limited availability of sub-alpine meadow habitats. Populations expanded during the 1980s, with marmots also successfully colonizing new habitats created by logging of high elevation forests. Populations declined thereafter, from 300-350 individuals during the mid 1980s to 65-70 in 1998. Reproductive rates remained relatively stable but apparent survival rates declined. Most mortality was from predation by wolves (*Canis lupus*), cougars (*Felis concolor*) and golden eagles (*Aquila chrysaetus*). A total of 56 marmots were taken into captivity from 1997 through 2004, with most being captured as pups or yearlings. Captive marmots were housed the Toronto Zoo, Calgary Zoo, Mountain View Conservation Centre, and a facility constructed at Mount Washington on Vancouver Island. The captive breeding program has been successful to date, with 171 pups born from 2000 through 2006, and a positive population growth rate (lambda = 1.31). Reproductive rates were similar to those observed in the wild. Beginning in 2003, a total of 53 captive-born marmots were reintroduced, 6 wild-born marmots were returned to the wild, and 5 wild marmots were transplanted between colonies. Results have been mixed. Some animals adapted well, hibernated successfully, and eventually reproduced. Others dispersed to unsuitable habitat or died from predation or during hibernation. It would be premature to describe the reintroduction program as successful, but the prognosis is positive.

PLANNING MARINE PROTECTED AREAS FOR MARBLED MURRELETS: THE NEED TO IDENTIFY PREDICTABLE HABITAT USE. **Alan E Burger, Robert A Ronconi, Sarah N P Wong.** *Department of Biology, University of Victoria, Victoria, B.C., V8W 3N5*; **Bob Hansen and Danielle Bellefleur.** *Pacific Rim National Park Reserve of Canada, P.O. Box 280, Ucluelet, B.C., V0R 3A0*; **aburger@uvic.ca.**

The Marbled Murrelet (*Brachyramphus marmoratus*) is listed as Threatened in Canada and in Washington, Oregon and California. Research and management have focused mainly on identifying and protecting nesting habitat in old-growth forests, but attention is now needed for the species' marine habitat where the birds spend 90% of their lives. The principal marine threats are oil spills, gill-nets, aquaculture, boat disturbance, and disruption of prey. Marine areas that might be candidates for protection need to support both high densities and predictable aggregations of murrelets. Human activities which threaten murrelets should be restricted in these areas. Using data from boat surveys made during the breeding seasons in 1993-2006 we show that high densities of murrelets predictably occur in certain sections of the West Coast Trail in Pacific Rim National Park Reserve, southwest Vancouver Island. Spatial distributions of murrelets differed from those of other alcids in this area. Research is underway to identify the habitat parameters that make these areas preferable to murrelets. Although we found some differences in coarse-scale distribution between adult murrelets and newly-fledged juveniles, they appear to use similar micro-habitats and we found no evidence for discrete "nursery areas" such as those identified in Alaska. Thus the protection of critical marine habitat for adult murrelets would also benefit juveniles (which might be particularly susceptible to disturbance and habitat alteration). Our research will facilitate the identification of predictable marine aggregations of murrelets being undertaken by the Canadian Marbled Murrelet Recovery Team.

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RESERVE PLANNING FOR MARBLED MURRELETS IN CLAYOQUOT SOUND. **Trudy Chatwin, Jenna Cragg, Tanya Dunlop** *Environmental Stewardship Division, Ministry of Environment, 2080 Labieux Rd, Nanaimo BC V9T 6J9*; **Sally Leigh-Spencer** *Ecologic Biological Consulting, 5632 Menzies Rd, Duncan BC V9L 6G7*; **Jenna.Cragg@gov.bc.ca**

We used an ecosystem-based management approach to delineate Marbled Murrelet nesting habitat reserves in Clayoquot Sound, BC. Our goal was to ensure that the quality and quantity of nesting reserves would sustain the present and future populations of Marbled Murrelets. A combination of audio-visual and vegetation surveys defined nesting habitat attributes for Marbled Murrelets, which were then used to construct a Habitat Suitability Model applied to Vegetation Resource Inventory maps at a 1:20,000 scale. Potential reserves were chosen through examination of the Habitat Suitability maps, air photo interpretation and low-level aerial surveys. The 88 reserves contained 15,626 ha of habitat. Including habitat protected in other reserves, the total protected area within Clayoquot Sound is 44,576 ha or 61.8% of all habitat. Population estimates and nest density data (from radar counts and a tree-climbing study) were combined to assess the adequacy of this reserve strategy. Using radar estimates we predict that the reserve network will protect 17-89% of the population (mean 57%). Our strategy is to protect a large fraction of the population at any given time, while relying on the slow rate of cut in Clayoquot Sound to effectively provide more protection than what is included in reserves. We present a monitoring approach that will measure the effects of forest harvest as well as other environmental disturbances on the population. Reserve design based on these multi-scale science-based research and inventory techniques has application to ecosystem management of nesting habitat throughout the Marbled Murrelet's range.

OREGON SPOTTED FROG MOVEMENT AND DEMOGRAPHY AT DILMAN MEADOW, CENTRAL OREGON: 5 YEARS OF POPULATION CHANGE FOLLOWING TRANSLOCATION. **Nathan D Chelgren, Christopher A Pearl, Michael J Adams.** *USGS, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331;* **Jay Bowerman,** *Sunriver Nature Center, Box 3533, Sunriver, OR 97707*; **nchelgren@usgs.gov.**

From 2001 to 2005, we studied the demography and seasonal movement of Oregon spotted frogs (*Rana pretiosa*) translocated into created ponds in Dilman Meadow in central Oregon. Movement rates revealed complementary use of ponds seasonally, with one small spring being heavily used during winter that was rarely used during the rest of the year. Growth rates were significantly higher for frogs in ponds that were not used for breeding, and larger size resulted in substantially higher survival. We found little variation among ponds in survival after accounting for size. Seasonal estimates of survival were lowest for males during the breeding/post-breeding redistribution period, suggesting a high cost of breeding for males. Overwintering survival for both genders was relatively high. Our study supports others in suggesting Oregon spotted frogs are specific in their overwintering habitat requirements, and that predator-free springs may be of particular value. Complete study of the annual life cycle is needed to isolate the life stages and mechanisms through which Oregon spotted frogs are affected by stressors such as nonnative predators. Dilman Meadow, which lacks many hypothesized stressors, is an important reference for isolating the life stages most responsive to management elsewhere in the species' range.

TOWARDS FORMATION OF A PACIFIC NORTHWEST PEATLAND FORUM. **John A Christy.** *Oregon Natural Heritage Information Center, Oregon State University, 1322 SE Morrison St., Portland, OR, 97214-2423*. **john.christy@oregonstate.edu**

Peatlands are rare features in the Pacific Northwest and contain a variety of plants and animals found nowhere else in the landscape. An estimated 50 % of sphagnum mires in western Oregon, Washington, and southwestern British Columbia have been lost to development since 1930. The remaining sites are in serious trouble as losses continue to occur despite wetland regulations and nominal protection of many sites as natural areas. Plant succession and altered hydrology are converting remaining open fens to tall shrub and forest stands in as little as 25 years. With a few exceptions, almost nothing is known about amphibian, small mammal, and invertebrate populations in these habitats. Inventory, active management, and restoration are essential if our peatlands and their biota are to be preserved. Recent work at several sites in the region has generated information that can be applied to other peatlands in our area, and a

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regional Peatland Forum is proposed to facilitate dissemination of existing knowledge and initiate new research. Periodic meetings, workshops, and web-based resources are venues where issues relevant to the Pacific Northwest can be provided to those interested in peatland conservation.

QUANTIFYING SPATIAL VARIATION IN FIRE REGIMES OF THE SOUTHERN ROCKY MOUNTAIN TRENCH: SOUTH VERSUS NORTH ASPECTS. **Jed Cochrane, Lori Daniels** *University of British Columbia, Dept. of Geography*

Knowledge of the natural disturbance processes affecting forested landscapes is essential to any forest management plan, whether the objective is timber production, wildlife conservation or wilderness management. Spatial variation in forest fire regimes is an important source of environmental heterogeneity and species diversity. We examined topography as a control on spatial variation in the mixed conifer forests of southeastern British Columbia by stratifying stands by aspect (warm: 165° - 285° and cool: 345° - 105°) and randomly selecting twenty plots from across the landscape. Each plot, one hectare in size, was sampled for fire history by collecting an average of nine fire scarred trees, stumps or logs. Dates were assigned to fire scars using visual cross-dating techniques (28%) or COFECHA (72%). In this presentation, fire frequency is compared between four warm and four cool plots. The Weibull median fire interval was longer for the warm plots (average = 54 years, ranging from 16.8 to 88.3 years) compared to the cool plots (average = 40.5 years, ranging from 27.1 to 50.8 years). The longer fire interval associated with the warm plots may reflect small sample sizes or a reduced fire intensity associated with more frequent fires and fewer recorded events. The time since last fire at all eight plots ranged from 21 to 123 years and averaged 83.3 years. The time since fire exceeds the Weibull mean interval at all plots except one, suggesting that these stands have deviated from the historical frequency.

LINKING WATERSHED CHARACTERISTICS AND STREAM CONDITION IN WESTERN OREGON. **Jana E. Compton,** *U.S. Environmental Protection Agency, NHEERL-WED, 200 SW 35th St., Corvallis, OR 97330***, and Effie A. Greathouse,** *Independent Contractor, 200 SW 35th St., Corvallis, OR 97330***. Compton.jana@epa.gov**

This work examines the influence of human activities and natural processes on stream chemistry in western Washington and Oregon. We are currently developing a database and a statistical approach to examine relationships between landscape characteristics and stream chemistry. The initial goal is to develop landscape-stream chemistry relationships that apply to the Oregon Coast Range, using existing stream chemistry data and landscape layers such as land cover, soils and geology. The relationships and predictions linking landscape characteristics and stream condition for this physically and biologically complex region will be compared with model outputs from ongoing modeling work at EPA. There are two long-term goals of this project: 1) to produce estimates of nutrient loading to rivers and coastal waters in western Oregon and Washington, and 2) to use these linking relationships to predict future stream chemistry based on trajectories for human populations, restoration and land-use activities.

USING MOLECULAR GENETICS TO ASSESS POPULATION CONNECTIVITY FOR BLACK BEARS **Samuel A Cushman, Michael K. Schwartz , Kevin McKelvey.** *USDA Forest Service, RMRS, 800 E Beckwith, Missoula, MT 59801***; Jim Hayden,** *Idaho Department of Fish and Game, Couer D'Alene, ID 83815***; scushman@fs.fed.us**

By linking cost modeling to the actual patterns of genetic similarity among individuals it is possible to obtain rigorous, empirical models describing the relationship between landscape structure and gene flow, and to produce species-specific maps of landscape connectivity. In this study we compared the patterns of genetic similarity among 146 individual black bears (*Ursus americanus*) sampled across a 3,000 square kilometer study area in northern Idaho, USA, with 110 landscape resistance hypotheses. The landscape resistance hypotheses describe a range of potential relationships between movement cost and landcover, slope, elevation, roads, Euclidean distance and a putative movement barrier. Only one of the competing models was fully supported. This model predicts gene flow to be significantly related to landscape resistance gradients, with no significant partial relationship with Euclidean distance or landscape barriers. The most highly supported models show an apparent optimum at middle elevation with strong positive relationships to forest cover. Testing only a few simple models, such as distance or putative barriers is

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common in population genetics. However, landscapes are perceived uniquely by an individual species in ways that may not correspond to our assumptions of connectivity. Thus, it is essential to test a range of potential relationships between gene flow and landscape structure to determine the factors that influence gene flow for a given species. Our results show that landscape gradients of landcover and elevation are primarily related to observed patterns of genetic structure, and that alternative landscape models, isolation by barriers and isolation by distance are not supported.

TEMPORAL VARIATION IN FIRE HISTORY OF THE SOUTHERN ROCKY MOUNTAIN TRENCH: 1700-2000. **Lori D Daniels, Jed Cochrane.** *Department of Geography, University of British Columbia, 1984 West Mall, Vancouver, BC V6T 1Z2*; **Robert W Gray,** *RW Gray Consulting Ltd, Chilliwack BC V2R 2N2*; **daniels@geog.ubc.ca**

We used tree rings to reconstruct the fire history of 10 stands dominated by western larch, Douglas-fir, and ponderosa pine trees in the southern Rocky Mountain Trench of British Columbia. The 77 fire scar samples from nine of the 10 study sites yielded 204 fire scars and 70 unique fire dates from 1567 to 1944. Scars were recorded at only one site for 59 of 70 fire years. Notable years in the fire record occurred in years when a large number or percent of trees were scarred and fires scarred trees at more than one site. The highest scar frequencies were in 1720 and 1889, when 60% and 28% of recorder trees were scarred at three different sites. Fires that caused scars at two or more sites burned in 12 years from 1652 to 1922. For individual sites, the fire scar records ranged from 177 to 470 years and included 13 to 37 fire scars, which represented four to 14 fire intervals. The Weibull median probability intervals (WMPI) ranged from 13.8 to 32.4 years and two to 102 years separated successive fires at each site. The current fire-free intervals ranged from 61 to 121 years and generally exceed the historic range of variation for the study stands. Over the last three centuries, the highest fire frequencies and shortest intervals between fires were during the settlement era from 1870 to 1939. Prior to the 1870, mean fire intervals significantly longer than fire intervals during the settlement era, likely reflecting the influence of land-use and climate variation on fire frequency.

MOVEMENT PATTERNS OF ADULT WESTERN TOADS, BUFO BOREAS, IN FRAGMENTED LANDSCAPES: ARE CLEAR-CUTS BARRIERS TO MOVEMENT? **Isabelle Deguise, John S. Richardson.** *Centre for Applied Conservation Research, University of British Columbia, Vancouver, BC V6T 1Z4*; **ideguise@interchange.ubc.ca.**

Habitat fragmentation continues to rise and its impact on movement patterns are key to understanding population dynamics in disturbed landscapes. We radio-tracked 23 western toads, Bufo boreas, in a landscape consisting of forest and matrix patches to investigate the permeability of clear-cuts (CC) and their influence on movement behaviour. Preliminary results show that clear-cuts are not barriers to toad movement and appear favoured as habitat. Toads were found to orient themselves towards the forest/CC edge and actively move into clear-cuts from neighbouring forest patches. Movement parameters, such as net displacement and movement rate, were not different between forest and matrix habitat. However, 24% of toads did use logging roads during the course of this study and movement parameters on this habitat type were significantly greater than in the forest and matrix. In addition, the number of days toads stayed in their release patches before dispersing into the surrounding landscape was significantly higher in clear-cuts than in forests. These results indicate that western toads are not restricted by clear-cuts under 5 hectares in size and movement occurs equally well in forested and matrix habitat. This study confirms that Bufo boreas is a generalist species that prefers disturbed environments.

HBC: HIT BY CAR - VERTEBRATE MORTALITY AT BC WILDLIFE REHABILITATION CENTRES FROM 1990-2001. **Sara D Dubois.** *BC SPCA Wild Animal Rehabilitation Centre, 1020 Malloch Road, Victoria, BC V9C 4G9*, **info@wildarc.com**

A survey of records from 11 BC wildlife rehabilitation centers between 1990-2001 indicates that vehicle impact is the second leading cause of injury of vertebrates, and is likely responsible for many of the orphaned animals brought into care. Successful rehabilitation rates vary based on degree of injury, species, and facility. Recent case histories from BC's second largest centre, the Wild ARC in Victoria BC, will be highlighted. Twenty-two government permitted wildlife rehabilitation centers in BC treat

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over 18,000 injured, orphaned, sick, and pollution-damaged wild animals annually. Theses non-profit organizations are generally the first responders to wildlife emergencies in their communities, answering nearly wildlife-related 100,000 phone calls annually. The Wildlife Rehabilitators Network of BC is a volunteer board that plays the role of an umbrella organization for the centers, assisting with areas of governance, communications and animal care.

IMPACT OF BROOM REMOVAL ON GRAZING PRESSURE OF WHITE-TOP ASTER ON MILL HILL, VICTORIA, BC. **Christian Engelstoft,** *Alula Biological Consulting, 1967 Nicholas Road, Saanichton, BC, V8M 1X8, Canada***; alula.bc@telus.net**

This study assessed the grazing pressure of the threatened white-top aster (*Aster curtus* or *Sericocarpus rigidus*) in Mill Hill Regional Park as Scotch broom (*Cytisus scoparius*) was removed. Black-tailed Deer (*Odocoileus hemionus columbianus*) and Eastern Cottontail (*Sylvilagus floridanus*) grazing pressure was separated by constructing grazing exclosures around white-top aster shoots that provided access to one or the other species. The cottontail and deer populations were estimated by using pellet or pellet group counts, respectively, and we initiated a pilot pellet deterioration study during the last year of the study. The results of this project suggest that white-top aster is relatively heavily grazed upon by both cottontail and deer and that broom removal causes a decrease in the cottontail population. The only exclosure type with a decline in white-top aster shoot numbers over the three years was the exclosure where both species had access. This suggests that other white-top aster sub-populations on Mill Hill are likely declining due to grazing pressure. By contrast, we found that there was almost a doubling in the white-top aster biomass index (height of shoot) over the three years in the protected exclosures. We found no fecal pellet deterioration over the summer. Cottontail pellets, however, disappeared in other ways which raised questions about the interpretation of the pellet count data. We found a summer density equivalent of 40-49 deer/km^2 and 3-5.7 rabbit pellets/m^2, whereas during the winter of 2005-06 the densities were 15 deer/km^2 and 1.1 rabbit pellets/m^2.

THE CANADIAN GLOBAL CLIMATE MODEL: DEVELOPMENT AND FUTURE PROJECTIONS **Gregory M. Flato,** *Canadian Centre for Climate Modelling and Analysis, Environment Canada PO Box 1700 University of Victoria Victoria, BC V8W 2Y2***, Greg.Flato@ec.gc.ca**

Global climate models represent the three-dimensional climate system. They are based on physical laws as expressed and approximate, to the best of our ability, the basic functioning of the global climate system. The recent trend is toward so-called 'Earth System Models', which represent biogeochemical cycles along with the physical system. This talk will provide a brief overview of the Canadian Global Climate Model, and some examples of how the model is evaluated by comparison with present and historical observations. Some results of future climate change projections will be shown. The talk will conclude with a brief discussion of future trends in climate model development.

SHOOTS WITH ROOTS - HELPING COMMUNITY 'SHOOTS' MAKE AND MEET 'ROOTS'. **Charlene Forrest** *Program Co-ordinator, Milner Gardens & Woodland-2179 West Island Highway, Qualicum Beach, BC, V9K 1G1***, www.milnergardens.org. charleneforrest@hotmail.com.**

Milner Gardens & Woodland (MGW) is an estate garden and woodland property in Qualicum Beach, on Vancouver Island. Opened to the public as a botanical garden in 2000, the property's 60 acres of old- and second-growth woodland partnered with the magic of the 10 acres of "Artist's Garden" is not only rich in nature's wonders, but is also linked to important local and global social history. Now in its sixth year as a not-for-profit operation, MGW has a handful of seasonal staff, over 240 volunteers, more than 2000 members and a vast array of supporters. It educates and inspires approximately 18,500 visitors per year. MGW has created and effective hands-on education program for the younger members if its community. The Shoots with Roots (SwR) program began in 2003 and uses the features of the property to introduce children to the wonders of nature, and of the tools used to learn more about it, and to work with it. There are multi-visit onsite school programs (preschool-Grade 7), school break camps, group field trips, birthday parties and offsite outreach programs. Participants explore the native flora, fauna and lore, practice outdoor safety; and they cultivate a fantastic children's food garden. In their Woodland Research duties participants collect field notes while monitoring the Eagle Nest, sand trap track beds,

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remote camera systems and amphibian habitat. They are also responsible for creating a SwR herbarium of native flora, and interpretive sign material.

APPLICATION OF A COASTAL LANDFORM CLASSIFICATION GIS DATABASE TO WASHINGTON STATE PARKS IN THE PUGET SOUND. **Anthony Gabriel, Cinde Donoghue, Andrew Perkins, Janet Rhoades, Melissa Blackburn.** *Center for Spatial Information, Department of Geography & Land Studies, Central Washington University, Ellensburg, WA 98926-7420*; **gabriela@cwu.edu.**

A process-based coastal landform classification GIS database using existing data sources was developed for Washington's Puget Sound shoreline. A geo-database was used to compile a wide variety of data sources for analysis, including historical and current aerial photographs (oblique and vertical) as well as information on topography, hydrology, slope stability, drift cells, coastal dynamics, and other relevant shore zone information such as sediment type and abundance. The classification breaks the shoreline into a nested hierarchy of segments that relate to the physical processes important in determining geomorphology and shape. The resulting classification distinguish between the beachforms and upland forms, including further distinctions such as anthropogenic modifications and whether they are depositional, stable or erosional These smaller features are further nested into beachform and upland form groups, which identify larger process-based geomorphic systems. The classification is a critical basis for understanding how different shoreline types are formed and how susceptible they are to change and various impacts. A case study application of the classification to Washington State Park shorelines demonstrates its utility as a planning tool for assessing the links between geomorphic processes and land forms and the ecological functions related to the wide diversity of marine shorelines found in the Puget Sound.

INDIRECT EFFECTS OF UV-B RADIATION ON LARVAL AMPHIBIAN COMPETITION ACROSS AN ELEVATION GRADIENT. **Tiffany Sacra Garcia,** *Oregon State University, Department of Fisheries and Wildlife, Corvallis, OR 97331*; **Rebbecca Hill, Andrew R Blaustein.** *Oregon State University, Department of Zoology, Corvallis, OR 97331;* **tiffany.garcia@oregonstate.edu**

Direct effects of UV-B radiation on amphibian larvae, (i.e. changes in density, distribution and behavior) can lead to indirect impacts on other members of the community, including competing amphibian species. If sympatric amphibian species differ in susceptibility to damage from UV-B radiation, stress-induced changes in larval growth and development rates could indirectly favor UV-B resistant species. We tested the effects of UV-B radiation on competing larval amphibian species at both high and low elevations. *Hyla regilla* are sympatric with two species of *Rana*: *Rana aurora* at low elevations and Rana cascadae at high elevations. *Hyla regilla* larvae are relatively resistant to UV-B damage but are inferior competitors relative to *R. aurora* and *R. cascadae* in lab experiments. These two *Rana* species, however, are susceptible to UV-B damage. Therefore, in UV-B exposed environments, the competitive outcome was predicted to shift away from *Rana* to favor *Hyla*. Using mesocosms (150 L tubs) and a 2x3 factorial design, we quantified growth and development in amphibian larvae in experiments conducted at high (4,200 m) and low (200 m) elevation sites. Treatments included two UV-B exposure regimes (present, absent) and three species combinations (*Hyla* alone, *Rana* alone, both species) with a total of 50 individuals in each tub. In the low elevation experiment, *Hyla* significantly increased growth rates when competing with R. aurora larvae relative to other *Hyla* larvae, regardless of UV-B exposure. In the high elevation treatment however, the competitive outcome was reversed in response to UV-B presence, with *Hyla* out-competing R. cascadae only in UV-B exposed tubs.

PATHOPHYSIOLOGY OF Batrachochytrium dendrobatidis. **Christopher A Gaulke, Jason T Irwin, Jim Johnson, R Steven Wagner.** *Central Washington University, 400 E University Way, Ellensburg, WA 98926*; **gaulkec@cwu.edu.**

The fungus *Batrachochytrium dendrobatidis* has been linked to the decline of amphibians worldwide. Research has been devoted to examining the range of *B. dendrobatidis* and various physiological aspects of the fungus; however, little is known about how it causes mortality in individuals. Therefore, we

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investigated the potential mechanisms of mortality by examining the pathogen's effect on metabolic rate and osmotic balance. *Rana pipiens* (N = 14) and *Hyla regilla* (N =14) were screened for *B. dendrobatidis* using PCR and microscopy, and each individual was housed separately to avoid cross-contamination. Every three days individuals were monitored for symptoms of illness, weighed, and had urine samples taken (*R. pipiens* only). Preliminary results suggest that infected individuals do not always display symptoms. In addition, mail ordered Rana pipiens may be a source of the spread of Bd and we urge containment of potentially infected individuals.

TRACKING MARINE SPECIES AT RISK IN THE GEORGIA BASIN PUGET SOUND: VALUE OF AN ECOSYSTEM-BASED APPROACH. **Joseph K Gaydos, Nicholas A. Brown.** *The SeaDoc Society, UC Davis Wildlife Health Center - Orcas Island Office, 1016 Deer Harbor Rd., Eastsound, WA 98245*; **Kirsten V. K. Gilardi,** *The SeaDoc Society, UC Davis Wildlife Health Center, 1 Shields Avenue, Davis, CA 95616*; **jkgaydos@ucdavis.edu**

Within the Georgia Basin Puget Sound marine ecosystem, four governmental jurisdictions list species at risk of extinction: the Province of British Columbia, the State of Washington, the Canadian Federal Government, and the United States Federal Government. Since September 2002, the SeaDoc Society has tracked marine species in this ecosystem that are listed by one or more jurisdiction as threatened, endangered, species of concern or candidates for listing. An ecosystem-based list of marine species at risk serves as a crude indicator of ecosystem health, permits cross checking of species of concern between jurisdictions, suggests where more research is needed and highlights where transboundary approaches could benefit species recovery. Since 2002 the number of species at risk has slowly advanced from 60 species in 2002, to 63 in 2004 to 64 species in 2006. As expected, all jurisdictions underestimate the total number of species at risk within the ecosystem however the percentage of total species listed by each jurisdiction has not altered significantly from year to year. Using unpublished data on species richness for the ecosystem, approximately 0.1% of invertebrates (3/3000), 12% of fishes (27/219), 19% of birds (24/128) and 45% (9/20) of mammals that utilize the Georgia Basin Puget Sound marine waters are at risk. This is concerning and suggests what we really have is an ecosystem at risk. Efforts need to be enhanced to more rapidly address regional species declines and to institute multi-species ecosystem-based solutions where possible.

SPATIO-TEMPORAL ANALYSIS OF WESTERN SPRUCE BUDWORM DYNAMICS IN THE INTERIOR DOUGLAS-FIR ZONE, BRITISH COLUMBIA. **Ze'ev Gedalof,** *Climate and Ecosystem Dynamics Research Laboratory, Department of Geography, University of Guelph, Guelph, ON N1H 2H1*; **André Arsenault,** *BC Minsitry of Forests, Southern Interior Forest Region, 515 Columbia Street, Kamloops, BC V2C 2T7*; **Dan J Smith,** *University of Victoria Tree-Ring Laboratory, Department of Geography, University of Victoria, Box 3050, Stn. CSC, Victoria, BC V8R 3P8*; **zgedalof@uoguelph.ca**

The purposes of this research were (1) to quantify the degree to which climatic variability controls the timing and severity of western spruce budworm outbreaks in BC; (2) to assess the extent to which wildfire events precondition stands to infestation by western spruce budworm; and (3) to forecast future changes in the frequency and magnitude of western spruce budworm outbreaks using regionally downscaled climate scenarios. Two parallel analyses were undertaken to address these questions. First, the observed record of western spruce budworm was analyzed to provide insights into regional patterns and trends. Secondly, tree-ring reconstructions of western spruce budworm outbreaks from ten sites distributed throughout the Interior Douglas-fir zone were analyzed to provide insights into site-specific relationships, and to provide a longer context for the assessment of disturbance dynamics. We found that regional outbreaks are associated with antecedent wet conditions - consistent with studies from other regions, but not some locales in BC. In contrast, the tree-ring reconstructions of site-specific western spruce budworm outbreaks revealed a range of responses to climatic conditions. Stand conditions seem to explain some of this variability, with more xeric sites showing increased infestations during wet intervals, and more mesic sites exhibiting an approximately opposite response. Dispersal limitations and population dynamics of the western spruce budworm probably play an important role in modulating this susceptibility. Western spruce budworm outbreaks appear to be less likely in the decade following

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wildfire than they are in the decade preceding wildfire. Given these findings, future sensitivities will be difficult to predict.

PLANT BIOGEOGRAPHY AND FLORISTICS OF THE SAN JUAN ISLANDS. **David E Giblin,** *University of Washington Herbarium, Seattle, WA 98195; Peter W Dunwiddie, The Nature Conservancy, Seattle, WA 98101;* **Ben S Legler,** *University of Washington Herbarium, Seattle, WA 98195*. **dgiblin@u.washington.edu.**

Significant gaps remain in our knowledge regarding the diversity and distribution of vascular plants throughout the 172 islands comprising the San Juan Archipelago. In 2005, we initiated comprehensive botanical surveys of the smaller islands (0.02-19 ha) in this chain. To generate complete species lists for each island, we surveyed at different periods of the growing season, vouchered all fertile species encountered, and listed all sterile species observed. Through the 2006 field season, we have made over 2,500 collections from 54 islands, have located more than 20 new localities for state-listed taxa, and have discovered the first known U.S. population of a newly described species in the genus Castilleja (Indian paintbrush) that is endemic to the region. Overall, 72% of the species surveyed were native, but this percentage varied widely among islands (44-100%). Species richness increased as a function of island area, but the rate of increase was greater for native species than it was for nonnatives. We discuss these results in the contexts of regional plant conservation, island biogeography theory, and baseline data for future changes in the Archipelago's flora. Results from this study represent an important contribution to ongoing floristics and conservation efforts in the San Juan Islands in particular, and the Puget Sound lowlands in general. Moreover, these data will be of special interest to current and future researchers wishing to study the effects of disturbance and climate change on insular floras.

FLORISTIC SURVEYS OF LICHENS ON THE SMALL ISLANDS IN THE SAN JUAN ARCHIPELAGO, WASHINGTON STATE. **Katherine Glew,** *Lichen Collection, Herbarium, Box 355320, University of Washington, Seattle, WA 98195*; **kglew@u.washington.edu**

During the years of 2005 and 2006, the University of Washington Herbarium organized collection forays to the small islands of the San Juan Archipelago. These forays were funded by The Nature Conservancy, Bureau of Land Management and private donors. The purpose of the forays was to determine the lichen, plant, and bryophyte diversity of the smaller islands, often inhabited only by animals or occasional owners. Several of the islands are marine parks for day use only. There are 172 islands in the San Juan Archipelago and it was expected that the new collections would fill some of the voids in our knowledge regarding the lichen species found in the islands. Lichens from the 4 larger islands (San Juan, Orcas, Shaw, Lopez) were collected in 1998, by the author. To date, 25 small islands were surveyed for lichens. Several of the genera prefer the small rocky islands inhabited by marine birds, showered in nitrogenous waste. Caloplacas display their highest diversity along the shoreline. Thelomma mammosum is common on these rocky islands but rarely seen on the larger islands. Niebla cephalota was frequently found on conifers and small woody shrubs by shoreline. A new species of Sagiolechia was found on several of the islands, intermittently on oak and driftwood. It is hoped that this project will facilitate the development of priorities and policies for protecting these small island ecosystems.

WESTERN RATTLESNAKE (*Crotalus oreganus*) USE OF SUMMER HABITATS IN THE INTERIOR OF BRITISH COLUMBIA. **Lita M Gomez, Patrick T. Gregory.** *University of Victoria, Victoria, BC, V8W3N5*; **Karl W Larsen,** *Thompson Rivers University, Kamloops, BC, V2C5*; **lgomez@uvic.ca**

The western rattlesnake (*Crotalus oreganus*) uses the low-lying grassland habitats in the southern interior of British Columbia for overwintering and foraging. These habitats are being increasingly altered and fragmented by urbanization and agricultural land use practices. Although habitat loss poses a major threat to the persistence of this species, there has been no rigorous evaluation of which habitats are essential to western rattlesnakes. In response to this need, we undertook a two year study on habitat use and movements exhibited by the snake in the interior of BC. We radio-tracked 12 adult male rattlesnakes and at each location point, we recorded habitat characteristics that potentially could have an effect on snake behaviour (e.g. thermoregulation, predator avoidance). We used logistic regression to determine

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which localized features best described rattlesnake habitat during the summer season. At a larger scale, our research has shown that some rattlesnakes use areas not previously considered typical rattlesnake habitat (e.g. low-lying grasslands and higher elevation Douglas-fir forests). We highlight the need for more research to determine whether the pattern of habitat use detected in our study occurs throughout the range of the western rattlesnake.

MOVING BEYOND CONTROL IN THE MANAGEMENT OF INVASIVE SPECIES: CASE STUDY OF THE AMERICAN BULLFROG (RANA CATESBEIANA). **Purnima P Govindarajulu,** *Department of Biology, University of Victoria, PO Box 1700 STN CSC, Victoria, BC V8W 2Y2*, **Canada; purnimap@uvic.ca**

The need to design effective management strategy for invasive alien species (IAS) is now considered a conservation priority. Prevention of arrival and establishment, eradication of incipient populations, and control and containment of established populations are sequentially the best management strategies for IAS, going from most effective to less beneficial. However, management is often not initiated until invasive populations are well established and most efforts are focused on the last option of the above sequence. This is the case of the introduced bullfrog (*Rana catesbeiana*) in western North America. Introduced bullfrog populations were well established in the early part of the 20th Century but were not recognized as a potential threat to native amphibians until almost half a century later. In most cases, control efforts were not initiated until the 1990s. Using population matrix models, I examined how changes in vital rates brought about by the control efforts affect growth rate of bullfrog populations. Prospective demographic perturbation analysis showed that bullfrog population growth rate ( ) was most influenced by the proportion of tadpoles metamorphosing early (tadpole development rate), and by early post-metamorphic survival rates. The modelling showed that some control efforts might not be very effective due to compensatory responses in these two vital rates, making eradication of bullfrog populations close to unfeasible. On a more optimistic note, recent research shows that habitat modification may be used to maintain native amphibian diversity at the landscape level in the continued presence of bullfrogs.

KEEPING STILL TO AVOID PREDATION? IMMOBILITY AS A RESPONSE TO HANDLING IN SNAKES. **Patrick T Gregory.** *Department of Biology, University of Victoria, PO Box 3020, Victoria, BC, Canada V8W 3N5*; **viper@uvic.ca.**

Most studies of anti-predator behaviour in animals focus on avoidance of capture, but, given the common occurrence of injuries in many species, escapes from predators' clutches apparently do occur. Once caught, an individual's options for escape obviously are limited, but one response to capture in some snakes is to feign death. Death-feigning is spottily distributed across various taxa of snakes, but is well known in hognose snakes (Heterodon) and in the grass snake (*Natrix natrix*). At a study site in southern England, about 2/3 of captured grass snakes exhibit some degree of death-feigning, which often involves voluntary supination and is affected by several factors, including amount of handling. Although death-feigning is unusual behaviour, it is best viewed as an elaboration of simple tonic immobility, which is widespread in nature. For example, garter snakes (*Thamnophis*) often remain immobile for some time following routine handling. In a study of this behaviour in *Thamnophis elegans* in British Columbia, 24% of captured snakes remained immobile for minimum times of 10-600 s following handling. Of these, ½ remained supine when placed in that position. Immobility and supination were most frequent in gravid females; presumably, the reduced locomotory capabilities of gravid females sometimes force them into alternative anti-predator tactics rather than immediate attempts to flee. At first glance, immobility in the face of extreme danger seems maladaptive, but a review of the literature suggests that it can buy time to escape from predators that do not kill and eat their prey immediately.

DISTRIBUTION SURVEYS AND HABITAT MODELS IMPROVE KNOWLEDGE OF THE EXTENT AND CAUSES OF RECENT DECLINES OF THE OLYMPIC MARMOT. **Suzanne C. Griffin,** *Wildlife Biology Program, College of Forestry and Conservation, University of Montana, Missoula, MT 59802*; **Roger Hoffman,** *Olympic National Park, Division of Natural Resources, 600 Park Avenue, Port Angeles, WA 99362*; **Mark L. Taper,** *Department of Ecology, Lewis Hall, Montana State University, Bozeman, MT 59717*; **L. Scott Mills,** *Wildlife*

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Biology Program, College of Forestry and Conservation, University of Montana, Missoula, MT 59802. **olympicmarmots@aol.com.**

Olympic marmots (*Marmota olympus*) are large, ground-dwelling squirrels endemic to the Olympic Mountains. Over the last 25 years, marmots have disappeared from several long-occupied sites in the northeastern Olympics. These local extinctions raised concerns about the range-wide status of the species, and in 2002 -2005 we conducted distribution, demographic and genetic studies within Olympic National Park. The objectives of the distribution survey were to determine the marmot's current and recent distribution; to develop a model to identify suitable habitat; and, if the declines were extensive, to investigate spatial and habitat patterns of the abandoned sites relative to the occupied sites. We initially identified open habitats >1400 m as potentially suitable for marmots, subdividing patches by aspect. We surveyed 23% of the resulting polygons, classifying them as "occupied" (n=219), "abandoned" (n=110), or "no sign" (n=485). The abandoned sites were concentrated in the northeast and the south. When marmots or burrows (active or abandoned) were found, a subset of these locations was recorded with GPS. We are using Mahalanobis distance models to refine our models of suitable habitat. Mahalanobis distance models require only presence data, making no assumption about the quality of the unoccupied habitat. Thus, they are useful when non-habitat related extinctions have resulted in suitable habitat being unoccupied, or when detection probability is less than one. Because we found a large number of apparently abandoned sites, relative to the occupied sites, we will create a similar model of potential abandoned habitat to help clarify the causes of the decline.

SECONDARY FIRE EFFECTS ON SNOWBERRY-ROSE SPP. PLANT ASSOCIATION IN THE CANYON GRASSLANDS OF NORTH-CENTRAL IDAHO. **Brenda L Guettler, Stephen C. Bunting.** *Department of Rangeland Ecology and Management, University of Idaho, Moscow, ID 83844;* **brendag@uidaho.edu, (208) 885-6536.**

The snowberry-rose (*Symphoricarpos albus-Rosa* spp.) plant association is a significant component of the canyon grasslands of Hells Canyon. The Corral Creek fire of 2001 burned 645 ha of the Corral Creek drainage within the Garden Creek Nature Preserve which is located on the west side of Craig Mountain in Nez Perce County, Idaho. Ten unburned and 10 burned plots were sampled in order to compare cover of shrubs, grasses, forbs, and ground cover. The line intercept method was used to measure shrub cover and a modified Daubenmire cover class method was used for grass and forb cover. Snowberry cover was lower on burned plots while rose cover was not different. Total grass cover was not different across treatments. Japanese brome (*Bromus arvensis*)/cheatgrass (*Bromus tectorum*), had higher cover on burned plots. Rattlesnake brome (*Bromus briziformis*) cover was higher on unburned plots. Total forb and total herbaceous cover was not different. Western yarrow (*Achillea millefolium*), slender cinquefoil (*Potentilla gracilis*), Missouri goldenrod (*Solidago missouriensis*), spring draba (*Draba verna*), and Lewiston cornsalad (*Valerianella locusta*) had higher cover on burned plots. Bedstraw (*Galium aparine*) and winter vetch (*Vicia villosa*) were higher on unburned plots. Bare ground was higher in burned plots while lichen and moss cover was lower in the burned plots. Litter was not different between treatments. Litter recovery shows resilience of this plant association following fire. Species composition was different across the treatments which probably resulted from the change in resources and competition following the fire and variable species responses to fire.

WETLAND MITIGATION ALTERNATIVES UTILIZED BY THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. **Brooke Hamilton.** *Washington State Department of Transportation, Olympia, WA 98504***; hamiltb@wsdot.wa.gov.**

WSDOT utilizes wetland mitigation alternatives such as wetland banking and advanced mitigation to better address watershed needs, improve habitat connectivity, and decrease site management challenges. These alternative approaches to wetland mitigation create/re-establish, rehabilitate/enhance and preserve wetlands prior to impacts caused by transportation projects. Wetland Banking can be considered as a "mitigation savings account". Banking is consolidated mitigation, set-up (site established) in advance of impacts that earn credits by successful achievement of performance standards over a period of time. Credits are the "money" in the account that can be debited for projects within the service area of bank. However, utilizing a bank for a project w/ impacts is not a get-out-of-jail-free card. Each WSDOT highway project still has to go through avoidance and minimization steps before trying to

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use the bank. There are many ecological benefits associated w/ wetland banking. Wetland banking provides an opportunity to link habitats by establishing larger wetland complexes than traditional postage stamp mitigation. Larger sites are established before impacts occur. Sustainability of a site is increased. Decreased buffer area and better replacement ratios than traditional mitigation are also benefits if banking that can save money. WSDOT has three banks site across the state: two functioning wetland bank sites (rural) and one bank site (urban) slated for construction this summer.

THE MOSS FLORA OF THE SAN JUAN ISLANDS, SAN JUAN COUNTY, WASHINGTON. **Judith Harpel,** *Bryophyte Collection, Herbarium, Box 355320, University of Washington, Seattle, WA 98195***; wjharpel@earthlink.net**

Prior floristic work on bryophytes in the state of Washington has been confined mostly to the mainland with little information available for the San Juan Islands. Four years of field work and an extensive search of historical records from herbaria throughout the region, show that the San Juan Islands contain a diverse moss flora within a small geographic area. While the bulk of this flora consists of circumboreal species, the islands also can be interpreted as a "modern" refugium for southern Mediterranean type climate species. This flora consists of 224 species and varieties, 33 families and 97 genera. Four species, *Drepanocladus crassicostatus, Orthotrichum hallii, Tortula papillosa* and *Tortula lavipila* var. *meridionalis* are reported new for the State of Washington. Tortula lavipila var. meridionalis is new for the United States and represented the second North American location. Recent forays over the last two years, organized by the University of Washington Herbarium and funded by The Nature Conservancy, Bureau of Land Management and private donors have added additional ecological information and new locations for several species. This increased distribution data is helpful in determining the appropriate conservation strategies for these taxa.

MITIGATING THE IMPACTS OF ANIMAL-VEHICLE COLLISIONS WHILE MAINTAINING PERMEABILITY ON MAJOR HIGHWAY CONSTRUCTION PROJECTS IN BRITISH COLUMBIA. **William L Harper.** *Osiris Wildlife Consulting, 4399 Shore Way, Victoria, BC V8N 3V1***; Bill.Harper@shaw.ca**

Animal-vehicle collisions (AVCs) are becoming an increasing problem on modern highways with faster design speeds. The frequency of AVCs is primarily a function of four factors: 1) traffic volume, 2) traffic speed, 3) pattern of traffic flow, and 4) the abundance and distribution of animals. Upgrading a highway to four-lanes will increase average traffic speed and reduce vehicle "platooning" thus increasing the number of lead vehicles that are at greatest risk of striking animals. The 82 km long Okanagan Connector is a 4-lane divided freeway constructed in the late 1980s with a system of wildlife exclusion fencing (including 22 crossing structures) that has been 97% effective in preventing AVCs. A 2005 audit of this system indicated most of the crossing structures were functioning as intended, but problems were identified with structures that are shared with cattle or in areas with high levels of human disturbance. The Kicking Horse Canyon Project is twinning the Trans-Canada Highway between Golden and Yoho National Park. Data on roadkill pickups through the Wildlife Accident Reporting System estimated AVC rates ranging from 0.2 to 5.7 per km per year (mostly deer and elk) and RCMP records show wild animals were more likely than any other factor to contribute to reported accidents. To improve public safety and conserve wildlife resources, mitigation measures for reducing AVCs are being contemplated at the east and west ends of the project where AVCs are highest. Wildlife fencing, crossing structures (both underpasses and overpasses), ungulate guards and one-way earthen escape ramps are part of the mitigation measures being considered.

THE IMPORTANCE OF FOREST STRUCTURE AROUND NORTHERN GOSHAWK NEST SITES. **William L Harrower;** *Department of Biology, University of Victoria PO Box 3020 STN CSC Victoria, BC V8W 3N5***; Kari Stuart-Smith;** *Tembec Inc., BC Division PO Box 4600 Cranbrook, BC V1C 4J7***; Karl W Larsen** *Department of Natural Resource Science, Thompson Rivers University PO Box 3010 Kamloops, BC V2C 5N3***; harrower@uvic.ca**

In western North America, the northern goshawk (*Accipiter gentilis atricapillus*) is of concern due to its association with mature forest and the increasing fragmentation of these ecosystems. Goshawks

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use specific nesting areas consistently over multiple years and disturbance of these areas can result in abandonment of these sites. We compared the results of a nest site selection by adult breeding pairs to the habitat selection of fledgling goshawks in southeastern British Columbia, Canada. We examined 63 nesting events at 36 nest areas between 1998 and 2005 in order to describe the characteristics of forests and the extent of disturbance selected by breeding pairs at multiple spatial scales. We also radio-tagged 25 nestlings at 15 nest sites and followed their movements during the post-fledgling period in order to determine the type of forests selected by fledgling birds. We determined that although both adults and fledglings select older forest and avoided recently harvested areas they did tolerated some level of disturbance surrounding the nest. Fledgling movements can be restricted by forest alteration; however, adult goshawks prefer areas with larger amounts of mature forest at scales different than areas used by fledglings.

LONG-TERM MONITORING OF A DIVERSITY OF LOW-DETECTABILITY CRYPTOGAMS AT A PROVINCIAL-SCALE: PLAUSIBLE OR PIPE-DREAM? **Diane L Haughland.** *Department of Biological Sciences, University of Alberta, CW 405 Biological Sciences Centre, Edmonton, AB T6G 2E9*; **dianeh@ualberta.ca.**

The goal of the Alberta Biodiversity Monitoring Program (ABMP) is to systematically measure and report the status and trends of species and habitats in Alberta. Ideally, the ABMP will have the capacity to detect a minimum of 3% per annum change in a species' occurrence over three to four monitoring cycles (15-20 years) with 90% certainty. To achieve this goal at a provincial scale, the ABMP needs to balance three competing demands: while we desire to monitor a diversity of species, we require survey methods that are both quick and require little training to conduct, and protocols that produce data with a minimal amount of noise (i.e., high repeatability). Lichens and mosses, due to their size, plasticity, and cryptic nature, are perhaps the most difficult taxa for which to achieve this goal if we want to monitor more than common species. Here I report on preliminary power analysis exploring the ability of ABMP to meet their goal with current methods in the boreal forest. As well, I discuss a study in progress exploring how to better make this trade-off. Repeatability may be improved by focusing on certain microhabitats and/or altering the sampling methodology. I will report on the repeatability of two different sampling methods, as well as the species capture of each method. As well, I will report on whether certain microhabitats are more amenable to long-term monitoring than others, based on variability of species composition and responsiveness to human impacts.

VEGETATION COMMUNITIES OF EASTERN WASHINGTON INLAND SAND DUNES. **Ryan D Haugo, Rex Crawford, Lisa A Hallock,** *Washington Natural Heritage Program, Department of Natural Resources, 1111 Washington St. SE, Olympia, WA 98503*; **ryan.haugo@dnr.wa.gov, 360.902.1523**

Inland sand dunes of eastern Washington State support a number of plant and animal species uniquely adapted to habitats of shifting sand, extreme temperature changes and low moisture content. The 2003 Washington Natural Heritage Plan lists a globally rare (G1S1) dune community and fourteen associated rare plant and animal species. Many of these dune habitats, however, have been lost to agricultural conversion, urban development and inundation from reservoirs. In addition to direct conversion, loss of dune habitat is also occurring through stabilization and exotic species invasion. This study characterizes the variation in inland sand dune vegetation and the relationship between vegetation communities and the highly dynamic physical environment. Across eastern Washington 28 dune fields have presently been characterized through field sampling. Abundance of the dominant vegetation species and functional / physiognomic groups, dune position and relative ecological quality were quantified using variable-sized reconnaissance plots stratified by degree of sand activity. Community classification was based on DCA ordination and hierarchical clustering. Approximately 11 vegetation community types have been identified, relating strongly to dune position and degree of sand activity. Exotic, annual species were often dominant in late successional community types and present in early successional communities. Because sand deposition has stopped, the extent and quality of dune habitat and their associated species will be unable to recover. Further analysis of vegetation communities and assessment of ecological functioning will help provide the necessary details for conservation planning for this diminishing habitat.

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HABITAT RELATIONSHIPS OF AMPHIBIANS RELATIVE TO RIPARIAN MANAGEMENT ZONES IN WESTERN WASHINGTON STATE. **Virgil C Hawkes,** *University of Victoria, Department of Biology, Victoria BC, V8W3N5 and LGL Limited environmental research associates, 9768 Second Street, Sidney BC V8L 3Y8*, **vhawkes@lgl.com**

Riparian habitats in the Pacific Northwest are home to a diverse group of flora and fauna and are often more diverse than adjacent upland habitats. Similarly, the abundance of certain species can also be higher in riparian zones. Because of the unique and important habitats that riparian ecosystems provide, retention of riparian zones in managed forests has become increasingly important; however, the efficacy of riparian management zones in providing habitat for amphibians over the long-term has not been adequately studied. Riparian buffer width criteria used in the Pacific Northwest are based largely on the requirements of fish, not terrestrial animals and empirical data to support those criteria are lacking. Conservation of amphibians in forested habitats of the Pacific Northwest has been linked to the retention of riparian management zones around 3rd and 4th order streams; however, data in support of this link is non-existent. I evaluated the efficacy of riparian management zones in providing habitat for amphibians relative to adjacent upland logged areas over three time intervals: pre-logging, two years post-logging, and ten-years post-logging. I describe the habitat associations over the three sampling intervals for two common species *Plethodon vehiculum* and *Ensatina eschscholtzii* and an old-growth related species *Ascaphus truei* relative to logging and two different riparian buffer zone configurations. My data suggest that although riparian habitat is necessary to maintain amphibian diversity and abundance, the width of the buffers in my study was not important. Despite measurable changes in habitat structure and complexity, observed changes in relative abundance are likely regional rather than local and habitat alteration is only one of myriad possible explanations for the observed change.

DISEQUILIBRIUM, THE FUTURE OF NORTHWEST NORTH AMERICAN ECOSYSTEMS: INSIGHTS FROM THE PAST AND MODELS OF THE FUTURE. **Richard J Hebda.** *Royal British Columbia Museum, 675 Belleville Street, Victoria, BC V8W 9W2*; **rhebda@royalbcmuseum.bc.ca**

Climate change in this century will be of major amplitude, take place rapidly, involve extreme weather events and occur on an already disturbed landscape. The recent fossil record illustrates ecosystem responses to climatic forcing with an example of warmer-than-present climate in our region only 9000 years ago. We can expect rising tree lines, shrinking and changing wetlands, expanding grasslands, altered composition and structure of forests, and development of new ecosystems without modern analog. Ecological transformation will be driven by major shifts in species' ranges and abundance. Climate impact models show potential for Okanagan ecosystem climates to occur in the boreal zone of northeast British Columbia and adjacent Alberta by end of century. Western redcedar may disappear from southern lowlands within decades and Garry oaks thrive in northwest British Columbia. Climate will change much more rapidly than terrestrial plant species can adjust leading to extended climate-ecosystem disequilibrium. This BIG SQUEEZE may involve major population losses before expansions into new regions. Ecological transformation will be of such magnitude and scope that we have to shift from a species by species focus to one of understanding and fostering basic ecological process. For each ecosystem, identification and monitoring of essential characteristics, such as rates of primary productivity, hydrology, soil attributes is critical.

ASSESSING THE IMPACTS OF CLIMATE CHANGE ON COLONIAL SEABIRDS IN BRITISH COLUMBIA. **Mark Hipfner,** *Centre for Wildlife Ecology, Pacific Wildlife Research Centre. RR #1 5421 Robertson Road, Delta, BC , V4K 3N2*; **mark.hipfner@ec.gc.ca.**

Biological processes in the marine environment are being severely altered by climate change. As middle to upper trophic-level feeders, we can expect marine bird populations to be particularly affected. In Canada, very dramatic effects of climate change have been observed on populations of Arctic-nesting seabirds over recent decades, a consequence of ecosystem perturbations associated with sea ice recession. Not surprisingly, the impacts of climate change have been, to date, somewhat less overt for colonial seabirds in British Columbia. Nonetheless, observations made at Triangle Island since the mid 1970s provide a glimpse of what we might expect to see in coming decades as a consequence of climate

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change. At Triangle, warm-water seasons are associated with delayed breeding, reduced hatching and fledging success, reduced chick growth rates, greater variability in chick diets, and lower adult survival rates. Those demographic effects, which are associated with low ocean productivity, operate similarly on seabirds that feed across a range of trophic levels. Other, more subtle effects, such as offspring sex ratio adjustments, also occur in relation to ocean climate. Our capacity to predict future impacts of climate change on colonial seabirds will depend on research that addresses questions at a variety of levels, from individuals (behavioural and physiological ecology) to populations (demographics monitoring).

DIFFERENT COLOUR PATTERNS IN THE WESTERN TERRESTRIAL GARTER SNAKE, THAMNOPHIS ELEGANS - ARE THERE THERMAL BENEFITS AND/OR ANTI-PREDATOR BENEFITS? **Leigh Anne Isaac,** *Dept. of Biology, University of Victoria, PO BOX 3020 STN CSC, Victoria, BC V8W 3N5***; laisaac@uvic.ca**

Colours and colour patterns influence numerous aspects of an organism's ecology, including foraging ability, intraspecific communication, predator avoidance and thermoregulation. Optimal colouration for various functions may differ; thus, a particular pattern that is adaptive in one context may entail a fitness cost in another. Such tradeoffs or compromises should be common in nature, sometimes resulting in colour polymorphisms. In general, my research addresses the evolution of animal colour patterns, with specific reference to reptiles. I am interested in how snake colour patterns vary and what, if any, ecological variables are correlated with colour polymorphism. Also, I am also interested in the selective advantage that certain colour patterns may confer against potential predators in nature. Here I present preliminary results of an enclosure study in Creston, BC and Victoria, BC where I compared the thermal ecology of two morphs of the Western Terrestrial Garter Snake, Thamnophis elegans. Next, I present preliminary results from a field experiment in the same locations where I compared the relative predation rates on snake models of two different colour types of T. elegans.

MARINE SPECIES AT RISK IN NORTHERN BRITISH COLUMBIA, CANADA. **Glen Jamieson,** *Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo, BC, V9T 6N7, Canada***; Barbara Lucas,** *Lucas Research, Box 37054, 38 - 3200 Island Highway, Nanaimo, BC, V9T 6N4, Canada***; jamiesong@pac.dfo-mpo.gc.ca**

As part of a pilot marine integrated management initiative in Northern British Columbia, Fisheries and Oceans Canada has just completed initial drafts of documents that designate Ecologically Significant Species (ESSs) and Depleted Species (DSs). Designation does not confer any additional legislative protection for identified features at this time, but the intent is to facilitate the application of a higher level of protection and/or encourage more cautious risk assessment by managers of human activities impacting identified indigenous ESS, and possibly more aggressive management of alien ESS. The ESS initiative seeks to identify those species known or believed at this time to have ecological roles with greatest relative significance. DSs are those species that have been identified as at risk or particularly vulnerable, and therefore also warranting enhanced management consideration. Criteria used for identifying ESSs are briefly described, and initial identification of species and/or species groups proposed as ESSs are listed. Criteria used for identifying DSs are those species that have been assessed as at risk or that have been listed as particularly vulnerable to existing human activities by either Canada's Species At Risk Act (SARA); the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), where assessments have not been challenged by Fisheries and Oceans Canada (DFO), and can thus include currently non-listed species; the Accord for the Protection of Species at Risk (General Status of Species in Canada); the World Conservation Union (IUCN); or by the Province of British Columbia's Conservation Data Centre (Red List and Blue List).

CONSERVATION, IS IT POSSIBLE? OLIVE RIDLEY SEA TURTLES (*LEPIDOCHELYS OLIVACEA*) ON THE PACIFIC COAST OF COSTA RICA. **Jean W. Jang.** *Environment Canada - Canada Wildlife Service, Vancouver, BC V5X 1S4***; JeanJang@shaw.ca.**

Olive ridley sea turtles (*Lepidochelys olivacea*) are the most abundant marine turtle in the world. It nests in solitary fashion and in a synchronized flotilla commonly called 'arribada'. There are nine arribada beaches in the world: Costa Rica, Nicaragua, Panama, Mexico, Surinam and India. Their northern extent on the

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Pacific Coast is Washington with two carcasses found in Alaska. On Mexico's Pacific Coast it is listed as endangered and at other locations, threatened under the US Endangered Species Act. In Costa Rica, Ostional National Wildlife Refuge (ONWR) a 7 km rookery area supports on average 4-12 or more arribadas per year. Arribadas typically occur after every full moon. Monthly averages of nesting females range from 5,000 to more than 400,000 depending on the season. For generations the olive ridley sea turtle eggs have been harvested for local consumption by the community of Ostional. A community development association called ADIO was formed in 1984 to manage the egg harvest and distribute the benefits within the community. Eggs are sold at various farmer markets and cantinas across Costa Rica. Olive ridleys face many threats throughout its lifecycle. At Ostional, eggs are eaten by dogs, birds and the local community. Poaching of eggs occur on a regular basis. Hatchlings are vulnerable to predators such as black vultures and dogs. Further north on the US Pacific Coast, juvenile and adult sea turtles are threatened by incidental take in fisheries, boat collisions and cold stunning in Washington and Oregon.

A "TAIL" OF TWO STREAMS: ABUNDANCE & AGE CLASS DISTRIBUTION PATTERNS OF ROCKY MOUNTAIN TAILED FROG LARVAE IN TWO BIO-GEO-CLIMATICALLY DIFFERENT STREAM NETWORKS. **Jason L Jones, Charles R Peterson, Colden V Baxter.** *Idaho State University, Pocatello, ID 83209*; **jonejaso@isu.edu**

Few studies have focused on detecting patterns of occurrence and abundance of Rocky Mountain tailed frog (*Ascaphus montanus*) larvae along the length of a stream or within a single stream network, let alone two bio-geo-climatically distinct networks. Moreover, no studies to date have addressed possible variation that may exist among age classes. As part of a larger study, we addressed three questions: 1) How does tadpole occurrence and abundance vary in a stream network? 2) How does tadpole age class structure vary in a stream network? 3) Do bio-geo-climatically different stream networks share similar patterns? Between June 28th and August 10th, 2005 and 2006, we conducted our study in two stream networks of comparable tadpole biomass/density: Mica Creek watershed in Idaho and Youngs Creek watershed in Montana. With a stratified sampling design, we kick sampled and snorkeled =150 randomly selected transect belts across each stream network, beginning in the headwaters and continuing to the largest stream order occupied by tadpoles. Additionally, we measured physical habitat variables and food resource availability at each transect. In both stream networks, occurrence and abundance increased from headwater to intermediate stream order then decreased in larger stream orders. Additionally, 1st year tadpoles decreased in density with increasing stream order, while 3rd year tadpoles increased in density with increasing stream order. Although our two different stream networks maintained similar patterns in occurrence and abundance, the availability of food and habitat differed between networks, indicating that factors limiting Rocky Mountain tailed frog tadpole distribution and abundance change geographically.

A PRELIMINARY TREE-RING ANALYSIS OF GARRY OAK (QUERCUS GARRYANA) ON SALTSPRING ISLAND, BRITISH COLUMIBA. **David A Jordan.** *Department of Geographic Studies, Trinity Western University, Langley, BC V2Y1Y1*; **davidj@twu.ca**

Garry oak (*Quercus garryana* Douglas ex. Hook) ecosystems are widely considered one of the most endangered ecosystems in Canada. Both the removal of natural disturbances (e.g., fire), and the imposition of human disturbances (e.g., logging), can lead to reduced biodiversity and altered ecosystem composition. Using dendrochronological methods can contribute to reconstructing historical dynamics and baseline ecological conditions of Garry oak ecosystems. This presentation reports on the first dendrochronological investigation of Garry oak trees at woodland sites on Saltspring Island, British Columbia. Mature Garry oak trees were selected for study in two 25 m. plots at approximately 180 m. a.s.l. A total of 46 cores from 40 trees were extracted for age determination and development of a master ring-width chronology. High quality cores were prepared, carefully measured and cross-dated using standard dendrochronological techniques. Trees on the site cross-dated well (mean interseries correlation r = 0.700) and proved ideally suited for chronology development. Age estimates range from a number of individuals < 50 years old to one individual > 320 years in age. The best replicated segment of the chronology (1898-2005 A.D.) shows common intervals of reduced radial growth in the 1900s, early 1920s, mid 1930s to mid 1940s and 1980s. A significant sustained growth release begins in 1948 and lasts until approximately 1960. A second significant, albeit shorter, growth release begins in 1989

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and lasts until 1995. The results suggest that further dendrochronological studies using this species are warranted and can contribute to establishing historical Garry oak ecosystem conditions.

INVESTIGATION OF ICE AGE FLOOD GEOMORPHOLOGY AND STRATIGRAPHY IN GINKGO PETRIFIED FOREST STATE PARK, WASHINGTON: IMPLICATIONS FOR PARK INTERPRETATION. **Ryan C Karlson.** *Washington State Parks and Recreation Commission, Olympia, WA 98504*; **Karl Lillquist,** *Central Washington University, Ellensburg, WA 98926*; **ryan.karlson@parks.wa.gov**

Documentation of Ice Age flood evidence in Ginkgo Petrified Forest State Park, Washington fills a gap in landscape-scale analysis and interpretation of cataclysmic flooding in the Vantage Reach of the Columbia River Valley. High-energy floodwaters exiting Frenchman Gap excavated soil and modified underlying basalt bedrock up to 600 ft above the paleo-Columbia River. Subsequent hydraulic pooling reached maximum depths of at least 783 ft. Ice-rafted erratic, rhythmite, and modified eddy bar deposits developed within low-energy flood environments. Ice-rafted erratic deposits were the most common flood feature observed, occupying study area elevations between 641 ft and 1,263 ft. The highest frequency of ice-rafted erratics occurred above 1,100 ft on erosional landforms. High-density erratic cluster and bergmound deposits, resulting from deposition of large icebergs, were limited between 917 ft and 1,218 ft. Public interpretation of research results is prescribed within a three-level park interpretive network comprised of previsit and on-site orientation, interpretive hubs, and site-specific story points.

VEGETATION RESPONSE TO CLIMATE VARIABILITY IN THE TREELINE ECOTONE, SUNWAPTA PASS, ALBERTA. **Trudy A Kavanagh.** *Biology & Physical Geography, University of British Columbia Okanagan, Kelowna, B.C. V1V 1V7*; **Trudy.Kavanagh@ubc.ca.**

Vegetation dynamics were reconstructed for the past 400 years at two treeline sites (N-facing and S-Facing) in the Canadian Rockies using age-structure studies. Trees, seedlings and snags were mapped in two 30m wide plots that run 275 m upslope from continuous forest into alpine tundra. Despite differences in environment and vegetation structure in the plots, synchrony in the establishment record of seed-established trees and seedlings suggests strong climatic control on recruitment. Climate effects on treeline are examined at three spatial scales: landscape, population and individual. In the south-facing plot, a severe cooling event in the late 1600s coincides with a significant tree mortality event that resulted in treeline recession. Most subsequent establishment occurred in the 20th century. In the north-facing plot, recruitment was dominated by layering and treeline has slowly advanced upslope during the past 400 years. Comparison of temporal establishment patterns with climate data found significant correlations with June, August and seasonal (JJA, JAS) temperatures, and April and June precipitation. Correlations improve markedly when climate data are averaged for 5-7 years indicating that several favourable years are necessary for seedling establishment and survival. Annual vertical growth was measured on seedlings for the period 1986-2001. Despite significant differences in absolute growth within and between plots, the relative growth pattern of seedlings over time is similar, indicating regional climate control on growth. Different growth rates means a shift upslope of treeline at the N-facing site will not be a visible for 150 years, whereas it is already apparent at the S-facing site.

INVASIVE SPARTINA CONTROL AND CALIFORNIA CLAPPER RAIL IN THE SAN FRANCISCO ESTUARY. **Drew W Kerr, Erik K Grijalva.** *California Coastal Conservancy Invasive Spartina Project, Berkeley, CA 94710*; **dwkerr@spartina.org.**

The San Francisco Estuary has been invaded by the aggressive cordgrass *Spartina alterniflora*, introduced in the 1970s by the US Army Corps of Engineers for bank stabilization. The resulting infestation, a hybrid with native *Spartina foliosa*, has spread to over 1500 acres, dominating unvegetated mudflats and tidal channels. The Invasive Spartina Project (ISP) of the California Coastal Conservancy has embarked on an ambitious control program to eliminate this threat. Although it is common to manage invasive vegetation based on the assumption that it has detrimental impacts to wildlife habitat, it is uncommon to evaluate impacts to certain wildlife species from the results of control efforts since removal of the invasive is normally perceived as a pure benefit. However, due to the high degree of habitat loss from the development of San Francisco Bay, the Federally endangered California clapper rail (*Rallus*

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longirostris obsoletus) has established significant local populations in non-native *Spartina*. Once the *Spartina* is removed, some sites will no longer provide habitat for the clapper rail because there are no native California macrophytes that live at those low marsh elevations. The ISP and US Fish & Wildlife Service developed an impact evaluation model to enable the Baywide *Spartina* control strategy to move forward, and to mitigate any damage to the clapper rail. The model will be presented, along with *Spartina* control methods utilized in 2005 and 2006, data from annual breeding rail call counts, and innovative techniques being used to reduce short-term impacts to the rail.

RESPONSE BY DISPERSERS TO A GRADIENT OF HABITATS: ACTIVITY BY JUVENILE RED SQUIRRELS IN VARYING-AGED FORESTS. **Karl W Larsen.** *Department of Natural Resource Science, Thompson Rivers University, Kamloops, BC V2C 5N3*; **klarsen@tru.ca**

Understanding the subtleties of the dispersal process, such as how dispersers investigate or avoid different habitat types, is critical to gaining insight into colonization rates and other population dynamics that occur across landscapes. In central British Columbia, I examined the relative amounts of red squirrel (*Tamiasciurus hudsonicus*) dispersal activity in second-growth forest stands of varying ages, using indices of track counts collected over two years. Some live-trapping and a small amount of telemetry also were conducted in order to validate the results of the track counts. In general, dispersal activity became noticeably greater in forest stands once they reached 14-18 years of age; younger stands showed relatively little activity, and activity increased with older stands. Both average tree height and cone production in the second-growth forest stands were correlated with stand age, so both of these characteristics may be the actual cues that the animals key into. However, to elucidate the relative importance of these potential cues will require further study. Although the results of this study are intuitive, they represent some of the first data on how dispersing animals respond to a seral gradient of habitats.

THE USE OF MOSQUITO BLOOD MEALS FOR MONITORING WILDLIFE DISEASE. **Bruce J Leighton, BD Roitberg, P Belton, CA Lowenberger.** *Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A1S6*; **leighton@sfu.ca**

Infectious diseases are of concern in the conservation of wildlife species already threatened by habitat loss and exploitation. Human health and livestock production are also impacted by infectious diseases of wildlife that live in close proximity to human habitations and livestock operations. Surveillance of disease in wildlife involves trapping or killing large numbers of animals for sampling of blood and tissues and may be unacceptable in parks and wildlife preserves or with endangered species. When a mosquito bites its host, it carries away a blood sample containing specific antibodies which can provide a history of the immune responses of the vertebrate host. The purpose of this research was to determine if specific antibodies could be detected in blood-fed mosquitoes. Mosquitoes were fed on blood containing a specific antibody and assayed using an enzyme-linked immunosorbent assay to determine the limits of detection of the antibody post-feeding over time, and at different temperatures and antibody concentrations. The results showed that the antibody, at an initial concentration of 1-10μg/ml could be detected in mosquitoes for 24-72 hours after feeding. Blind tests simulating the assay of feral mosquitoes detected positive mosquitoes with few false negatives and no false positives. It was also possible to detect these antibodies in mosquitoes that were blood fed and then air dried or alcohol preserved. This research indicates that the collection and immunological assay of mosquitoes could be used to detect and monitor infectious disease in wildlife.

SPECIES DIVERSITY OF VASCULAR PLANTS AND CRYPTOGAMS OF OLD-GROWTH FORESTS ACROSS ENVIRONMENTAL GRADIENTS IN THE WESTERN NORTH CASCADES. **Robin D. Lesher, Jan A. Henderson,** *USDA Forest Service, Mountlake Terrace WA 98043*; **rlesher@fs.fed.us.**

Species diversity from USFS benchmark ecology plots in the Washington North Cascades was analyzed to assess the relationship between diversity and a number of ecological and stand variables across this landscape and between the different taxonomic classes of plants. For this analysis, data from 70 permanent plots in old-growth stands (over 200 years old) in the three major forest vegetation zones

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(western hemlock, Pacific silver fir and mountain hemlock zones) were used to quantify plant (i.e. the autotrophs) species diversity. Over 400 species of vascular plants and cryptogams were documented on these 70 plots. On the average, there was twice the number of cryptogam species (bryophytes and lichens) as vascular plant species across all plots and vegetation zones. We found only weak correlations with precipitation, temperature and site moisture; but generally warmer and moister sites had greater vascular plant and cryptogam diversity. In addition, there was considerable variation in species diversity between plots and within vegetation zones. This variability may be more attributable to factors such as structural variability and diversity of microsites within stands than to external ecological factors such as temperature and moisture. In the past, the importance of the diversity of cryptogams in these forests has been generally discounted in ecological studies of diversity and production. Bryophytes and lichens have already been shown to be important components of the life history of Northern spotted owl, Marbled Murrelet and Northern Flying Squirrels.

POPULATION SIZE ESTIMATES OF CHINESE PADDLE-TAIL SALAMANDERS USING MARK-RECAPTURE WITH SPOT PATTERN RECOGNITION. **Michelle Lester, Megan Matheson, Lori Sheeran, Jinhua Li., R. Steven Wagner.** *Department of Biological Sciences, Central Washington University, Ellensburg Washington, WA 98925*; **lesterm@cwu.edu.**

An abundance and demography survey was conducted on Chinese Paddle-tail salamanders, *Pachytriton brevipes*, a Dicamptodon ecological equivalent found within the Valley of the Wild Monkeys Park in the Huangshan, China. Mark-recapture was used to investigate population size of this species within the park's streams. Daily intensive surveys of high gradient mountain streams were conducted in three 300m2 plots each located at different elevations. Digital photographs were taken of all individuals encountered in order to identify recaptures in a non-invasive manner. During twenty survey sessions there were 68 individuals encountered with twelve being recaptured during subsequent surveys. Both Jolly-Seber closed population and Lincoln-Peterson open population models were used to estimate population abundance with daily ranges of 1-98 and 1-71 individuals, respectively. Abundance of salamanders was related to elevation and temperature. Daily air temperature varied from 24°C to 32°C during the entire survey period, with captures occurring most frequently in the fast flowing, higher elevation stream plots when ambient air temperatures were between 27°C and 30°C. Population estimates were data collected during the 2005 CWU-Anhui University cooperative field school to evaluate population stability. The previous study estimated a total population of 230 individuals, indicating a decrease in detection. The results provide baseline data on the demography of the species to assess population trends with continued long-term monitoring.

The 49th PARALLEL AND WHAT IT MEANS TO CARNIVORE CONSERVATION IN THE WEST. **Jeffrey C Lewis,** *Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501-1091*; **Keith B Aubry,** *USDA Forest Service, Pacific Northwest Research Station, Olympia, WA 98512*; **Eric C Lofroth,** *BC Ministry of Environment, Victoria, BC V8W 9M1*; **Michael K. Schwartz,** *USDA Forest Service, Rocky Mountain Research Station, Missoula, Montana 59801*; **lewisjcl@dfw.wa.gov**

The ranges of a number of large and mid-sized carnivores straddle the Canada-US border in western North America. The ranges of the Grizzly Bear, Gray Wolf, Wolverine, Lynx, and Fisher are greatly reduced or heavily fragmented south of the border, prompting concerns that these species will be lost without significant protections or reintroductions. The demographic support (dispersal, recruitment) from larger populations in British Columbia and Alberta has likely sustained populations of these species in Washington, Idaho and Montana, which might have otherwise disappeared. The reverse is the case for lowland, shrub-steppe and grassland species in British Columbia, such as the badger, which depend on demographic support from larger populations in the US. We will discuss the status and distribution of a number of these carnivores in the trans-boundary west. We will also identify factors that put these species at risk and the research needed to evaluate limiting factors for these populations. Lastly we will discuss the management approaches that have been developed and those currently being developed to conserve these carnivores.

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AGRICULTURE IN THE WORLD WAR II-ERA, JAPANESE-AMERICAN RELOCATION CAMPS, WESTERN UNITED STATES. **Karl Lillquist,** *Geography and Land Studies Department, Central Washington University, Ellensburg, WA 98926***; lillquis@cwu.edu.**

Agricultural potential was a primary consideration in the siting of each of ten World War II-era, Japanese-American relocation camps in Arizona, Arkansas, California, Colorado, Idaho, Utah, and Wyoming. This research describes the agricultural programs of eight semi-arid, western U.S. camps, and evaluates their successes and failures based on documentary evidence. Most of the camp lands had never been farmed before, often for good reason. Japanese-Americans thus first had to create irrigation canals and ditches, and clear and level the lands prior to farming. Mostly operating in 1943 and 1944, each program included vegetable and fruit crops for human consumption, feed crops, and livestock. Each camp raised at least 20 different vegetables, many of which were traditional Japanese foods, and often, several different fruits. Crops were consumed fresh in the camp dining halls or preserved in root cellars, pickled, canned, or dried. Livestock included chickens, turkeys, hogs, beef cattle, and dairy cattle, and were typically butchered and consumed on site. Seasonal surpluses were shipped to other camps or in a few cases, sold on the open market. Camp agriculture was hampered by poor soils, short growing seasons, initially undeveloped lands, lack of farm equipment, and labor shortages. However, Japanese-American farmers proved that diverse agricultural programs could be successful in the harsh camp settings primarily because of labor-intensive farming methods and the large markets provided by each of the camps. Further, Japanese-American labor used to prepare the virgin lands made it possible for subsequent Caucasian settlers to successfully farm after the war.

PRELIMINARY RESULTS OF TRANSLOCATION METHODS TESTING FOR TAYLOR'S CHECKERSPOT BUTTERFLY IN SOUTH PUGET SOUND, WASHINGTON. **Mary J Linders;** *Washington Department of Fish and Wildlife, Olympia, WA 98501-1091***; lindemjl@dfw.wa.gov**

Significant declines of Taylor's checkerspot butterfly (*Euphydryas editha taylori*) have reduced its occurrence to two disjunct locations in south Puget Sound, Washington. The remaining forb-rich grasslands on which it depends are often small and isolated relative to historic conditions. Restoration is proceeding on many of these sites but recolonization is prohibited by 1) a limited number of source populations, 2) the distance between source populations and potential reintroduction sites, and 3) low population levels at source populations. Isolation decreases the likelihood of recolonization, particularly for invertebrates of low vagility, and increases the likelihood of extinction in the absence of human intervention. Active population management is needed to reverse the downward trend observed in the past decade by increasing the number and size of populations. Captive rearing trials are being conducted at the Oregon Zoo to develop a cost-effective strategy for increasing the number of individuals. Three release experiments are being used to identify which life stage is most apt to lead to successful establishment. Releases are designed to identify limiting factors and measure the survival of released animals. Captive rearing success increased considerably in 2006 compared to 2004 and 2005, and is above 90 percent for each stage to date. Initial release results indicate that as expected, survival of eggs and prediapause larvae are low. As in other butterfly translocations, weather is proving to be a significant factor affecting the likelihood of success.

SMORGASBORD STRATEGIES: HABITAT SELECTION BY WOLVERINES IN BRITISH COLUMBIA. **Eric C Lofroth,** *BC Ministry of Environment, Victoria, BC V8W 9M1***; John Krebs,** *Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC V1L 4K3***; Ian Parfitt,** *Selkirk College Geospatial Research Centre, Castlegar, BC V1N 3J1***; Eric.Lofroth@gov.bc.ca**

Wolverines (*Gulo gulo*) are found throughout circum-boreal regions and the western North American mountains. Until recently, however, they have been little studied compared to many carnivores of conservation concern. Within the last two decades studies in Scandinavia and western North America have done much to dispel (or not!) much folklore and myth. This presentation will focus on the commonalities and differences in wolverine habitat ecology between two recent BC studies and the role that ecological conditions and landform may play in those. We radio-tracked 90 wolverines in the Omineca and Columbia Mountains of British Columbia from 1994 - 2001. Habitat analyses demonstrate

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that, in BC, food is the primary factor influencing most wolverine habitat selection. Wolverine food habits varied geographically and as such habitat selection patterns also varied. Topography and its influence on prey distribution and availability was an important factor in differences between study areas. Habitat selection was moderated by the avoidance of human disturbance, reduction in predation risk, and in the case of denning females by requirements for shelter for kits and security from predation.

INDIRECT IMPACTS OF INTRODUCED PREDATORS ON ISLANDS. **Heather L Major.** *Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Dr., Burnaby, BC, V5A 1S6*; **hmajor@sfu.ca.**

Island biotas have been especially hard hit with loss of biodiversity and extinctions resulting from introduced predators. Rats (*Rattus* sp.) are by far the most detrimental introduced predator to island avifauna and have exterminated at least 18 species and subspecies of birds and yet, impacts of introduced rats are not always apparent and in many cases may be missed entirely. For example, at Kiska Island, Alaska a mass die off of Least Auklet chicks occurred before the end of their first week after hatching. These chicks were not being depredated but were presumably neglected by their parents. I present two hypotheses for this, 1) excessive killing by rats early in the breeding season removes the highest quality breeders, creating a colony of first-time and low quality breeders that cannot provision their chicks, and 2) disturbance to breeding adults by rats contributes to high levels of nest abandonment and chick death during the only week when chicks require an adult to incubate them. In order to mitigate the impacts of introduced species, eradication programs have been ongoing for many years but many islands do not recover. For example, Norway rats decimated the Langara Island Ancient Murrelet population and were eradicated from Langara Island, British Columbia in the 1990s, but little Ancient Murrelet recovery has occurred. One hypothesis for this is that rats change ecosystem processes, leaving the system unavailable to prospectors and recovery. I argue that because of indirect and lasting impacts even seemingly healthy populations are at risk both during and after rat occupation and mitigation programs must incorporate this information into all management plans.

DIVERSITY, ABUNDANCE, AND DISTRIBUTION OF MILLIPEDES IN CLEAR-CUTS AND MATURE FORESTS OF SOUTHWESTERN BRITISH COLUMBIA. **Brent M Matsuda.** *University of British Columbia, Department of Forest Sciences, 3041-2424 Main Mall, Vancouver, BC V6T 1Z4 and Jacques Whitford Environmental, 4370 Dominion Street, 5th Floor, Burnaby, BC V5G 4L7*; **John S Richardson.** *University of British Columbia, Department of Forest Sciences, 3041-2424 Main Mall, Vancouver, BC V6T 1Z4*; **brent.matsuda@jacqueswhitford.com**

Relative differences in millipede diversity, abundance, and distribution were assessed in three mature forest habitats (>81 years) and three clear-cut habitats (<5 years) in the Chilliwack Valley of southwestern British Columbia from May to August 1998 using pitfall traps and drift fences. The Shannon-Wiener diversity index indicated that millipede diversity and abundance was significantly greater in mature stands (M) than clear-cuts (CC). For M, 7901 individuals representing at least nine species (most could only be identified to family) were used in the analysis. For CC, 2438 individuals comprised at least seven species in the analysis. For the abundance and distribution analyses, only the yellow-spotted millipede (*Harpaphe haydeniana*; HAHA) and members of the family Parajulidae (all lumped together), were caught in sufficient numbers to be analysed. Although there was no significant difference in the abundance of these two groups in M, Parajulids were significantly more abundant in CC than HAHA. However, for both millipede groups, capture numbers varied significantly between sites within habitat type. These findings indicate that there are significant differences in soil invertebrate diversity, abundance, and distribution between clear-cuts and mature forests. This may have implications on forest management practices that typically overlook soil invertebrates, particularly with regards to role they play in ecosystem function and integrity.

HABITAT SUITABILITY & SUPPLY MODELLING FOR NORTHERN GOSHAWKS IN COASTAL BRITISH COLUMBIA. **Erica L McClaren,** *Northern Goshawk Recovery Team/BC Environment, Black Creek, BC V9J 1K1*; **Jason Smith,** *Cortex Consultants Inc., Victoria, BC V8W 1W2*; **erica.mcclaren@gov.bc.ca.**

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The Northern Goshawk (*Accipiter gentilis laingi*) Recovery Team and Habitat Recovery Implementation Group (RIG) has been working with Cortex Consultants Inc. to develop a strategic model that will predict nesting and foraging habitat suitability and supply for Northern Goshawks within four conservation regions of coastal British Columbia (BC): 1) Haida Gwaii (Queen Charlotte Islands); 2) North Coast; 3) South Coast; and 4) Vancouver Island. As well, we have been working to develop a territory model, that overlays habitat models, to predict the number of breeding pairs of Northern Goshawks that could be supported under different habitat levels and configurations. These efforts will assist us to quantify threats to coastal goshawk populations from habitat loss and fragmentation and to delineate Critical Habitat, where necessary. To develop parameter estimates for these models, we used local empirical data and relevant literature on Northern Goshawk habitat selection and territory requirements, where available. Where data were unavailable, we derived parameter estimates from a panel of three BC Northern Goshawk experts. Each conservation region has a unique set of parameter estimates to reflect variability in coastal habitats for Northern Goshawks. Coincidental to running habitat suitability models, we are testing the accuracy of these models through ground-based habitat assessments. We hope these models will enable us to develop measurable goals and objectives for Northern Goshawk habitat and population recovery throughout coastal BC and provide a standardized approach for modeling habitat suitability and potential territories.

EVALUATION OF THE ROLE OF CLIMATE IN DRIVING WESTERN HEMLOCK LOOPER POPULATION OUTBREAKS **Shane PJ McCloskey, Lori D Daniels.** *Department of Geography, University of British Columbia, 1984 West Mall, Vancouver, BC V6T 1Z2*; **John A McLean** *Department of Forest Sciences, University of British Columbia, 2424 Main Mall, Vancouver, BC V6T 1Z4*; **shanem@geog.ubc.ca**

Western hemlock looper (*Lambdina fiscellaria lugubrosa*) populations along coastal British Columbia have undergone seven episodes of outbreak from 1911 to 2004, leading to visible defoliation of western hemlock (*Tsuga heterophylla*)-dominated forests. In this study, we identify the specific antecedent climate conditions that contributed to these outbreaks. We analyzed local meteorological records to develop a moisture stress index of combined temperature and precipitation data that identified periods of warm, dry climate between 1895 and 2004. We hypothesized that warm, dry conditions would improve the survival of western hemlock looper larvae and facilitate population increases. A high moisture stress index in June was associated with the onset of visible defoliation by western hemlock looper populations later that year. A high moisture stress index over the entire growing season (May to September) was associated with conditions 2 years before visible defoliation events, providing a trigger for populations to increase to outbreak levels in subsequent years. Given predicted warmer and drier climatic conditions in coastal BC, we propose the frequency of western hemlock looper outbreaks will increase in future.

FIRE AND VEGETATION HISTORY OF GARRY OAK AND DRY COASTAL DOUGLAS-FIR ECOSYSTEMS IN SOUTHWESTERN BC. **Marian M McCoy, Rolf Mathewes.** *Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada, V5A 1S6*; **Marlow G. Pellatt,** *Coastal Ecologist. Parks Canada, Western Canada Service Centre, 300 - 300 West Georgia Street, Vancouver, BC, V6B 6B4, and School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC, V5A 1S6*. **mmmccoy@sfu.ca.**

Garry oak (*Quercus garryana*) ecosystems have been the focus of restoration efforts in Canada and the US for several years. In British Columbia, these ecosystems have been reduced to less than 5% of their pre-European extent, and those remaining are significantly degraded and fragmented. Their restoration might include the reintroduction of fire, a disturbance process that is essential to maintaining their open woodland-meadow structure. However, pre-European fire regimes of these Garry oak ecosystems, and the more extensive dry Coastal Douglas-fir forests that surround them, are not well understood. Analyses of pollen and charcoal deposited in lake sediments can improve our understanding and provide clues to fire regime and return intervals. We used fossil pollen and macroscopic charcoal in sediments extracted from three lakes on southeastern Vancouver Island and Pender Island to investigate the influence of climate and human activity on fire regimes and vegetation of Coastal Douglas-fir and Garry oak ecosystems in British Columbia. Sediment records from Roe Lake and Quamichan Lake spanned the past 250 calendar years, while Florence Lake record spanned 560 calendar years. All three

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charcoal records exhibited synchroneity of fire events and correspond to other fire records in the Pacific Northwest, indicating climate-driven responses. After ca. 1870, European agriculture, logging, and fire suppression dominate the study site sediment records. Variations in pollen abundance and species composition confirm forest clearance and exotic plant introductions. These results indicate that, up until the mid-1800s, fire events and vegetation assemblages varied in response to climate; thereafter, cultural activities appear to dominate disturbance regimes.

RESULTS FROM A STUDY OF THE BIOLOGICAL CRUST RECOVERY IN FORMER SHRUB-STEPPE HABITATS, CENTRAL WASHINGTON STATE. **Terry McIntosh.** *Biospherics Environmental Inc., 3-1175 E. 14th Ave., Vancouver, British Columbia, V5T 2P2***. Matthew Vander Haegen, Mike Schroeder,** *Washington Department of Fish and Wildlife, Wildlife Program, Science Division, 600 Capitol Way North, Olympia, WA, 98501***. ginkgo@shaw.ca**

Biological soil crusts, comprised of complex associations of organisms most prominently lichens and mosses, are ecologically important components of healthy shrub-steppe ecosystems. However, few studies have examined biological crust recovery and successional trends in barren landscapes. Preceding settlement, shrub-steppe was the dominant habitat type throughout much of eastern Washington. Since then, mainly because of habitat conversion to crop production, over 60% of the original shrub-steppe and associated soil crusts in Washington have been lost. Further, the remaining shrub-steppe is highly fragmented, with patches often isolated across large distances, and often severely degraded mainly through over-grazing by livestock, concurrent invasion by exotic plants, and changes in fire frequency. This study examined recovery of biological crusts following the planting of former cropland areas in central Washington State through the Conservation Reserve Program. Crusts were measured in three main treatment types: old fields, planted mainly with exotic grasses 16 to 20 years ago, new fields planted mainly with native grasses, forbs, and native arid-land shrubs 4-9 years ago, and shrub-steppe communities. Results from this study include: characteristic early successional mosses, including Pterygoneurum ovatum and Bryum caespiticium, dominate crusts in both old and new fields and lichens are mostly absent from these sites; some characteristic early successional mosses, in particular Ceratodon purpureus, are also prominent in late seral crusts, possibly because of natural small-scale disturbances; late seral crusts are characterized by mosses and a rich lichen component, including *Aspicilia* spp., *Psora globifera*, *Acarospora schleicheri*, *Cladonia* spp., and *Diploschistes muscorum*.

SEXY GENITAL BONES: HOW TO IDENTIFY A CHIPMUNK. **David W Nagorsen,** *Mammalia Biological Consulting, 4268 Metchosin Road, Victoria, BC V9C 3Z4; Nick Panter, Royal British Columbia Museum, 675 Belleville Street, Victoria, BC V8W 9W2***; mammalia@shaw.ca.**

Three chipmunk species co-occur in the southern Columbia and Rocky mountains of Canada: red-tailed chipmunk (*Tamias ruficaudus*), yellow-pine chipmunk (*Tamias amoenus*), and least chipmunk (*Tamias minimus*). Subspecies of *T. ruficaudus* and *T. minimus* are listed provincially and by the IUCN, but reliable identification of historical museum specimens and live captures has hindered their conservation assessment. Using genital bone preparations from voucher specimens and radiographs of museum study skins, we could unequivocally discriminate these species from morphology of the male and female genital bones (baculum, baubellum). Based solely on genital bone morphology we assigned 140 adult specimens to reference groups, then used discriminant analyses to assess the reliability of pelage colour, body size, and skull morphology for identification. In the Rocky Mountains, 95-100% of specimens were assigned to the correct species; in the Columbia Mountains 20-30% of *T. amoenus* and *T. ruficaudus* were misidentified because of convergence in morphology. An analysis of 117 specimens sequenced for the mitochondrial cytochrome-b gene revealed that genetic and genital bone identifications were concordant except for 19 of 33 (58%) *T. amoenus* from the Rocky Mountains that were 'hybrids' carrying the mtDNA of *T. ruficaudus*. Despite mitochondrial introgression, we found no evidence for morphological intergradation-all hybrids were clearly *T. amoenus*. We review the limitations of morphological criteria and DNA sequences for discriminating these 3 chipmunk species.

BIODIVERSITY WITHIN DRY FORESTS OF THE INTERIOR OF BRITISH COLUMBIA. **Dustin K Oaten, John D Nelson.** *University of British Columbia, Department of Forest Resource Management, Vancouver, BC, V6T 1Z4***; Karl W Larsen,** *Thompson Rivers University,*

Kamloops, BC, V2C 5N3; **doaten@tru.ca**

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The dry interior forests of British Columbia are composed of contiguous coniferous forests dominated by Douglas-fir (*Pseudotsuga menziesii*), with a small portion consisting of trembling aspen (*Populus tremuloides*). These trembling aspen stands are of particular interest as there is evidence that they may support a relatively abundant and diverse faunal community. However; this potential has not been extensively explored within these forests. Three bioindicator taxa (small mammals, cavity-nesting birds, and carabid beetles) were investigated within trembling aspen stands during 2005 and 2006 and were compared to neighbouring Douglas-fir and mixedwood stands. Over 7397 captures of 12 small mammal species were made during 15,761 trap nights with 48% of captures within aspen stands. Seven species were numerically dominant within these stands. 1545 detections of 14 cavity-nesting bird species were made during 288 point count surveys with 48% of detections within aspen stands. Four species dominated these counts: three weak cavity excavating and a single primary cavity excavator. Carabid beetles also were investigated, yielding 1027 samples of 13 species. The pure stands of aspen supported the largest numbers and diversity of small mammals and birds, whereas beetles appeared more diverse in the mixedwood stands. Stand attributes such as the abundance of trembling aspen, the amount of dead wood and the total amount of plant cover appear to play significant roles in these patterns. These results highlight the importance of aspen stands as they may serve as biodiversity 'hotspots' within dry interior British Columbia forests.

PARTNERS FOR AMPHIBIAN AND REPTILE CONSERVATION (PARC): "NORTHWEST HO!". **Deanna H Olson,** *USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331*; **Ernesto Garcia,** *PARC Federal Agencies Coordinator, US Fish and Wildlife Service, Weaverville, CA*; **Priya Nanjappa Mitchell,** *PARC State Agencies Coordinator, Purnee, IL*; **dedeolson@fs.fed.us**

PARC is an emerging entity in North America with the mission "to conserve amphibians, reptiles, and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public/private partnerships." PARC is a diverse network of like-minded citizens, professionals, and organizations dedicated to herpetofaunal conservation. It was created to help connect, and compliment local, regional, and national efforts to conserve amphibians, reptiles, and their habitats. A focus of PARC has been to assist with various existing or planned efforts related to herp conservation, and to develop conservation tools such as regional habitat management guidelines, inventory and monitoring handbooks, and training sessions. The Northwest regional working group of PARC is just getting started. There is planning afoot to have an inaugural meeting in the Fall of 2007. However, some PARC-sponsored activities have begun in the Northwest. For example, the Northwest PARC Habitat Management Guides are in preparation, with a 2007 publication date planned. Also, stemming from a strong interest at last year's Society for Northwestern Vertebrate Biology meeting, compilation and mapping of locations of the emerging amphibian infectious disease, chytrid or "Bd," is ongoing and spreading to a national, and hopefully global, effort. Lastly, the State of Idaho has begun its own very active chapter. We welcome new participants, and new ideas to pursue for the welfare of herps.

THE STATUS OF SPECIES' SITES. **Deanna H Olson,** *USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331*; **Kelli J Van Norman, Robert D. Huff,** *USDI Bureau of Land Management, Portland, OR*; **Russell N. Holmes,** *USDA Forest Service, Portland, OR*; **dedeolson@fs.fed.us**

Locality data for species' occurrences are pivotal to decisions of species status rankings and some land management decisions, yet are problematic in several regards. First, lack of a common terminology hinders basic understanding of the issues. A species' "site" may represent an individual or a group with or without defined spatial or habitat boundaries. Secondly, precision of locations are variable, ranging from use of Global Positioning Systems documenting sites within meters to vague location descriptions within a county. Next, for many taxa, site data are neither well-recorded, nor entered into databases. Common concerns include reliability of species identification, whether sites are extant, and data quality especially in regard to site size, extent and condition. Compilation of site records from different agencies and institutions into comprehensive databases creates additional concerns, such as duplicate records with differing data. While site data may be useful to assess general distribution patterns, caution must

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be exercised for other usages, especially abundance assessments. The number of "sites" is not a useful metric for status decision unless the data are fully screened, and even though it is best to document species occurrences at finer spatial scales, aggregation of observations to larger spatial scales may resolve variable site definitions and locality precisions. Implications of these issues for status decisions include misdirected efforts, fewer protections for truly rare species, and high data management costs. Improvement of species-data collection standards and archival procedures will facilitate knowledge-based decisions.

RECRUITMENT AND REGENERATION FOLLOWING FINE-SCALE DISTURBANCES IN COASTAL OLD-GROWTH FORESTS. **J Passmore,** *School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC V5A 1S6***; L Daniels,** *Department of Geography, University of British Columbia, Vancouver, BC V6T 1Z2***; K Lertzman,** *SFU School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC V5A 1S6***; A Stan,** *Department of Geography, University of British Columbia, Vancouver, BC V6T 1Z2;* **japassmo@sfu.ca**

Fine-scale disturbances involving the death of one to a few trees create gaps in the forest canopy and, where large-scale disturbances are rare, exert a dominant influence on community and population dynamics. I examine the natural regeneration and recruitment of seedlings and saplings following fine-scale disturbances in old-growth stands within the Capilano, Seymour and Coquitlam River watersheds near Vancouver, BC. I compared the abundance of western red-cedar, western hemlock, and Pacific silver fir seedlings and saplings between plots located within and adjacent-to 20 gaps of known date of origin. From a subset of 6 gaps, I destructively sampled seedlings and saplings of each species and applied dendroecological methods to determine the age of each sample, and to elucidate patterns of suppression and release in radial growth. Hemlock seedlings and saplings were more abundant than fir or cedar seedlings and saplings, regardless of location, and all three species were more abundant within gap versus forest plots. For all three species, the proportions of samples germinating around the time of gap-formation were greater in gap versus forest plots. Similarly, the proportions of fir and hemlock samples exhibiting radial-growth releases around the time of gap-formation were greater in gap versus forest plots. These results suggest that gaps reduce rates of mortality in seedlings and saplings, and increase rates of establishment and radial growth. Managers challenged with implementing ecosystem-based management should consider how patterns of regeneration and recruitment in natural gaps compare to those observed following management practices such as high-retention forest harvesting.

DENDROGEOMORPHOLOGICAL ANALYSIS OF ROCKFALL ACTIVITY ON SUMAS MOUNTAIN, BRITISH COLUMBIA. **Andrew Perkins, Karl Lillquist.** *Geography & Land Studies Department, Central Washington University, WA 98926;* **David Jordan.** *Department of Geography, Trinity Western University, BC, V2Y 1Y1***; perkinsan@cwu.edu.**

Mass wasting and human development often conflict, resulting in socioeconomic cost. The objective of this research was to conduct analysis on rockfall frequency for Sumas Mountain, southwestern British Columbia to determine rockfall hazard. To complete this I: 1) Chose a representative site, which included both active rockfall and stable slopes, based on airphoto interpretation and field investigation; 2) Assessed mass wasting variables on the slope, including substrate type, vegetation growth, drainage and any obvious mass wasting features; 3) Sampled 59 *Pseudotsuga menziesii* trees in a one hectare plot, using a standard increment borer, observing any macroscopic wood-anatomical features such as wounds, snapped stems, and S-shaped stems; 4) Determined frequency of rockfall events from the core samples using microscopic wood-anatomical features combined with visual growth analysis completed in the field; and 5) Analyzed spatial distribution of rockfall frequency using individual tree locations and years in which they recorded a rockfall event. Preliminary results show the slope is undergoing low magnitude, high frequency rockfall. Trees within the active rockfall area show a higher frequency of rockfall events than those located in the stable area. The forest acts as a protection for slopes below, absorbing bouncing and rolling rocks, released as a result of freeze-thaw activity on the source unit. Recommendations for land use and development for analogous slopes in the area include maintaining forest stands on active rockfall paths to act as protection, scaling suspect rock from parent units, and avoidance of major infrastructure directly below active slopes.

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A WOOD INVENTORY AND DENDROECOLOGICAL ANALYSIS OF LARGE WOODY DEBRIS IN SMALL STREAMS IN THE FOOTHILLS MODEL FOREST, HINTON, ALBERTA. **Sonya R Powell.** *Morrow Environmental Consultant Ltd., Burnaby, BC V5A4N6*; **Lori D Daniels.** *Department of Geography, University of British Columbia, 1984 West Mall, Vancouver, BC V6T 1Z2;* **Sonya.Powell@snclavalin.com**

This research explores large woody debris (LWD) dynamics in five 100-year old lodgepole pine-dominated and five = 100 year old spruce-dominated riparian forests of the Foothills Model Forest in west-central Alberta. The objectives of my research were to (1) quantify the abundance and type of in-stream LWD in mature pine and spruce forests, (2) determine ages of in-stream LWD using tree-ring methods, (3) compare ages of LWD to the age structure of canopy trees to determine how disturbance and stand dynamics contribute to recruitment, and (4) quantify rates of decay and residence times by testing for differences in LWD abundance and volume among sites and among decay and position classes. Two major disturbance types generated large woody debris in mature riparian forests. Lodgepole pine-dominated stands established ca. 1890 to 1900 after fires. During canopy closure, ca. 40 years after stand initiation, a pulse of tree mortality generated LWD. At the spruce-dominated sites, canopy trees established between 1730 and 1910. Using dendrochronological techniques, I successfully estimated the year of death of 180 logs; 56% of estimates were high quality estimates from samples that included bark and/or sapwood. The age of LWD increased significantly with decay and position classes. The oldest LWD of lodgepole pine, white spruce and black spruce were 82, 137 and 80 years, respectively. Given the longevity of LWD, I conclude that management decisions that alter the abundance and recruitment of LWD into streams have long-term implications for both biodiversity and the structure and dynamics of riparian environments.

USING GEOSPATIAL DATA AND METHODS TO IDENTIFY POTENTIAL WETLAND RESTORATION SITES. **Janet E Rhoades.** *Central Washington University, Ellensburg, WA 98926*; **rhoadesj@cwu.edu.**

Wetlands provide numerous benefits to nature and society, from wildlife habitat to flood control. As wetlands continue to be impacted by urban development, tools that make identifying potential wetland restoration sites a more ecologically-effective and economically-efficient process are becoming increasingly important. I have developed a hierarchical methodology for using Geographic Information Systems (GIS) to create a customized, user-friendly, scientifically-valid, and policy-compliant process for identifying potential wetland restoration sites. Site selection is based on prioritized, user-driven, function-specific management objectives. Potential mitigation sites are initially screened based on general factors (hydric soils, water source, minimal slope, and compatible land use), and further refined by prioritizing a combination of wetland functions (wildlife habitat, water quality, flood control, and public recreation) based on the user's needs. This methodology was applied to King County, WA and Yakima County, WA to demonstrate its customizability and transferability to two very different case studies.

COMPARATIVE DIET OF THREE SPECIES OF TERRESTRIAL FOREST-DWELLING AMPHIBIANS (*RANA AURORA, DICAMPTODON TENEBROSUS, AND RHYACOTRITON KEZERI***) IN WESTERN WASHINGTON.** **Casey H Richart, Marc P Hayes,** *Habitat Program, Washington Department of Fish and Wildlife, Olympia, WA, 98501*; **Ryan P O'Donnell,** *Department of Biology and The Ecology Center, Utah State University, Logan, UT, 84321*; **pileated@gmail.com.**

We present data from ongoing research on the diet of the terrestrial forest-dwelling amphibians of western Washington. This study seeks to provide highly resolved dietary data to gain insight into how the terrestrial compartment of their life histories may differ and elucidate preliminary predator-prey interactions. All specimens examined represent historical collections obtained from the herpetology collection at the University of Washington Burke Museum. All were obtained during the fall seasonal window. We removed the gastrointestinal contents of these animals by dissection, and prey taxa were identified and measured. *Rana aurora* and *Dicamptodon tenebrosus* were collected from the Cascade Mountains or Willapa Hills, whereas *Rhyacotriton kezeri* were collected only from the latter region. For

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this preliminary analysis, we present data from 17 R. kezeri, 5 R. aurora, and 5 *D. tenebrosus*. The analysis reveals several key findings: 1) All three species have significant portions of their diets comprised of insects (mostly Coleoptera and Diptera), arachnids, and mollusks; 2) Within insects, R. kezeri tends to consume more larval prey; and 3) R. kezeri diet has more smaller forms (including Collembola, Isopoda, and Acarina). Highlights of the natural history of some mollusks, millipedes, and opiliones commonly consumed will be presented.

WETLAND MANAGENT FOR WILDLIFE IN KING COUNTY, WASHINGTON: A LOCAL JURISDICTIONAL PROGRAM. **Klaus O Richter,** *King County Department of Natural Resources and Parks, 201 South Jackson Street, Suite 600, Seattle, Washington 98104***; Drew W Kerr** *California State Coastal Conservancy, San Francisco Estuary Invasive Spartina Project, 2560 9th St. Suite 216, Berkeley, California 94710***; klaus.richter@metrokc.gov.**

King County's wetland wildlife regulatory framework includes the Critical Areas (CAO), Stormwater (SWO), and Clearing and Grading (CGO) ordinances. The CAO protects wetlands through buffers based on wildlife functions and land use context, with maximum buffers of 91m on wetlands with high wildlife value and high land use intensity. Wetland Complexes and Wildlife Networks were created to address habitat fragmentation. The complexes group wetlands within (152m) of each other that have no barriers to dispersal, and increase the number required to constitute a complex as quality (category) decreases. The Wildlife Networks facilitate animal dispersal by connecting isolated critical areas, segments, open space, and wooded areas on adjacent properties with a width of 91m but not less than 46m of protected land. Unavoidable mitigation is addressed through buffer-averaging, rural stewardship planning, mitigation banking and mitigation reserves. Buffer averaging maintains total fixed-buffer area by allowing decreasing widths with wider compensating sections. Rural Stewardship Plans include site-specific habitat plans allowing buffer reductions if an increase in habitat can be achieved. Mitigation Banking protects wetlands in perpetuity in advance of authorized impacts. The Mitigation Reserves Program purchases and enhances, restores, maintains, or protects wetlands. The SWO prevents hydrological and water quality impacts to wetlands with highest flow protection levels matching the pre-developed site's peak discharge rates for the two-year and 10-year return periods, and include pollution controls requiring best management practices. Significant to protecting wetlands and wildlife, the CGO places limits on clearing that get stricter as the lot acreage increases, down to 35% for lots greater than 2 hectares.

IDENTIFYING PRIORITY AREAS FOR MARINE CONSERVATION IN BC: A COLLABORATIVE APPROACH. **Krista Royle.** *Parks Canada, Western and Northern Service Centre, 300 - 300 West Georgia Street, Vancouver, BC V6B 6B4***; Natalie Ban,** *University of British Columbia, 2202 Main Mall, Vancouver, BC V6T 1Z4***; Ken Cripps,** *Coastal First Nations, 1410 Fisher Rd. Gabriola, BC V0R 1X6***; Dave Nicholson,** *The Nature Conservancy of Canada, 26 Bastion Square, Suite 202, Victoria, BC V8W 1H9***; Charles Short.** *British Columbia Integrated Land Management Bureau, PO Box 9301 Stn Prov Govt Victoria, BC V8W 9M3***; Kate Willis,** *Living Oceans Society, 204-207 W Hastings Street Vancouver, BC VB 1H7***; krista.royle@pc.gc.ca.**

Implementation of marine conservation measures has been slow in British Columbia, with an increasing number of marine species proposed or listed as threatened. The purpose of the Conservation Utility Analysis 2 (CUA2) Project is to collaboratively identify areas of high conservation utility/interest for the coast of BC. The project team is comprised of representatives from academia, First Nations communities, non-profit environmental groups, the federal government, and the provincial government. The CUA2 project will involve two main components: (1) an atlas of known ecological and human use values; and (2) the Marxan spatial analysis. The Atlas will map ecological data, human use data, and a combination of areas of ecological value and human use hotspots. The Marxan spatial analysis will iteratively identify: (1) areas of high conservation value using ecological data only; (2) areas of high conservation utility that minimize impacts to marine users and coastal communities; and (3) areas of high conservation value that incorporate reserve design principles. To guide and inform our analysis, we are hosting a minimum of 8 expert workshops, focused on various ecosystem components. These workshops will help us assemble and use the best available biological, ecological, oceanographic, and socio-economic data, and to draw on the knowledge and expertise of resource managers, the conservation community, academics and First Nations to develop sound, scientifically defensible methods and products. The

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results of the CUA2 project are intended to help advance marine planning initiatives in BC by identifying priority areas for conservation.

WETLAND MITIGATION IN ALBERTA. **Ian Rudland.** *Alberta Environment, Environmental Strategies Advisor, Environmental Strategies Branch Main Floor, Oxbridge Place, 9820 - 106 Street Edmonton, AB T5K 2J6*; **ian.rudlan@gov.ab.ca**

Faced with unprecedented economic growth, Alberta through its Water for Life provincial water strategy and its regulatory processes, namely the Water Act and wetland policy, strives to meet its goal of no further wetland loss. This presentation will provide background on strategies, legislation, and policy related to wetland mitigation.

WETLAND LOSS COMPENSATION IN ALBERTA. **Ian Rudland.** *Alberta Environment, Environmental Strategies Advisor, Environmental Strategies Branch Main Floor, Oxbridge Place, 9820 - 106 Street Edmonton, AB T5K 2J6*; **ian.rudland@gov.ab.ca,; Rick Shewchuk,** *Head, Wetland Restoration Alberta, 170th Street, Edmonton, Alberta, T5S 1J3*; **r_shewchuk@ducks.ca.**

Alberta Environment (AENV) and Ducks Unlimited Canada (DUC) as partners within the Alberta North American Waterfowl Management Plan Partnership have developed a process where complimentary initiatives work to achieve provincial wetland objectives. Through a joint presentation, AENV will focus upon the Alberta regulatory wetland loss compensation roles and responsibilities with DUC providing background on the implementation of wetland loss compensation projects and supporting programs.

DENDROECOLOGY OF GARRY OAK SAVANNAHS IN COASTAL BRITISH COLUMBIA. **Shyanne J. Smith, Ze'ev Gedalof.** *Climate and Ecosystem Dynamics Research Laboratory, Department of Geography, University of Guelph, Guelph, ON N1H 2H1.* **Shyanne.Smith@goert.ca**

Garry oak (*Quercus garryana*) savannahs in British Columbia have largely disappeared, with only approximately 5% of their historical range remaining. These remnants have been altered over the last two centuries by a number of factors including agricultural development and livestock grazing, establishment of exotic plant species, increased deer browsing, and fire suppression. Identifying the historical stand structure and ecosystem processes is therefore critical for effective restoration and management of these ecosystems. In this study, tree-ring analysis was used to reconstruct the stand history at seven Garry oak communities within and adjacent to the Gulf Islands National Park Reserve. At all study sites, encroachment by conifers has been progressing over recent decades. Additionally, few Garry oak trees have become established since ca. 1950, although seedlings are present at almost all sites, often in large numbers. At several sites, it appears that establishment of Garry oak occurred after stand-replacing fires that were followed by multiyear wet intervals. After the initial colonization by Garry oak, Douglas-fir (*Pseudotsuga menziesii*) also began establishing at these sites, and recruitment of Douglas-fir has continued until present. Results from the smaller island sites suggest that local environmental conditions, weather events, and competitive interactions are likely important controls on Garry oak ecosystem dynamics.

NON-BREEDING PERIOD OBSERVATIONS OF A MARKED POPULATION OF URBAN-NESTING COOPER'S HAWKS. **Andrew C Stewart.** *BC Conservation Data Centre, Ecosystems Branch, Ministry of Environment, PO Box 9358 STN PROV GOV, Victoria, BC V8W 9M2*; **andy.stewart@gov.bc.ca**

From 1996 through 2006 I color-banded 1207 (617 males, 590 females) Cooper's Hawks (*Accipiter cooperii*) on their nest sites in urban Greater Victoria on southern Vancouver Island. Each year I solicited observations of these marked hawks from the general public. From August 1996 through December 2006, I received a total of 773 non-breeding period observations of these hawks where the band color was noted and thus the sex could be determined. Included among these observations were 114 records of hawks with prey. Although the sexes were banded in nearly equal proportion (51% males, 49% females), males were encountered (597 records) significantly more often than were females (176 records).

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This study concludes that male Cooper's Hawks exploit bird feeding stations significantly more often than do females, and is in general support of the hypothesis of intersexual prey-size partitioning.

PITFALL VS. LONGWORTH LIVE-TRAPPING OF SOREX VAGRANS IN AGRICULTURAL SET ASIDES, DELTA, B.C. **Eric J Stromgren; Thomas P Sullivan** *Faculty of Land and Food Systems, 2357 Main Mall, University of British Columbia, Vancouver, BC, V6T 1Z4*. **zav@interchange.ubc.ca**

Pitfall trapping is believed to be the most efficient method for capturing shrews (*Sorex* spp), however, Longworth live-traps have been used successfully in Great Britain. Due to high metabolic rates, attempted live-trapping of shrews has previously been faced with high mortality rates. I compared pitfall and Longworth live-traps operated with drift fences on one ha trapping grids in agricultural set-asides in Delta, British Columbia. One-hundred trap stations, at each of 3 trapping grids, were equipped with a 3-m long drift fence and randomly assigned either one pitfall at the centre of each fence, or two Longworth traps, one at each end of the fence. In addition, one half of trap stations were randomly selected and provided with 6 g of mealworms (*Tenebrio molitor* larvae) as bait. Finally, in response to high mortality rates I varied the frequency of trap checks, with ranges from 12 - 14 h (long), 6 - 10 h (medium) and 3 - 4 h (short). Longworth traps captured on average 10.47 ± 6.33 individuals/session, while pitfall traps captured 2.25 ± 1.36. The highest mortality rates were observed in traps without mealworms and checked at long intervals (52.20 ± 4.24 %). The lowest mortality rates were observed in mealworm baited traps checked at short intervals (0%). Mealworm baited traps checked at medium intervals had mortality of 6.72 ± 2.97 %. These results indicate that with minor changes to currently used live-trapping methods it is possible to effectively include shrew species in standard small mammal monitoring protocols.

SURVEYING FOR FRESHWATER MUSSELS IN THE YAKIMA RIVER. **Allen E Sullivan.** *Central Washington University, Ellensburg, WA 98926*; **sulliall@cwu.edu.**

Freshwater mussels, once abundant throughout the northern hemisphere, are currently endangered. Freshwater mussels are long-lived, sessile, habitat-selective organisms that share a mutualistic relationship with salmon. Little is known about freshwater mussels in the Pacific Northwest, particularly east of the Cascade Mountains. As habitat-selective organisms, the importance of freshwater mussels for their role as environmental indicators, is noted. Additionally, the mussels role, as filter-feeders, for maintaining and improving water quality make their study worthwhile. Finally, due to their symbiotic relationship with salmonids, mussels may also serve as indicator species of past, present, and future salmon habitat. A survey of the Yakima River as it flows through the Kittitas Valley has been initiated. Difficulties associated with this survey have proven manifold, and include not only the generally cryptic nature of the mussel as found in its habitat, but, as it relates to the Yakima River, an altered flow regime, rapid flow fluctuations, extended periods of high turbidity, river access issues, inclement weather, and bank and channel ice. Despite these obstacles, this paper describes the process of developing a preliminary map of mussel distribution.

GOLDEN PAINTBRUSH - A MANAGEMENT DEPENDENT SPECIES OF NORTHWEST GRASSLANDS. **Theodore B. Thomas.** *U.S. Fish and Wildlife Service, Lacey, WA 98503*; **ted_thomas@fws.gov.**

Golden paintbrush (*Castilleja levisecta*) has been listed as a threatened species for nearly ten years. The recovery plan was finalized in 2000. The objective of the recovery plan is to improve the species status to where it can be removed from the list of endangered species. Several tasks are required to achieve this objective, including acquisition, restoration, and management of its grassland ecosystem, and the reintroduction of the species into its historic range. Research by our conservation partners has contributed to our understanding of golden paintbrush's habitat requirements, genetics, and population biology. The viability of golden paintbrush populations is dependent upon management. Populations that receive management in the form of mowing, prescribed fire, or judicious chemical control of invasive species have improved their numbers and distribution, compared to populations that receive no management. For recovery of the species to be successful, threats such as loss of grassland habitat, encroachment by woody shrubs and trees, and competition from nonnative, invasive plants will need to be reduced. A commitment from private and public landowners to actively manage for the long-term

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viability of the species will be required. Finally, new populations should be reintroduced into Oregon's Willamette Valley and SW Washington to recover the species throughout its historic range. Based on annual monitoring of the populations and the grasslands upon which it depends, all golden paintbrush populations will require management to improve their conservation status and to enable the Fish and Wildlife Service to remove golden paintbrush from the list of endangered species.

DISPERSED CAMPING INDUCED ENVIRONMENTAL DEGRADATION ALONG RIPARIAN HABITATS: ASSESSMENT, METHOD DEVELOPMENT, AND MANAGEMENT SOLUTIONS ALONG THE UPPER CLE ELUM RIVER, WASHINGTON. **Gretchen A Volker.** *Central Washington University, Ellensburg, WA 98926*; **volkerg@cwu.edu.**

There is no established, repeatable method for assessing total impacts of front country dispersed camping in National Forests. The research objectives are to assess front country dispersed camping impacts in the upper Cle Elum River area using a holistic method, and then compare this impact assessment with the Cle Elum Ranger District's environmental assessment research to determine if gaps exist in their campsite assessment data. The combined use of several existing methods of campsite degradation assessment will permit a comprehensive analysis of overall user impacts. The significance of this research is the development of a new impact evaluation methodology to assess the impacts of front country dispersed camping upon the environment to provide for more informed management decision-making. This holistic method has the potential to be used in other front country areas that experience intensive camping impacts and will verify that front country dispersed camping is a highly destructive recreational activity that needs immediate management attention.

NONNATIVE FISH PREDATION AND AN EMERGING DISEASE ILLUSTRATE COMPLEXITY OF RECOVERY EFFORTS FOR ENDANGERED AMPHIBIANS. **Vance T Vredenburg,** *Department of Integrative Biology, University of California, Berkeley, Berkeley, CA, 94720*, **USA; vancev@berkeley.edu**

Amphibian declines are occurring worldwide and many potential causes have been identified, yet there is still little known about the relative importance of various factors in population declines. In the Sierra Nevada, California, the endangered mountain yellow-legged frog (*Rana muscosa*) is declining. This montane frog occurs almost exclusively in naturally fishless alpine lakes and streams; however, more than century of misguided management practices has resulted in a landscape presently dominated by introduced fish. To test whether removal on nonnative trout in the absence of disease would affect endangered frogs, I removed all nonnative trout from 5 lakes in Kings Canyon National Park, California, USA. From 1998-2003, frogs from nearby lakes quickly colonized the newly fishless habitat and established large populations. Additional experiments showed that the most sensitive stage is the tadpole, which can take 3-4 years to metamorphose. The emergence of chytridiomycosis, a worldwide disease deadly to many amphibians, has complicated otherwise straightforward recovery efforts. Over the last four years mass die offs and population extinctions caused by chytridiomycosis have made recovery efforts much more challenging for the mountain yellow-legged frog. This study illustrates our need for an in-depth understanding of how multiple factors affect sensitive species and their relative importance.

SYNERGISTIC INTERACTIONS AMONG AN HERBICIDE AND AMPHIBIAN PATHOGENS: A POTENTIAL EVOLUTIONARY ARMS RACE **R. Steven Wagner, Tara Chestnut, Jim Johnson,** *Department of Biological Sciences, Central Washington University, Ellensburg Washington, WA 98925*; **wagners@cwu.edu.**

Increasing evidence suggests the recent, dramatic decline of amphibians is mediated by the effects of environmental stressors such as chemical pollutants and ultraviolet radiation that can weaken the immune defenses of a host and increase the virulence of pathogens. In order to address the potential interaction of a widely used herbicide (Roundup®) and a common introduced pathogen, *Saprolegnia* sp., we conducted infection experiments on Rana aurora embryos. We exposed embryos to four different treatment levels of Roundup® (0 ppm, 1 ppm, 2 ppm and 4 ppm) and two different strains of *Saprolegnia*

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(*Saprolegnia ferax* isolated from *Rana cascadae* embryos and a novel strain (B1) isolated from *R. aurora* embryos). Significant differences in infection rate, mortality, and hatching occurred among treatments with Saprolegnia exposure and increasing Roundup®. Specifically, an increased rate of infection and mortality, and decreased hatching occurred with the novel Saprolegnia strain B1. The results suggest that Roundup® does increase the susceptibility of amphibian embryos to pathogen infection and that the strain B1 maybe in an evolutionary arms race with its host because it has a greater virulence toward the species from which is was isolated.

TEASING APART DEATH AND PESTILENCE: DEMOGRAPHY AND INFECTION OF *Batrachochytrium dendrobatidis* **IN A NATURAL POPULATION OF PACIFIC TREEFROGS. R Steven Wagner, Susan Belmont, Jim Johnson. Central Washington University, 400 E University Way, Ellensburg, WA 98922. belmonts@cwu.edu**

Chytrid fungus *Batrachochytrium dendrobatidis* (Bd) has been implicated in mass mortalities and declines of amphibian species world-wide, including Washington State. However, there have been few long-term studies on the incidence and impact of infection on a natural population. Demographic changes in abundance have been estimated in a population of *Hyla regilla* at Engelhorn Pond (Kittitas Co., WA) since 2002 using mark-recapture methods. During the spring of 2006, B. dendrobatidis was detected in the population using PCR analyses. Consequently, we implemented a swabbing/PCR procedure for all captured/recaptured individuals to measure pathogen prevalance. Initial prevalence of the disease was approximately 43% and mark-recapture results suggest a decline in the number of recaptured individuals compared to previous mark-recapture years. In addition, no individuals testing positive for B. dendrobatidis were recaptured. The results of this study suggest that *B. dendrobatidis* is responsible for a significant decline in abundance of *H. regilla* which may have widespread implications for the persistence of other Northwest amphibians.

NON-INVASIVE SAMPLING OF FISHER AND MARTEN USING HAIR SNARES AND MOLECULAR GENETICS **Tzeidle N. Wasserman,** *Western Washington University*; **Samuel A Cushman,** *USDA Forest Service, RMRS, 800 E Beckwith, Missoula, MT 59801*; **Jim Hayden,** *Idaho Department of Fish and Game, Couer D'Alene, ID 83815*; **moonhowlin@yahoo.com**

Collecting representative occurrence data across large and remote landscapes for rare carnivores has been an abiding challenge for researchers and managers. New advances in molecular genetics and non-invasive sampling greatly facilitate efficient and representative data collection. We present results from four years of non-invasive hair snare surveys of three mountain ranges in northern Idaho for fisher (*Martes pennanti*) and American marten (*Martes americana*). The method uses plastic sheets as cubbies, and rifle gunbrushes as hair snares. Our results demonstrate that the approach is highly effective and cost efficient. We have placed out over 500 individual hair snares across an area of over 1000 square miles. The method is highly efficient, and a crew of two with snowmobile support can install and monitor upwards of 150 snares concurrently, even with a multiple visit protocol. Results to date indicate that marten are well distributed and fairly common in the middle to upper elevations in mature forest, and fisher are very rare and sparsely distributed in pockets, mainly in large low-elevation drainages. Additional advantages of the method include unequivocal identification to species with molecular genetics, and the discrimination of individuals and relationships among individuals. Such detailed information about the genetic characteristics of individual animals across complex landscapes provides rich data to address important questions in landscape genetics, such as identifying the factors that lead to isolation and fragmentation of populations.

FACTORS AFFECTING NEST PREDATION BY RAVENS. **William C Webb, John M. Marzluff.** *University of Washington, College of Forest Resources, Box 352100, Seattle, WA 98195-2100*; **webb@u.washington.edu**

Landscapes that provide supplemental resources for wildlife species exacerbate predator impact. Generalist predators often utilize food, water, and other anthropogenic resources in fragmented forested

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landscapes. The Common Raven (*Corvus corax*) is a generalist nest predator and is suspected to limit the breeding success of sensitive avian species such as the federally threatened Marbled Murrelet (*Brachyramphus marmoratus*) and migrant songbirds. Raven populations have recently grown throughout western North America, along with an expanding human presence. Ravens often congregate at farms, settlements, hunting carcasses and other sources of rich anthropogenic food bonanzas in the forested landscape of Washington State's Olympic Peninsula. We test the statistical hypothesis that human food subsidies interact with local forest structure to determine the ability of ravens to prey on songbird nests. We compare the rate of raven predation on simulated bird nests in mature forests and clearcuts associated and not associated with experimental food bonanzas. Results for 327 artificial nests deployed in 42 treatments in 2004 and 2005 indicate that nest in forests survive longer than nests in clearcuts ($X^2 = 5.18$; $P < .05$), increased raven abundance is associated with increased risk of raven nest predation ($X^2 = 4.09$; $P < .05$). In addition, nests near food bonanzas are depredated faster than nests in treatments without food bonanzas ($X^2 = 27.97$; $P < .01$). Although ravens may not always search contiguous forests for songbird nests, an increase in raven abundance in fragmented landscapes may significantly increase the risk of incidental predation of songbird nests in the vicinity of anthropogenic food resources.

FACTORS AFFECTING LANDSCAPE OCCUPANCY BY FISHERS IN NORTH-CENTRAL BRITISH COLUMBIA. **Richard D. Weir,** *Artemis Wildlife Consultants, 4515 Hullcar Road, Armstrong, BC V0E 1B4*; **Fraser B. Corbould,** *Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Avenue, Prince George, BC V2L 3H9*: **rweir@artemiswildlife.com.**

To develop a better understanding of the distribution and density of fishers (*Martes pennanti*) in industrial forest settings of north-central British Columbia, we examined the selection of home ranges of 10 radio-tagged resident fishers in the landscape of the Sub-Boreal Spruce biogeoclimatic zone between 1996 and 2000. We used information-theoretic methods to examine factors affecting the probability of a potential home range being occupied by resident fishers by evaluating the support by the data for 10 a prior models. The model that was best supported by the data to predict the likelihood of occupancy by each fisher included the percentage of home range in wetlands and recent logging. The probability of a home range area being occupied by a resident fisher decreased with increasing amounts of wetlands and recent logging (within past 12 years) present in the area (Odds ratio = 0.803, 95% CI: 0.663 - 0.973). This parameterization estimates that a 5% increase in recent logging or wetlands decreased the probability of occupancy of a potential home range by 200%. This relationship suggests that the accelerated rate of harvest in forests affected by mountain pine beetle (Dendroctonus ponderosae) infestations may have strong implications for the ability of the landscape to support sustainable populations of fishers.

HERPETOFAUNA AND THE RIVER CONTINUUM: A LANDSCAPE STUDY FROM A NORTHWESTERN CALIFORNIA WATERSHED. **Hartwell H Welsh, Jr, Garth R. Hodgson.** *USDA Forest Service, PSW, Redwood Sciences Lab, 1700 Bayview Dr., Arcata, CA 95521*; **hwelsh@fs.fed.us.**

Recent developments in fluvial geomorphology have yielded multi-scale conceptual models of the dynamic processes that alternately create, maintain, and destroy tributary and main channel aquatic and riparian habitats in mountain catchments. Such models have been applied to understanding the distribution of fish and fish habitats at the basin scale (e.g., Reeves et al. 1995), but we are unaware of similar approaches with the herpetofauna. Here we examine distributions of the herpetofauna in a 112 km un-damned river and tributaries in a 789 km2 watershed in northern California - the Mattole - as they relate to landscape level channel processes. We describe unique faunal assemblages relative to geomorphological process domains (Montgomery 1999) associated with: (1) low gradient, shallow, unconfined, multiple or migrating channels in broad alluvial valley; (2) slightly entrenched, higher-gradient, meandering riffle/pool channel with well developed flood plain; (3) moderately entrenched channel with 2-4% gradients, structurally controlled by moderately steep valley; and (4) high-gradient tributaries with narrow, gorge-defined channels, with step pool/cascade structure. These channel categories represent four points along a river continuum/channel network with intermediate transition stages between. We link these process domains and habitats created with the natural histories of the resident riparian and aquatic herpetofauna of the Mattole.

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THE IMPACTS OF FINE-SEDIMENT LOADING ON THE GROWTH AND SURVIVAL OF WESTERN TOADS (*BUFO BOREAS*). **Sylvia Wood, John S. Richardson.** *Centre for Applied Conservation Research, University of British Columbia, Vancouver, BC, V6T 1Z4*; **sylvwood@interchange.ubc.ca**

The impact of fine sediment inputs into ponds on tadpole growth and development was studied in the Western Toad (*Bufo boreas*). Alterations to the natural flux of materials from terrestrial to aquatic environments have the potential to directly affect aquatic species and communities. Inputs of fine sediments from timber harvesting activities are known to negatively affect stream biota growth and behaviour, yet little is known about its affects on pond species. Sediment and nutrient levels were experimentally manipulated in pond mesocosms to simulate repeated run-off events associated with rainfall. Tadpoles (n = 90/tank) were subjected to weekly pulses of 0, 100 and 200g of fine sediment (<64μm) and bi-weekly nutrient spikes (P-10μg/L, N-160μg/L). Grazing pressure and sediment clearing abilities of tadpoles were assessed by AFDM of periphyton and sediment accrual on open and caged substrata. Growth rates and survival of tadpoles indicated a moderately negative impact of sediment loading. Tadpoles from high sediment treatments had 17% lower survival to metamorphosis, achieved a significantly lower maximum pre-metamorphic weight and emerging toadlets were ~10% smaller than controls. Analysis of forgaing behaviour and diet content suggest changes in foraging effort and food quality (% inorganic content) associated with sediment loading as potential mechanisms for these differences. Their ability to clear settled sediment from substrata, likely through ingestion, as indicated by AFDM results highlights a potential role for pond tadpoles as "ecosystem engineers" facilitating primary production on grazing surfaces.

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STATUS OF CANDIDATE SPECIES CONSERVATION ON PRAIRIE AND OAK WOODLANDS. **Hannah E Anderson.** *The Nature Conservancy of Washington, Olympia, WA 98502*; **handerson@tnc.org.**

Four species that are candidates for listing as endangered or threatened under the United States Federal Endangered Species Act occur on prairies and oak woodlands of the Georgia Basin, Puget Trough, and Willamette Valley - Taylor's checkerspot (*Euphydryas editha taylori*), mardon skipper (*Polites mardon*), Mazama pocket gopher (*Thomomys mazama*), and streaked horned lark (*Eremophila alpestris strigata*). All four species are in decline and have been extirpated from many historically occupied sites, including those in the northern and southern extents of their ranges. Integrated, cooperative conservation actions are necessary to both ensure the viability of existing populations and secure potential sites for reintroduction throughout the species' present and historic range. To ensure all partners working toward conservation of these species are in accord, we have compiled information both from the scientific literature and in cooperation with experts regarding the population status, research needs, and conservation/restoration actions necessary to promote recovery of these rare species. A generalized structure for recovery and conservation actions has been generated. Building on that structure, specific information regarding the status and conservation actions needed for each species is presented in a visual format. This work is funded by the Legacy Resource Management Program of the Department of Defense through the Rare Species Recovery Project. Information for the conservation status and actions needed was generated in cooperation with state and federal agency biologists and conservation organizations.

BATS OF FORT LEAVENWORTH MILITARY RESERVATION AND NEARBY AREAS OF EASTERN KANSAS AND WESTERN MISSOURI. **Virgil Brack, Jr.** *Center for North American Bat Research and Conservation, Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, IN 47089*; **Lynn W. Robbins.** *Department of Biology, Missouri State University, 901 South National Avenue, Springfield, MO 65897*; **Clay R. Davis.** *Department of Biology, Midwestern State University, Wichita Falls, Texas 76308*; **clay.davis@us.army.mil.**

Although nine species of bats are considered resident in northeastern Kansas, we caught only six (198 individuals). Big brown bats (*Eptesicus fuscus*) were 77% of the catch and three species, hoary bat (*Lasiurus cinereus*), northern myotis (*Myotis septentrionalis*), and Eastern pipistrelle (*Pipistrellus subflavus*), were each represented by only a single individual. Five captures of three species were county records: red bats in Linn and Miami counties, northern myotis in Leavenworth County, and evening bats in Leavenworth and Miami counties. We obtained evidence of reproduction for the big brown bat, red bat (*Lasiurus borealis*), evening bat (*Nycticeius humeralis*), and northern myotis. We captured no bats at 6 of 21 net sites, whereas the greatest catch at a single location was 56 bats. There was no difference in catch of adult male and reproductive female big brown and red bats, or for all species combined. The rate of capture over 5 hours of sampling was different than random for the big brown bat, and for all species combined, but was similar for all species combined excluding the big brown bat. Captures decreased over the sampling period. The rate of capture of red and evening bats was similar in all habitats sampled, whereas big brown bats were caught disproportionately often over stream versus bottomland and upland corridors. At 10 sites sampled ultrasonically we detected echolocation calls of seven species. Although we detected calls of the Eastern pipistrelle and little brown myotis, these species were not captured at these 10 sites.

THE WHISTLER BIODIVERSITY PROJECT. **Bob Brett,** *Snowline Ecological Research, 7-4815 Glacier Lane Whistler, BC. V0N 1B4*. **Bob@SnowlineResearch.ca.**

Conserving nature is a priority for residents and the local government in the resort community of Whistler BC. Conservation efforts to date have been hampered by data gaps, notably: (a) the lack of an inventory of native species; (b) little knowledge about local species-habitat relationships; and (c) lack of monitoring, either of species or their habitats. To address these data gaps, several non-profit groups and the Resort Municipality of Whistler (RMOW) initiated the Whistler Biodiversity Project in 2005. In its first two years, the Whistler Biodiversity Project began work on a variety of taxonomic groups including amphibians, vascular plants, fungi, bats, lichens, and dragonflies. Key results to date include: i) inventories for amphibians, fungi, and native and non-native vascular plants (first approximations); ii)the

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discovery of three listed plants species previously unknown to Whistler: *Euthamia graminifolia* (= *Solidago graminifolia*); *Botrychium ascendens*, and *Muhlenbergia glomerata*; iii) the first valley-wide survey of coastal tailed frogs (*Ascaphus truei*), a blue-listed species; and iv) pilot studies on bats, lichens, and dragonflies. An updated strategic plan for the Whistler Biodiversity Project is now in preparation which will identify: (a) opportunities for secure, multi-year funding, (b) priorities for research, e.g., which taxonomic groups to focus on; and (c) ways to link results to on-the-ground management in the RMOW.

DETECTING A DEADLY AMPHIBIAN DISEASE: ARE PARK VISITORS INADVERTANT VECTORS? Tara Chestnut, *Washington State Department of Transportation, Olympia, Washington 98504;* **Eric M Lund; Jim Johnson, R. Steven Wagner,** *Department of Biological Sciences, Central Washington University, Ellensburg, Washington 98925*. **tarachestnut@gmail.com**

The chytrid fungus *Batrachochytrium dendrobatidis* (Bd) is associated with mass amphibian mortalities and local extinctions in both disturbed and pristine landscapes. Bd causes the disease chytridiomycosis, an epidermal infection fatal to frogs and salamanders. In 2002, Bd was detected in a Wood Frog (*Rana sylvatica*) at the Kenai National Wildlife Refuge near a boat access ramp. Denali National Park (DNP) receives a large number of visitors during the summer months many of whom travel between DNP and the Kenai Peninsula to view Alaska's wildlife. This research project sought to determine if 1) Wood frogs in DNP are infected with Bd and 2) to infer whether park visitors are inadvertent vectors of Bd. Ponds were sampled using standard techniques in two strata: roadside (directly adjacent to the main park access road) and backcountry (> than 1-mile from roads). Sampling took place over a two week period in August 2006. Recent metamorphs were the most frequently encountered life stage. Tissue samples were collected from live frogs using non-invasive skin swabs preserved in a buffered TE solution. Known wood frog breeding sites were targeted although occupancy of some ponds was unknown. Thirty animals were encountered at known sites: 12 at roadside sites and 18 at backcountry sites. Wood frogs were not detected at sites where their status was previously unknown. Bd was not detected in any of the samples; however 8 dead and dying animals were encountered and collected for additional analysis to determine cause of death. Follow-up research will investigate Bd detection biases among wood frog life stages, determine if mortality is caused by other pathogens, and if the extended and extreme cold temperatures of the arctic may limit the distribution of Bd.

DAYTIME USE OF ROOSTS BY WESTERN SCREECH-OWLS (*MACFARLANEI* **SUBSPECIES) ALONG THE SHUSWAP RIVER, BRITISH COLUMBIA. Helen Davis, Richard D. Weir.** *Artemis Wildlife Consultants, 4515 Hullcar Road, Armstrong, BC, V0E 1B4***; hdavis@artemiswildlife.com.**

In 2003, we began researching the general biology and habitat use of western screech-owls (*Megascops kennicottii macfarlanei*) along the Shuswap River, north of Lumby, BC. Six owls (3 M, 3 F) were outfitted with radiotransmitters and followed between 17 July 2005 and 5 January 2007 to determine home range size, habitat use, nest type and success, and mortality factors. We identified screech-owls roosting on 140 different occasions in 7 different tree species. Roost sites were most frequently found in western redcedar (*Thuja plicata*; 78 of 140; 56%), followed by paper birch (*Betula papyrifera*), hybrid spruce (*Picea glauca* x *engelmanni*), black cottonwood (*Populus balsamifera* spp. *trichocarpa*), Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*) and willow shrub (*Salix* spp.). Male and female screech-owls selected conifer and deciduous tree species for roosts at different frequencies ($?^2 = 26.6$, df = 1, $P < 0.001$), with male owls utilizing conifer trees (84%) for roosting more than females (58%). Screech-owls primarily used deciduous trees for roosting during the leaf-on period. Screech-owls occasionally re-use roost trees; however no owl was detected using the same roost tree more than 4 times during monitoring. These results have implications for the conservation of roosting habitat for this endangered species in Canada.

ALBERTA WOLVERINE EXPERIMENTAL MONITORING PROJECT. Jason T Fisher, Steve Bradbury, Luke Nolan, Len Peleshok, Sharon Neuman. *Alberta Research Council, Vegreville, AB T9C 1T4***; Lisa Wilkinson,** *Alberta Fish and Wildlife Division, Edson, AB T7E 1T2***; jason.fisher@arc.ab.ca.**

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The wolverine (*Gulo gulo*) is a member of the weasel family (Mustelidae) that has experienced considerable population reduction and range retraction across North America since European occupation. In Alberta, wolverine inhabit the mountains, foothills, and boreal plain, but in unknown numbers. A long-term monitoring program for wolverine is required to aid species-at-risk assessment; this project assessed the efficacy of noninvasive genetic tagging (NGT) to monitor Alberta wolverines. In 2005 and 2006 we established ca. 60 monitoring stations across a 400 km linear transect from Cadomin to north of Grande Cache. In 2005, wolverines were detected at 7 of 60 baited stations (11.7%), compared with 2.2% of stations in 2003-2004. The same five wolverine individuals were detected in 2006. Our results suggest that wolverines occur in very low densities in Alberta - possibly as low as one wolverine per 300 km2, based on 2004 data. The apparently low wolverine density we see now stands in contrast to historically high densities indicated by trapping records. Extremely low density and high variability means that a very large sample size will be required to adequately detect population trends. Wolverine are listed as Data Deficient for sound reasons, and this research reflects the difficulty in obtaining rigorous data on elusive, vagile, low-density animals.

WESTERN BROOK LAMPREYS AT THE NORTHERN EXTENT OF THEIR RANGE. **Kim Hastings, Daniel Cushing.** *U.S. Fish and Wildlife Service, 3000 Vintage Blvd Suite 201, Juneau, AK 99801***; kim_hastings@fws.gov.**

Western brook lampreys (*Lampetra richardsoni*) reach the northern extent of their range in coastal southeastern Alaska. Our interest in the species was piqued in 2002 when an apparently isolated population was discovered upstream of a large waterfall near Petersburg, Alaska; western brook lampreys had previously been collected from only three locations in this region. Brook lampreys spend most of their lives as juveniles burrowed into soft substrate, emerging as adults only in their final spring to spawn in clean gravel. Spawning adults of the Petersburg isolated population were in a small, low gradient tributary immediately upstream of a large beaver pond complex. By searching similar settings, we found three more non-isolated populations, and in 2005 and 2006 we monitored one of these populations to determine the timing of spawning and longevity of redds. Spawning began by mid-May in 2005, but not until the start of June in 2006, likely due to an unusually cold spring. Spawning ended by mid-June in both years. Nearly all redds were located just above pool tailouts, slightly out of the main flow. In 2006, redds were detectable for less than two weeks following spawning, after which a high water event scoured the stream bottom. This event obliterated the pattern of disturbed algae around redds that is key to distinguishing brook lamprey redds from human or ungulate footprints. Redd dimensions and longevity were similar to that reported from Washington State. However, a shorter spawning period constrains the timing of lamprey surveys in southeastern Alaska.

BREEDING HABITAT OF COASTAL SANDHILL CRANES AND THE SUSTAINABILITY OF NORTHERN VANCOUVER ISLAND BOG ECOSYSTEMS. **Tyler M. Innes.** *Royal Roads University, 2005 Sooke Road, Victoria, BC V9C 3Y3***; Jacques Whitford -** *Axys Environmental, 11-2042 Mills Road, Sidney, BC V8L 5X4***; tinnes@axys.net**

Sandhill crane (*Grus canadensis*) breeding habitat and bog ecosystem values are not well understood in coastal British Columbia. Sandhill crane nests have recently been discovered in coastal blanket bogs on the Nahwitti Plateau of northern Vancouver Island and researchers are interested in the crane habitat preferences in this large bog complex. Wind energy development and forestry operations in the region may jeopardize ecological and societal values of the wetlands as well as reduce sandhill crane habitat and rare plant communities for future generations. The sandhill crane is blue-listed in British Columbia, Canada because of lack of data on nesting populations and habitat loss. The blanket bog wetland complex also provides global services such as storing carbon, preventing erosion and providing habitat for specific groups of biota. The bogs house rare and endemic plant species and ancient bog ecosystems that hold ecological and genetic biodiversity. The research will focus on identifying sandhill crane nesting habitat and valuable wetland functions that the blanket bogs of northern Vancouver Island offer. Sustainable development management strategies will be discussed with respect to wetland values and habitat functions. Ecosystem mapping, geographic information systems, and habitat models will aid in analyzing and displaying the sandhill crane nesting habitat and bog ecosystems in the region. Vegetation surveys, nest inventories and wetland measurements will be used to verify nesting habitats of the sandhill

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crane and rare vegetation elements. Sustainable use of the blanket bogs of the Nahwitti Plateau depends on setting spatial and temporal constraints on industrial development.

TESTING THE EFFECTIVENESS OF RIPARIAN BUFFERS ALONG NON-FISH-BEARING STREAMS: THE TYPE N EXPERIMENTAL BUFFER TREATMENT STUDY. **Aimee P McIntyre, Marc P Hayes, Casey H Richart, Timothy Quinn,** *Washington Department of Fish and Wildlife, Olympia, WA 98501*; **William J Ehinger, Stephanie Estrella,** *Washington Department of Ecology, Lacey, WA 98503*; **Robert E Bilby,** *Weyerhaeuser, Federal Way, WA 98063*; **James G MacCracken,** *Longview Fibre Company, Longview, WA 98632*; **Dave Schuett-Hames,** *Northwest Indian Fisheries Commission, Olympia WA 98516;* **Andrew Storfer,** *Washington State University, Pullman WA 99164*; **mcintam@dfw.wa.gov.**

The Type N Experimental Buffer Treatment Study will evaluate the effectiveness of riparian buffers along non-fishbearing streams in western Washington, providing information valuable to managing headwater streams harvested for timber. The study will compare 16 m wide buffers (on each bank) of differing lengths with an unharvested reference. Blocks of four treatment basins (0, 50, and 100% buffer lengths, and a reference) are replicated 4 times; two back-up sites are also included for a total 18 sites. Differences among treatments will be measured by changes of amphibian occupancy, density, and genetic structure; water quality; primary productivity; litter and nutrients exported to fishbearing streams; and the response of fish downstream. The study design includes two years of pre- and two years of post-treatment data collection with one year for treatment application. Analyses will distinguish potential differences among treatments and assess the ability of each buffer prescription to maintain headwater habitat and system functions. The Washington State Department of Fish and Wildlife is implementing the amphibian demographic response portion of the study. Target amphibian species are stream-associated and include: coastal tailed frog (*Ascaphus truei*), 3 torrent salamanders (*Rhyacotriton*), and 2 giant salamanders (*Dicamptodon*). We are collecting demographic data using 2 methods: longitudinal light-touch and block net sampling. Longitudinal light-touch, used to determine species occupancy, will provide life-stage specific detection information for all amphibian species encountered. Block net sampling is used to estimate amphibian density. Analysis will employ a mixed-model repeated measures ANOVA.

NORTHERN SAW-WHET OWL MIGRATION MONITORING ON VANCOUVER ISLAND, BRITISH COLUMBIA. **Jessica J Murray. Jacques Whitford -** *Axys Environmental, 11-2042 Mills Road, Sidney, BC V8L 5X4*; **Paul G Levesque,** *Rocky Point Bird Observatory, 7881 Fairview Rd, Black Creek, BC V9J 1G5*; **jmurray@axys.net**

Seasonal movements of the Northern saw-whet owl (*Aegolius acadicus*) are relatively undocumented in western North America. The saw-whet owl is known to be migratory in eastern North America, but information regarding annual movements of this species is virtually non-existent in British Columbia. Given this need for information, Rocky Point Bird Observatory has studied the timing and volume of Northern saw-whet owl migration on southern Vancouver Island for the past five years. During the falls (15 Sept. to 10 Nov.) of 2002-2006, migration monitoring was conducted by recording owl detections (vocalizations and sightings) and by the capturing and banding of saw-whet owls. Trapping effort has resulted in the banding of 1297 saw-whet owls: 210 banded in 2002, 311 in 2003, 403 in 2004, 77 in 2005, and 296 in 2006. Annual capture rates were similar between years varying between 0.32 and 0.42 owls/net hour, with the exception of 2005 when the capture rate dropped to 0.11. Four saw-whet owls banded at Rocky Point between 2003 and 2005 have been recovered in Washington State and one owl banded near Forks, WA in 2000 was recaptured at Rocky Point in 2004. Of interest, a saw-whet owl originally banded in 2003 at Rocky Point was recaptured in 2006 near Kyle, Saskatchewan, over 1150 km east of Rocky Point. Results suggest that the western populations of saw-whet owls are migratory along coastal British Columbia; however more information is required regarding the timing, volume, and extent of these seasonal movements. Rocky Point Bird Observatory is now developing a long term monitoring program to further document saw-whet owl migration.

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HISTORICAL RECORDS OF CLIMBING SALAMANDERS (GENUS *ANEIDES*) IN WASHINGTON STATE, U.S.A. **Ryan P O'Donnell.** *Department of Biology and the Ecology Center, Utah State University, 5305 Old Main Hill, Logan, UT 84322-5305*; **ryan@biology.usu.edu.**

The climbing salamanders (genus *Aneides*) are found in four widely separated geographic regions in North America, including a recently-split pair of species (*A. ferreus* and *A. vagrans*) which collectively have a curiously disjunct distribution, being found on the west coast of Baja California, California, Oregon, and British Columbia but supposedly not in Washington. An extensive search of the literature, however, revealed three published records of *Aneides* from Washington. The presence of *Aneides* in Washington, if confirmed, could help explain the disjunct distribution of the genus along the Pacific coast. A combination of museum specimens, field searches, and historical evidence suggests that all three of these records were most likely the result of misidentifications. Although it is logically impossible to prove the absence of *Aneides* from Washington, the current consensus that *Aneides* does not occur, and has not recently occurred, in Washington appears to be correct despite three published records to the contrary.

NORTHWEST HABITAT MANAGEMENT GUIDELINES FOR AMPHIBIANS AND REPTILES. **David S. Pilliod,** *USGS Forest and Rangeland Ecosystem Science Center, Snake River Field Station, Boise, ID*; **Elke Wind,** *E. Wind Consulting, Nanaimo, British Columbia;* **Deanna H. Olson,** *USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331;* **Ernesto R. Garcia,** *PARC Federal Agencies Coordinator, US Fish and Wildlife Service, Weaverville, CA*; **Priya Nanjappa Mitchell,** *PARC State Agencies Coordinator, Gurnee, IL*; **dpilliod@usgs.gov.**

Habitat alteration, fragmentation and loss are considered to be major challenges for the conservation of amphibians and reptiles (or herpetofauna). Herpetofaunal populations in the North America are declining, and as long as human populations expand, habitats will be modified. Thus, Partners in Amphibian and Reptile Conservation (PARC) recognized an opportunity to provide proactive guidance for improving the compatibility of land management practices with these animals. Partners in Amphibian and Reptile Conservation is sponsoring the development of a series of regionally specific management recommendations, or Habitat Management Guidelines (HMGs). These guidelines use the best science available to produce recommendations that are easily understood and practical for land managers and private landowners. The objectives of these guidelines are to keep common species common, stem the decline of imperiled species, provide guidance on the management and restoration of amphibian and reptile habitats while benefiting many other wildlife species, and reduce the likelihood of species becoming listed as threatened or endangered. Landowners and land managers are presented with measures to help them maximize compatibility with their existing management objectives, or to optimize their management actions specifically for herpetofauna. The Northwest HMGs are a multi-authored document capitalizing on the expertise of herpetologists in the region. They cover over 150 species in 20 habitat types, spanning the area from northern California to southern British Columbia, and from the Pacific Ocean to Montana.

IMPACTS OF CATTLE GRAZING ON AQUATIC INVERTEBRATE COMMUNITIES IN WETLANDS OF BC'S SOUTHERN INTERIOR. **Brian J Purvis, Brian A Heise,** *Natural Resource Sciences, Thompson Rivers University, Box 3010, 900 McGill Road, Kamloops, BC, Canada V2C 5N3*; **Bruce Harrison,** *Ducks Unlimited Canada, 954 A Laval Crescent Kamloops, BC V2C 5P5*. **bpurvis@telus.net**

Aquatic invertebrates in wetland ecosystems are essential to wetland function, serving as key trophic links between primary producers and higher organisms such as waterfowl. Intensive grazing by domestic cattle can degrade key wetland attributes leading to fragmented aquatic invertebrate community structure, decreased species richness and an overall decline in species diversity. Our June 2006 study compared littoral zone invertebrate populations of grassland-associated wetlands (n = 24) under different grazing pressures near Kamloops BC, Canada. Quantitative dip-net samples were obtained from isolated areas of the water column using a collapsible enclosure. This previously undocumented procedure increased the quantitative accuracy of the study. We hypothesized that wetlands under high grazing pressure would exhibit decreased species richness in aquatic invertebrate communities when compared to those lightly

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grazed. Invertebrate samples (n = 3) were taken from each of 24 wetlands, categorized as having either 'heavy' or 'light' grazing pressure based on degree of soil compaction and hummocking by livestock. Heavily grazed wetlands exhibited significantly lower mean Simpson's Diversity Index values ($p<0.05$) (at the family level) when compared to those exhibiting little to no cattle grazing pressure. Heavily grazed wetlands were dominated by elevated numbers of amphipods and dipterans, while those lightly grazed exhibited marked decreases in these taxa, while having higher proportion of Orders Anostraca, Basommatophora, Coleoptera, Ephemeroptera, Hemiptera, Lepidoptera, Odonata, Podocopida and Trichoptera. Our study indicates that cattle access to wetlands should be appropriately managed to maintain the functionality of these invertebrate communities, and the roles they play in food webs of higher vertebrates within wetland ecosystems.

WENAS CREEK MAMMOTH: INITIAL ATTEMPTS AT TAXONOMIC CLASSIFICATION BASED ON HUMERI LENGTH MEASUREMENTS. **Jake T Shapley,** *Resource Management Program, Department of Anthropology and Museum Studies, Central Washington University, Ellensburg, WA 98926;* **Bax R Barton,** *Burke Museum of Natural History and Culture (Paleontology Division), and Quaternary Research Center, University of Washington, Seattle, WA 98195*; **Patrick M Lubinski,** *Department of Anthropology and Museum Studies, Central Washington University, Ellensburg, 98926*; **Karl Lillquist, Morris Uebelacker,** *Department of Geography and Land Studies, Central Washington University, Ellensburg, WA 98926*. **shapleyj@cwu.edu.**

In the summer of 2005 an interdisciplinary team of scientists and students conducted initial excavation of a reported "mammoth" find located in the lower Wenas Creek Valley, Yakima County, Washington. The apparent stratigraphic age and size of the two recovered humeri from the site suggests that they belong to a late Pleistocene member of the Order Proboscidea. Based on their overall morphology there is little doubt the humeri are from a mammoth (*Mammuthus* sp.) rather than its distant cousin, the mastodon (*Mammut americanum*). A question remained as to what species of mammoth the humeri represented? Our initial attempt at taxonomic classification based on comparative length metrics proved unsuccessful. In general, long bones are not ideal for differentiating closely related mammoth species, but previously published data suggests a significant difference in average total length among the three possible species of mammoth found in the Pacific Northwest: imperial (*M. imperator*), Columbian (*M. columbi*) and woolly (*M. primigenius*). Based on initial length measurements the Wenas Creek mammoth could be any of these, but chronologically it is dated too late to be an imperial mammoth. Compared to published data for total length, the Wenas Creek humeri could either be from a small Columbian or a large woolly mammoth. However, woolly mammoths have not been found west of the Rocky Mountains. Unfortunately, the overlap in humeri length metrics between Columbian and woolly mammoths suggests that only the discovery of associated molars at this site is likely to definitively answer this question of species taxonomy.

USING CLUSTER ANALYSIS AND ORDINATION TO DESCRIBE THE HABITAT OF SPALDING'S CATCHFLY (*SILENE SPALDINGII*), A THREATED FORB, AT GARDEN CREEK RANCH. **Mamie J Smith, Stephen C Bunting.** *Department of Rangeland Ecology and Management, College of Natural Resources, University of Idaho, Moscow, ID 83844-1135*; **smit3905@uidaho.edu.**

Cluster analysis and ordination were used to evaluate the homogeneity of Spalding's catchfly (*Silene spaldingii*) habitat within Garden Creek Ranch (GCR), Idaho, located within Hells Canyon. During the spring of 2006 vascular plant canopy cover, ground cover, aspect, slope, and elevation data were collected over thirty macroplots in the China Garden Creek drainage. This information was input into the computer program PC-Ord and analyzed using cluster analysis and non-metric multidimensional scaling (NMS) ordination. Three community types emerged: a) macroplots with average shrub cover <1%, b) macroplots with mixed characteristics, c) macroplots with average shrub cover >1%. Of the ecological variables evaluated, bunchgrass canopy cover, shrub canopy cover, percent slope, and elevation most influenced the delineation between community types. The community types, though distinct via cluster analysis and ordination, most likely represent the continuum of Spalding's catchfly habitat at GCR.

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The three community types were then qualitatively compared to the three most widely used habitat classification systems in this region for goodness-of-fit. At GCR, sites which have higher shrub cover are classified differently than those without shrubs. Spalding's catchfly habitat that is influenced by shrubs most closely resembles Daubenmire's (1970) Idaho fescue (*Festuca idahoensis*)/common snowberry (*Symphoricarpos albus*) habitat type. Sites without shrub influence more closely resemble the Idaho fescue/ prairie junegrass (*Koeleria mcrantha*) plant association described by Johnson & Simon (1987) and Tisdale (1986).

BIRD USE OF INDUSTRIAL AND AGRICULTURAL FORESTS IN BORNEO. **Alison Styring.** *The Evergreen State College, Olympia, WA 98505*; **Pete Hosner, Fred Sheldon,** *Museum of Natural Science, Louisiana State University, Baton Rouge, LA 70803*; **styringa@evergreen.edu**

Most forests in SE Asia have been logged to the extent that they no longer can be managed for sustainable economic use. As a result, SE Asian countries are replacing native forests with exotic trees, including oil palm and rubber for agricultural use, and Acacia, Albizia, and Gmelina for the production of industrial wood products such as pulp and plywood. The extent to which native birds inhabit such forests is of substantial importance to conservationists. Also, because exotic tree plantations consist of different aged groves, they provide the wherewithal for an examination of successional development of forest bird communities through time. We surveyed birds in exotic tree plantations in two locations in Borneo, in the Malaysian states of Sabah and Sarawak, and found that native birds make substantial use of the groves of some species of trees, especially if plantations are near natural forest and plantation managers allow the development of secondary forest undergrowth.

EMERGENCE AND FORAGING PATTERNS OF MYOTIS SPP. BATS IN THE SOUTHERN PUGET SOUND REGION. **Trisha Towanda, Greg Falxa.** *The Evergreen State College, Olympia, WA 98505*; **trisha_towanda@ yahoo.com**

A maternity colony of Myotis spp. bats was observed for emergence and foraging patterns. Emergence was measured relative to time of sunset, illumination, temperature and lunar phase in Olympia, WA during May 2005. The time at initial emergence was strongly predicted by time of sunset, (+12.2 +/- 1.2 min after sunset). The time required for complete emergence also correlated with time of sunset but was not correlated with the number of bats emerged. Neither temperature nor lunar phase was associated with time at initial or complete emergence. Bats from this colony were radio-tracked during spring and summer of 2006 to document foraging behaviors. Bats were measured traveling round-trip distances of up to 30 km per night. One-way commute distance was measured at 11 km. Results indicate that this population of bats is not subject to increased predation during the full moon or that foraging opportunities supersede predation risks. Distances traveled are generally greater than has been previously reported for this species.

SPECIES IDENTIFICATION AND BODY SIZE ESTIMATION OF AMPHIBIANS IN WASHINGTON STATE BASED ON FOOT MORPHOLOGY. **Julie A Tyson, Marc P. Hayes.** *Washington Department of Fish and Wildlife, Olympia, WA 98501*; **Robert A Grove,** *U.S. Geological Survey, Corvallis OR 97330*; **tysonjat@dfw.wa.gov.**

Species identification of amphibians based on their dismembered or partly digested parts is a basic aspect of dietary studies on amphibian-consuming organisms. In the course of attempting to identify amphibian limbs obtained from river otter (*Lontra canadensis*) gastrointestinal tracts, we became aware of the lack of data to systematically identify amphibian limbs. We were also interested in estimating body size for the amphibian species consumed based on limb remnant size. Hence, we are developing systematic data with two foci: first, a dichotomous key to amphibians based on foot morphology (both front and hind) for all 27 species of amphibians in Washington State (14 salamanders and 13 frogs); and second, regressions designed to estimate body size based on single, easily measurable aspects of foot morphology. Here, we present two preliminary aspects of this work: a version of the dichotomous key to the feet of all 27 amphibian species in Washington State; and a preliminary regression for the relationship between toe length and body size for the northwestern salamander (*Ambystoma gracile*).

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LONG-TERM AMPHIBIAN MONITORING IN ALBERTA. **Lisa Wilkinson,** *Alberta Fish and Wildlife Division, Edson, AB T7E 1T2;* **lisa.wilkinson@gov.ab.ca.**

A long-term amphibian monitoring program was initiated in Alberta in 1997 at two sites, and since that time, up to seven sites have been monitored. Monitoring involves 1) pitfall trapping at a designated pond, and 2) pond surveys (or road transects in the grassland region). Over the course of the program, 67 506 trap nights have yielded 14 669 amphibian captures. In addition, 448 individual ponds and 10 individual road transects have been surveyed, many of which have been surveyed annually. All but one of the 10 amphibian species found in Alberta have been detected during this program. Population trends have fluctuated between years and sites; general trends will be presented and discussed. Some notable observations include: relatively stable population of the northern leopard frog (threatened) in Cypress Hills Provincial Park; absence of the Canadian toad (data deficient/may be at risk) in parts of its historic range in central Alberta; and local population declines of the long-toed salamander (species of special concern) in response to human activity at breeding ponds. The program also has a public education component, and has reached over 33 000 people through various types of outreach. Monitoring has occurred through funding and resources from a variety of partnerships, but unfortunately, funding has been reduced in recent years and the future of the program is in jeopardy.