

Understanding and Managing Diversity: *From Landscapes to Genes*



88th Annual Meeting of the Northwest Scientific Association
March 29 – April 1, 2017
Southern Oregon University, Ashland, OR

Cascade-Siskiyou National Monument
View to north towards Ashland, Oregon

Cover photograph by John Villella
2014

Program and Abstracts
Northwest Scientific Association
88th Annual Meeting

Southern Oregon University, Ashland, OR
March 29 – April 1, 2017

Held in Cooperation with

Southern Oregon University,
Department of Science, Technology, Engineering, and Math
Pacific Division of the American Association for the Advancement of Science
Northwest Lichenologists
California Lichen Society

Thank You to all who helped!

This event would not have been possible without the generous support of our partners, planners and volunteers

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NWSA - Linking Scientists throughout Northwestern North America

Since 1923 the Northwest Scientific Association (NWSA) has existed for the purpose of promoting scientific knowledge in the northwestern United States and western Canada. Our membership includes professional and amateur scientists, resource professionals, teachers and students interested in applied, natural, physical, environmental and conservation sciences in the Northwest. Each year the NWSA publishes four issues of our peer-reviewed journal, *Northwest Science*. Our annual meetings are held throughout the Northwest and provide an opportunity for our members and the scientific community to share their current research results and foster collaborative interactions.

Would you like to get involved? Students are encouraged to join and participate in the NWSA. All members in good standing, including Student members, are eligible to serve on various committees, including the Nominations, Student Grants, Awards and Honors, and local Annual Meeting Program committees. Would you like to get involved and begin networking with the oldest and largest association of scientists in the Northwest? To learn more, talk to one of the board of directors, or visit our website at <http://www.northwestscience.org>.

A Special THANK YOU is extended to our 2016-2017 Board of Directors

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WELCOME FROM THE PRESIDENT OF THE ASSOCIATION

Welcome to the 88th Annual Meeting of the Northwest Scientific Association (NWSA). Thank you for supporting the Association and your community of scientists in northwestern North America. Our conference organizers, John Villella, Dominc DiPaolo, Gregg Riegel, Dan Gavin, Robin Leshner, Michael Parker and Roger Christianson, have put together an exciting program to consider biodiversity, landscape change, and consequences of fire in the Klamath region. We are especially honored to have keynote and banquet speakers Dr. Susan Harrison and Dr. Pepper Trail. Dr. Harrison comes to us from UC Davis and her research aims to understand the processes that shape plant species diversity, especially the interaction among small-scale forces, such as competition, and large-scale forces such as niche evolution. She will provide a synthesis of the factors driving the remarkable biodiversity found in the Siskiyou region. Dr. Trail is a forensic biologist with the U.S. Fish and Wildlife Service and has fascinating tales coming from the intersection of law enforcement and biology. Our plenary session on the effects mixed severity fire on biodiversity will explore a number of perspectives on the topic. Complementing the technical sessions, our field trips focus on lichens and mosses of the Sampson Creek Preserve, and restoration of oak and chaparral of Lower Table Rock. Through offering a variety of technical and poster sessions, workshops, field trips, and conversations we hope that this conference provides inspiration and fosters collaboration.

If you are not a member of NWSA, I strongly encourage you to join. We welcome anyone in the northwestern United States and western Canada who is interested in science, and we strive to be inclusive. Through our diverse membership, annual meeting, peer-reviewed journal, website, and Facebook page we seek to connect scientists in the natural and applied sciences and disseminate scientific knowledge. Our Association provides a means to connect with others, publish research, seek student grants, and identify mentors. Explore our website at <http://www.northwestscience.org> to keep current on NWSA events and to sign-up or renew your membership. Follow this meeting on Twitter at #NWSci17. Our journal, *Northwest Science*, can be viewed on-line at the BioOne website, <http://www.bioone.org/loi/nwsc>. Full content is available to NWSA members. Given our worldwide accessibility via BioOne, *Northwest Science* is a great place to publish your work!

Please take a moment to review NWSA information (page 2) to learn about NWSA, how to get involved, and who to thank for making NWSA activities happen, including this annual meeting. NWSA is sustained by many dedicated and hard-working people.

This year's meeting has benefited from the support of generous co-sponsors: Department of Science, Technology, Engineering, and Math at Southern Oregon University, the Pacific Division of the American Association for the Advancement of Science, Northwest Lichenologists, and the California Lichen Society. On behalf of the NWSA Board of Directors, I am truly grateful for their backing.

I hope you enjoy the meeting and have a chance to see old friends and make new connections. And thank you for your support of the NWSA through your membership and meeting attendance.

Sincerely,

Andrea Woodward, President
Northwest Scientific Association

NWSA 88th Annual Meeting - Program Overview

Southern Oregon University

Science Hall and Stevenson Union (SU)

Wednesday March 29, 2017

- 2:30 pm - 5:30 pm NWSA Spring Board Meeting (Science Rm 356)
6:00 pm - 9:30 pm Evening Social: complimentary appetizers & host bar at SU – Diversions Room

Thursday March 30, 2017

- 8:00 am - 8:15 am Welcome & Introductions (Science Rm 151)
8:15 am - 9:00 am **Keynote Address:** Klamath-Siskiyou Plant Diversity: Patterns, Causes, and a Historical Perspective
9:00 am - Noon **Plenary Session:** Mixed Severity Fire and the Effects on Biodiversity
1:20 pm - 4:00 pm Woodland / Savannah Ecosystems: Diversity, Management, & Restoration
4:00 pm - 6:00 pm **Poster Session** (attended) and Social with appetizers & no-host bar (Science 2nd floor)

6:30 pm - 9:30 pm **Evening Banquet** with guest speaker, Dr. Pepper Trail (SU – Diversions Room) (U.S. Fish and Wildlife Service National Forensics Laboratory)
“Fighting Wildlife Crime with Science: The Casebook of a Forensic Biologist”

Friday March 31, 2016

- 8:20 am - Noon **Concurrent, Contributed Oral Sessions in Science Hall**
Post Fire Landscapes and Vegetation Change (Rm 151)
Workshop: Biodiversity of white oak dwelling lichens and bryophytes (Rm 175)
8:20 am – 10:00 Aquatic Systems (Rm 108)
10:40 am – Noon Ecology (Rm 108)
11:20 am – Noon Lichen Ecology (Rm 161)

Noon - 1:40 pm **NWSA Business Lunch and Annual Meeting of the Corporation** (SU – Diversions)
Free to NWSA members & those interested in engaging with NWSA

1:20 am - 5:00 pm **Concurrent, Contributed Oral Sessions in Science Hall**
Diversity in National Parks (Rm 151)
Posters (2nd floor)
1:20 am – 2:40 pm Historic Landscapes of the Klamath Province (Rm 108)
Lichen Ecology (cont.) (Rm 161)
3:20 pm – 5:00 pm **Publishing Workshop** (Rm 108)
Northern California Lichenology (Rm 161)

Saturday April 1, 2017 - Field Trips: 8:30 am – 1:00 pm; Meet at SOU **Parking Lot 36**

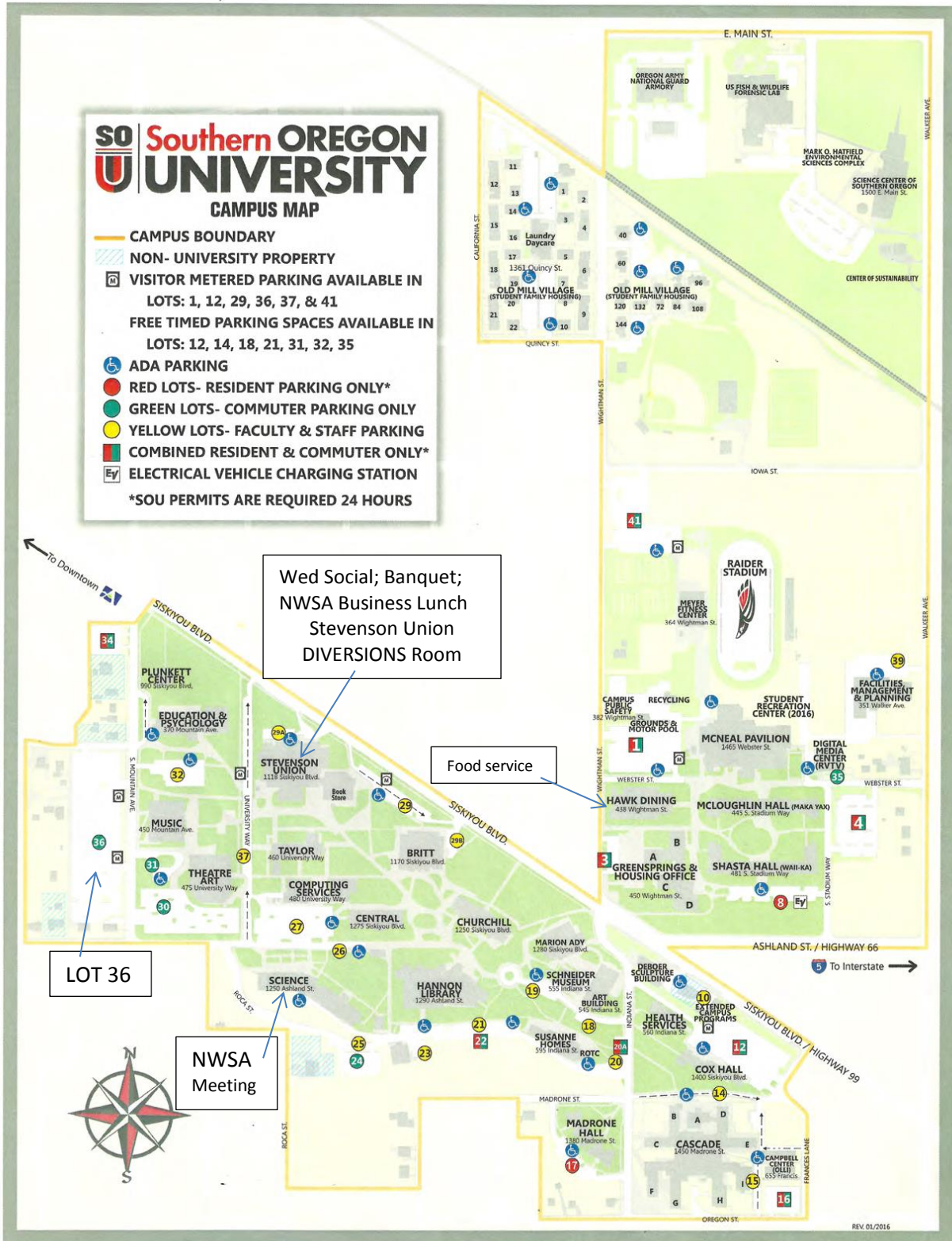
Lichens and Mosses of Sampson Creek Preserve
Oak and chaparral Restoration and Endemic Plants of Lower Table Rock

Southern Oregon University

Logistical information for meeting:

- FREE parking on campus in Lot 36, located northwest of Science Hall
- Registration; Lost and Found in Science Hall, 1st floor
- Technical Sessions held in Science Hall
- Evening Social, Banquet and NWSA Business Lunch held in Stevenson Union -
Diversions Room
- Campus food service in Hawk Dining, 438 Wightman Street, east of Siskiyou Blvd

Southern Oregon University –Campus Map



Program Overview

Thursday March 30					
Time	Science Building 1st floor lobby	Science Hall Rm 151	Science Hall Second Floor	Stevenson Union - Diversions	
7:30-8:00	Registration				
8:00-8:15		Welcome			
8:15-9:00		Keynote Address by Dr. Susan Harrison			
9:00-9:35		Symposium – <i>"Mixed Severity Fire and Biodiversity"</i>			
9:35-10:10					
10:10- 10:40		BREAK			
10:40- 11:15		Symposium – <i>"Mixed Severity Fire and Biodiversity"</i>			
11:15- 11:50					
11:50-12:00		Q&A Discussion			
12:00-1:20			LUNCH		
1:20-1:40		<i>Woodland/Savannah</i>			
1:40-2:00					
2:00-2:20					
2:20-2:40					
2:40-3:00		BREAK			
3:00-3:20		<i>Woodland/Savannah</i>			
3:20-4:00					
4:00-6:00				Poster Session (attended)	
6:30-9:30					Banquet with Presentation by Dr. Pepper Trail

Program Overview

Friday March 31						
Technical Sessions	Science 1st floor	Science Rm 151	Science Rm 108	Science 2nd Floor	Science Rm 161	Science Rm 175
Time						
<800-820>	Registration					
820-840		<i>Post Fire Landscapes and Vegetation Change</i>	<i>Aquatic Systems</i>	<i>Poster Session</i>		<i>Biodiversity of White Oak Dwelling Lichens and Bryophytes</i>
840-900						
900-920						
920-940						
940-1000						
1000-1040		BREAK				
1040-1100		<i>Post Fire Landscapes and Vegetation Change</i>	<i>Ecology</i>	<i>Poster Session</i>		<i>Biodiversity of White Oak Dwelling Lichens and Bryophytes</i>
1100-1120					<i>Lichen Ecology</i>	
1120-1140						
1140-1200						
1200-120	NWSA BUSINESS LUNCH					
120-140	<i>Diversity in National Parks</i>	<i>Historic Landscapes of the Klamath Province</i>	<i>Poster Session</i>	<i>Lichen Ecology</i>		
140-200						
200-220						
220-240						
240-320	BREAK					
320-340	<i>Diversity in National Parks</i>	<i>Publishing workshop</i>	<i>Poster Session</i>	<i>Northern California Lichenology</i>		
340-400						
400-420						
420-440						
440-500						

Thursday morning, March 30

Keynote and Plenary Session

Science Hall – Room 151

8:00 **Andrea Woodward/John Villella** Welcome and Introductions, Opening Remarks

Keynote Address

8:15 **Susan Harrison** *Klamath-Siskiyou Plant Diversity: Patterns, Causes, and a Historical Perspective*

Plenary Session: Mixed Severity Fire and the Effects on Biodiversity

Moderator: Gregg Riegel

9:00 **Carl Skinner** *Mixed Severity ≠ Mixed Severity ≠ Mixed Severity*

9:35 **Dominick A. DellaSala** *Integrating pyrodiversity and fire management: What happened to biodiversity?*

10:10 **BREAK**

10:40 **Chris Dunn** *Beyond patch-size distributions: An emergent property of mixed-severity fire regimes*

11:15 **John Bailey** *Restoring mixed-severity fire-prone landscapes*

11:50 **Gregg Riegel** *Q & A Discussion*

12:00 **LUNCH**

Dr. Susan Harrison - Keynote Speaker



Susan Harrison is a professor at U.C. Davis, Department of Science and Policy. She studies plant communities associated with serpentine geology. Her research has led into a major role of developing and managing the 3,100 hectare McLaughlin UC Natural Reserve, which is a key resource for studying plant ecology & evolution, wildlife ecology, soils, geology, and related environmental subjects.

She is a board member of the Napa County Land Trust and is on the steering committee for the Blue Ridge-Berryessa Natural Area Conservation Partnership. She consults on conservation issues (particularly on serpentine plants & ecosystems) to the California Department of Fish & Game, U.S. Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service. Susan serves on the science advisory board of the Siskiyou Field Institute (SFI), a non-profit environmental education organization in the underserved Josephine County, Oregon. Her National Science Foundation-funded research has employed and trained multiple students, community members, and K-12 teachers. She teaches short courses on climate change and plant ecology at SFI.

Thursday afternoon, March 24

Science Hall – Room 151

Woodland / Savannah Ecosystems: Diversity, Management & Restoration

Moderator: Amy Nathanson

1:20 Constance A. Harrington *Oregon white oak response to thinning: 12-year results*

1:40 Eamon Engber *Restoration and maintenance of deciduous oak woodlands on two Klamath Network parks in northern California*

2:00 Jaime L. Stephens *Chaparral landscape amount and local patch size influence songbird occupancy*

2:20 Sean Prive *Overstory structure development and community characteristics of Oregon ash (*Fraxinus latifolia*) forests of the Willamette Valley, Oregon*

2:40 BREAK

3:10 Maia Black *New opportunities for conservation and field research in oak ecosystems of southwest Oregon*

3:20 Ellen Goheen *Managing sudden oak death in Oregon tanoak forests: Past, present, and future*

4:00-6:00 Poster Session and Social with appetizers & host bar
Science Hall – 2nd floor

6:30–9:30 Evening Banquet with guest speaker, **Pepper Trail**

(US Fish and Wildlife Service National Forensics Laboratory)

“Fighting Wildlife Crime with Science: The Casebook of a Forensic Biologist”

Stevenson Union – DIVERSIONS Room

Thursday afternoon, March 24

Poster Session and Social - Science Hall – 2nd Floor

(presenting author shown– see Abstract section for complete abstract)

Maia Black	UTILIZING CITIZEN SCIENCE TO INVENTORY BIOLOGICAL RESOURCES ON THE SAMPSON CREEK PRESERVE
Leslie C. Brodie	14-YEAR SEEDLING RESPONSE OF 3 CONIFEROUS SPECIES TO VARYING LEVELS OF OVERSTORY RETENTION
Andrew Child	FRESHWATER FOOD POISONING: TRACKING AVAILABILITY AND BIOACCUMULATION OF HEAVY METALS IN FRESHWATER ZOOPLANKTON IN NORTHEASTERN WASHINGTON LAKES
Carla Cole	ACCELERATING DIVERSITY THROUGH VARIABLE DENSITY THINNING IN A COASTAL TEMPERATE RAINFOREST
Meghan Flannery	IDENTIFICATION OF FUNGI ASSOCIATED WITH POLLEN IN CRATER LAKE
Dan Gavin	LONG-DISTANCE JUMP DISPERSAL BUT SLOW RANGE INFILLING OF MOUNTAIN HEMLOCK IN THE INTERIOR PACIFIC NORTHWEST
Amanda Goddard	EFFECTS OF SALINITY REGIMES ON COASTAL BREEDING AMPHIBIANS IN OREGON
David Hering	GROWTH AND SITE FIDELITY OF INDIVIDUALLY MARKED AND RECAPTURED JENNY CREEK SUCKERS IN THE CASCADE SISKIYOU NATIONAL MONUMENT, OREGON
Reyn A. Hutten	AVERAGE ANNUAL RECESSION AND VARIABLES EFFECTING RECESSION RATE OF SHAKES GLACIER IN SOUTHEASTERN ALASKA
Christina Murphy	EVALUATION OF TRACE ELEMENT CONCENTRATIONS IN OREGON'S EDIBLE WILD-FORAGED MUSHROOM SPECIES
Kate S. Petersen	QUANTIFYING SEASONAL VARIABILITY IN NITROGEN-FIXATION BY CYANOBACTERIA ASSOCIATING WITH MOSSES <i>NIPHOTRICHUM ELONGATUM</i> , <i>PLEUROZIUM SCHREBERI</i> AND <i>RHYTIDIADELPHUS TRIQUETRUS</i> IN A NORTHWEST PRAIRIE ECOSYSTEM
Stephanie Pierce	IDENTIFICATION OF NITROGEN-FIXING CYANOBACTERIA-MOSS SYMBIONTS OF THE SOUTH PUGET SOUND PRAIRIES, WASHINGTON STATE
Samantha M. Roof	INFLUENCE OF FLOWER NATIVE STATUS, COLOR, AND MORPHOLOGY ON VISITING PREFERENCES OF BEES IN RIPARIAN AREAS OF EASTERN OREGON
Chris Shipway	CARBON SEQUESTRATION IN A NORTHWEST FOREST; AN EXAMINATION OF SPECIES-SPECIFIC CONTRIBUTIONS

Sean B. Smith	VASCULAR PLANT HYPERDIVERSITY IN HIGH-ELEVATION RIPARIAN COMMUNITIES OF NATIONAL PARK SERVICE UNITS IN THE KLAMATH NETWORK
Richard Sniezko	GENETIC VARIATION IN HEIGHT AND RESISTANCE TO WHITE PINE BLISTER RUST IN FOXTAIL PINE (<i>PINUS BALFOURIANA</i>) AND LIMBER PINE (<i>P. FLEXILIS</i>)
Teresa M. Vail	BREAKING BUD: THE DRIVING FORCES BEHIND OREGON WHITE OAK'S BUDBURST PHENOLOGY
John Vilella	TARDIGRADES IN THE CANOPY: LIVING WITH THE RED TREE VOLE
Sarah Ward	THE EFFECTS OF MICROCLIMATE ON SPRING PHENOLOGY AT THE H.J. ANDREWS EXPERIMENTAL FOREST IN WESTERN OREGON
Chhaya M. Werner	SPATIAL AND TEMPORAL CONTINGENCY IN RAPID PRIMARY SUCCESSION FOLLOWING REMOVAL OF THE ELWHA RIVER DAMS
Douglas J. Westlind	ATTRACTION OF RED TURPENTINE BEETLE AND OTHER SCOLYTINAE TO TRAPS RELEASING ETHANOL, 3-CARENE, OR BOTH IN AN OREGON PINE FOREST

NWSA Banquet, Thursday Evening
Stevenson Union – Diversions Room

“Fighting Wildlife Crime with Science: The Casebook of a
Forensic Biologist”

Presented by Dr. Pepper Trail

This fascinating talk will take us behind the scenes of the nation’s only full-service wildlife forensics laboratory, which is located in Ashland, Oregon. With specialists in pathology, genetics, chemistry, ballistics, herpetology, mammalogy, and ornithology, the Forensics Lab provides scientific support to federal wildlife crime investigations, both in the U.S. and internationally. Dr. Trail’s talk will provide a review of the dimensions of wildlife crime, an introduction to the Lab’s capabilities, and a series of case studies illustrating how Lab scientists use both classical methods and cutting-edge technologies to solve challenging cases.



Dr. Pepper Trail is an Ornithologist at the U.S. Fish and Wildlife Service National Forensics Laboratory. Since 1998, he has identified over 40,000 pieces of evidence, ranging from the feathers belonging to birds of paradise to the decomposed remains of birds recovered from oil pits. His work as a “feather detective” is featured in the current issue of *Audubon* magazine.

Friday morning, March 31

Technical Session – Contributed Papers

Science - Rm 151

Causes and Consequences of Post-fire Landscapes and Vegetation Change in Northern California

Moderator: Jesse Miller

8:20 **Jens T. Stevens** *Understory vegetation responses to fire and forest management in California mixed-conifer forests*

8:40 **Gabrielle N. Bohlman** *The effect of post-fire reforestation on the understory plant community*

9:00 **Jesse Miller** *Effects of fire severity on herbaceous plant biodiversity*

9:20 **Zachary Steel** *The influence of burn severity on bat species occurrence in post-fire landscapes*

9:40 **Alexandra M. Weill** *From plants to people: how do Californians interact with regenerating post-fire landscapes*

10:00 **BREAK**

10:40 **Michelle Coppoletta** *Influence of post-fire vegetation and fuels on fire severity patterns in reburns: Implications for restoration*

11:00 **Kevin R. Welch** *Increasing fire severity challenges forest resilience in California's mid-elevation mixed conifer forests*

11:20 **Derek J. N. Young** *Post-fire forest regeneration in a changing climate: Observational insights from the northern Sierra Nevada and Southern Cascades*

11:40 **Chhaya M. Werner** *Post-fire recruitment of two conifer species under manipulated drought and shrub competition conditions*

12:00 – 1:40 **NWSA Business Lunch** - Stevenson Union DIVERSIONS Room

Friday morning, March 31

Technical Sessions – Contributed Papers

Science - Rm 108

Aquatic Systems

Moderator: Michael Parker

- 8:20** **Kurt S. Imhoff** *Bedload dispersion through confluences in a gravel-bed river headwaters*
- 8:40** **Steve Niemela** *Presence/absence survey of *Rana boylei* comparing traditional visual encounter vs eNDA digital PCR detection*
- 9:00** **Emily R. Wolfe** *Fungal endophyte-infected *Acer macrophyllum* litter alters in-stream microbial decomposer communities*
- 9:20** **Lance Wyss** *Targeted restoration: Helping recover critical habitat for coho salmon*
- 9:40** **Andrew W. Child** *Paleo-forensic-limnology: tracking long-distance deposition of airborne smelter emissions in remote lakes*
- 10:00** **BREAK**

Ecology

Moderator: Michael Parker

- 10:40** **Gregory J. Retallack** *Another lichen-like post-Ediacaran vendobiont from the Devonian of New York*
- 11:00** **Golnaz Badr** *Spatial site assessment for vineyards in Oregon state*
- 11:20** **Cole D. Gross** *Soil carbon and nitrogen response to thinning and fertilization treatments in a coastal Pacific Northwest forest*
- 11:40** **Michelle Reilly** *Spatial and temporal response of wildlife to recreational activities in the San Francisco Bay ecoregion*
- 12:00 – 1:40** **NWSA Business Lunch** - Stevenson Union DIVERSIONS Room

Friday morning, March 31

Workshop

Science, Room 175

8:20 – 12:00

Biodiversity of White Oak Dwelling Lichens and Bryophytes

Presented by Northwest Lichenologists

This workshop will focus on epiphytes that inhabit Garry oak in the Pacific Northwest, with a focus on species of Southwest Oregon. Workshop coverage will include a focus on commonly encountered species as well as rare and difficult to identify groups. The lichen section will be led by Daphne Stone and Tom Carlberg. Dave Kofranek will lead the bryophyte section. Freshly collected specimens from the Cascade-Siskiyou National Monument will be used for demonstration purposes. Feel free to bring any tricky specimens and we will help you identify them.

Technical Sessions – Contributed Papers

Science - Rm 161

Lichen Ecology

Moderator: Lolita Calabria

11:20 **Roger Rosentreter** *Site suitability evaluation for translocating the federally endangered lichen, *Cladonia perforata**

11:40 **Ricardo Miranda-Gonzalez** *LICHEN-INVERTEBRATE INTERACTIONS IN TROPICAL DRY FORESTS*

12:00 – 1:40 **NWSA Business Lunch** - Stevenson Union DIVERSIONS Room

Friday afternoon, March 31

Technical Session – Contributed Papers

Science - Rm 161

Lichen Ecology (continued)

Moderator: Lolita Calabria

- 1:20** **Abby L. Glauser** *Biodiversity and floristic patterns of epiphytic macrolichens on Quercus garryana in the Cascade-Siskiyou National Monument*
- 1:40** **Nils Nelson** *Biodiversity and floristic patterns of epiphytic macrolichens on Quercus garryana in the Cascade-Siskiyou National Monument*
- 2:00** **Robert J. Smith** *Vulnerability of forest lichen communities to species loss under climatic warming*
- 2:20** **Bruce McCune** *Estimating age of rock cairns in southeast Alaska by combining evidence from successional metrics, lichenometry, and carbon dating*
- 2:40** **BREAK**

Northern California Lichenology

Moderator: Robert J Smith

- 3:20** **Steve Sheehy** *Cataloging the lichens of Lava Beds National Monument*
- 3:40** **Tom Carlberg** *Scytinium singulare, a new lichen species from coastal California*
- 4:00** **Shelly Benson** *Lichens in the mist: Investigating California's fog lichens*
- 4:20** **Alexander Young** *Zonation of epiphyte dwelling meiofauna in a Douglas-fir forest canopy*
- 4:40** **Eric B. Peterson** *Macro-photogrammetry using structure-from-motion (SfM) to capture lichens with high-precision point clouds*

Friday afternoon, March 31

Technical Session – Contributed Papers

Science - Rm 151

Diversity in National Parks

Moderator: Chris Lauver

- 1:20** **John D. Alexander** *Using regional bird density distribution models to evaluate protected area networks and inform conservation planning*
- 1:40** **Richard A. Sniezko** *Using natural genetic variation to maintain forest tree species in the face of non-native diseases, insects, and climate change*
- 2:00** **Jherime L. Kellermann** *Snowmelt, phenology, and growing season length in Crater Lake National Park*
- 2:20** **Regina Rochefort** *The Cascades Butterfly Project: Monitoring butterflies and plant phenology as indicators of climate change*

2:40 **BREAK**

Moderator: Mark Buktenica

- 3:20** **Jherime L. Kellermann** *Black-backed woodpecker and wood-boring beetle associates with post-fire burn severity following the National Creek Fire*
- 3:40** **Michael S. Parker** *Status and conservation of the threatened Oregon Spotted Frog (*Rana pretiosa*) at the Parsnip Lakes, Cascade-Siskiyou National Monument*
- 4:00** **Dave Hering** *Eradication of nonnative trout and the response of threatened bull trout in Sun Creek: Working with partners to conserve native fish diversity in and around Crater Lake National Park*
- 4:20** **Kathleen Page** *Microbial ecology of Crater Lake's deep-water moss*
- 4:40** **Mark W. Buktenica** *The impact of introduced crayfish on a unique population of salamander in Crater Lake, Oregon, and mechanisms for replacement*

Friday afternoon, March 31

Technical Session – Contributed Papers

Science - Rm 108

Historic Landscapes of the Klamath Province

Moderator: Dominic A. DiPaolo

- 1:20** **Luke Ruediger** *Historic Osborne Lookout photos: Historic photographs and landscape change in the Applegate watershed*
- 1:40** **Dominic A. DiPaolo** *Vegetation change following the Forest Reserve Homestead Act of 1906 in the Applegate River Watershed, Oregon*
- 2:00** **Gene Hickman** *Early landscape photography and historical (GLO) vegetation mapping of the central Rogue Valley near Medford, Oregon*
- 2:20** **Tom DeMeo** *Expanding our understanding of forest structural restoration needs in the Pacific Northwest*
- 2:40** **BREAK**

Manuscript Publishing Workshop

- 3:20** **Dylan Fischer** *Student Workshop on Best Practices for Submitting and Publishing Manuscripts in Scientific Journals*

Saturday, April 1

NWSA Field Trips

SOU Parking Lot 36 – Meeting Location; carpool to sites

8:30 am – 1:00 pm

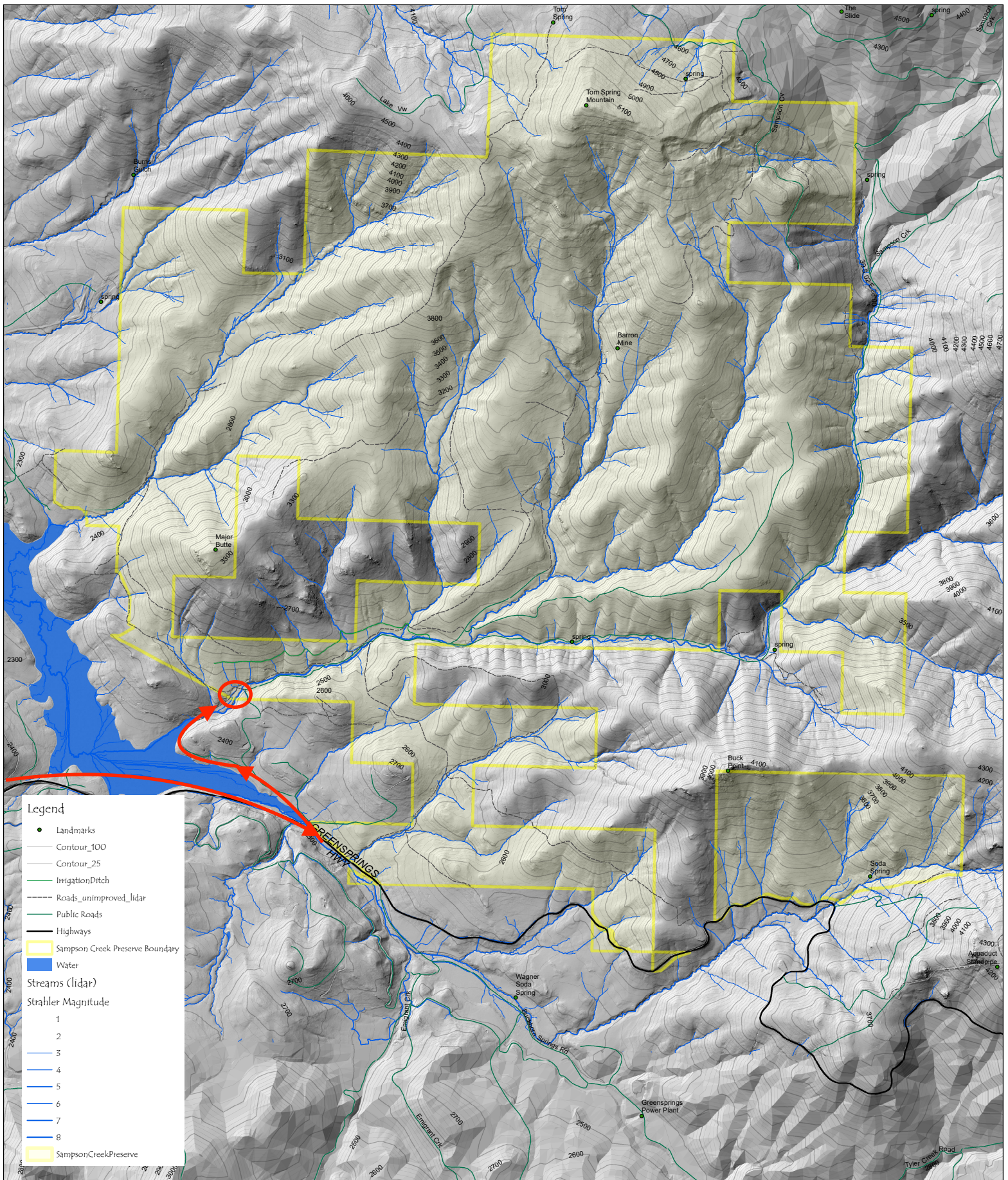
Lichens and Mosses of Sampson Creek Preserve

Led by Northwest Lichenologists

Sampson Creek Preserve is a newly established preserve on outskirts of Ashland. It was acquired by the Selberg Institute and is managed to maintain and promote biodiversity in this area of southwestern Oregon.

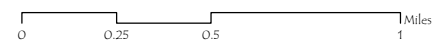
The Sampson Creek Preserve is approximately 3000 acres and provides of diversity of habitats, including white oak and black oak woodlands, savannah, chaparral, grassland, conifer forests and riparian habitats.

The objective of the field trip is to conduct a baseline inventory of lichens and bryophytes that will contribute information to the knowledge base for the preserve.



Sampson Creek Preserve

Topography, hydrology and unimproved roads and tracks derived from 3D LIDAR scanning data and color orthophotography



Selberg Institute
January, 2016

Oak and Chaparral Restoration and Endemic Plants of Lower Table Rock

Carpools leave from Southern Oregon University Parking Lot 36 at 8:30 am

Meet at Lower Table Rock parking lot (9:00 am) – map available on Friday at the meeting

*Bring water and snacks (unless registered for a lunch)
Be prepared for hiking upslope and spring weather*

9:00 am

Introductions – Terry Fairbanks (BLM), Sean Prive (LRP), Josh Budziak (LRP), Caitlyn Gillespie (KBO), Jason Clark (Siskiyou Biosurvey)

- Description and brief history of Table Rocks
- Framework for adaptation
- Restoration project description and objectives
- Overview of plant communities

9:30 am

Landscape context and supporting science – Sean Prive, Terry Fairbanks

- Protecting the best places using landscape analyses
- Climate change and the role of fire

10:00 am

Implementation

- Blending approaches to improve outcomes and learning – Josh Budziak
- Patch size heterogeneity and implications for bird communities – Caitlyn Gillespie
- Adaptive management and monitoring: Birds as indicators – Caitlyn Gillespie
- Herbaceous responses and seeding – Sean Prive
- Next steps: Returning fire, maintenance, and future restoration needs – Sean Prive, Terry Fairbanks

11:00 am

Endemic plants of Lower Table Rock – Jason Clark

12:00 pm

Lunch on top of Lower Table Rock & continued rare plant discussion



ABSTRACTS

NWSA ORAL AND POSTER PRESENTATIONS

(Arranged alphabetically by last name of presenting author)

ORAL

USING REGIONAL BIRD DENSITY DISTRIBUTION MODELS TO EVALUATE PROTECTED AREA NETWORKS AND INFORM CONSERVATION PLANNING. **John D. Alexander**, Jaime L. Stephens, Klamath Bird Observatory, PO Box 758 Ashland, OR 97520; Sam Veloz, Leo Salas, Point Blue Conservation Science, 3820 Cypress Drive #11, Petaluma, CA 94954; Josée Rousseau, Klamath Bird Observatory, PO Box 758 Ashland, OR 97520; C. John Ralph, US Forest Service Pacific Southwest Research Station – Arcata and Klamath Bird Observatory, 1700 Bayview Street, Arcata, CA 95521; Daniel A. Sarr, Klamath Network, National Park Service, 1250 Siskiyou Boulevard, Ashland, OR 97520; jda@KlamathBird.org

As data about populations of indicator species become available, proactive strategies that improve representation of biological diversity within protected area networks should consider finer-scaled evaluations, especially in regions identified as important through coarse-scale analyses. We use density distribution models derived from a robust regional bird abundance dataset and habitat conservation plans to evaluate a network of protected areas and to inform conservation and biodiversity planning in the greater Klamath Siskiyou Bioregion. Our novel modeling approach allowed for comparisons of abundance of focal species on federal versus non-federal lands, federal lands that are protected versus federal lands managed for multiple uses, and seven protected areas of interest. Our comparisons highlight conservation opportunities for suites of species associated with coniferous forests, oak woodlands, and grasslands. We found that species associated with oak woodland and grassland habitats were not well represented in the Bioregion's existing protected areas. These species would benefit from expanding the regional protected area network to include their associated at-risk habitats. In contrast, our results suggest coniferous forests birds are well represented in the Bioregion's protected areas. We identify management opportunities associated with the restoration of fire-adapted ecosystems that would benefit coniferous forest focal species on both federally protected areas and other multiple use lands. Our analysis provides an example of how a finer-scaled evaluation of a regional protected area network adds value to coarse-scale evaluations of protected areas and biological diversity. Data and results from this research informed the science-based expansion of the Cascade Siskiyou National Monument.

ORAL

SPATIAL SITE ASSESSMENT FOR VINEYARDS IN OREGON STATE. **Golnaz Badr**, Gregory Jones, Department of Environmental Science & Policy, Southern Oregon University, 1250 Siskiyou Blvd, Ashland, OR, 97520; badrg@sou.edu

There is a great potential for grape (*Vitis vinefera* L.) production in the Pacific Northwest region of the United States. However, there are few studies that have focused on a comprehensive spatial suitability system. The main objective of this study was to develop a spatial site selection system that can help with the identification of suitable areas for grapevine cultivation. The soil data were obtained from the gSSURGO dataset and several properties such as soil depth, pH, available water holding capacity (AWC), and drainage class were extracted for the study area. The topographical data were obtained from the National Elevation dataset. Following reclassification using fuzzy logic, the soil, and topographic suitability maps were developed. The

final vineyard potential scores were obtained by combining the suitability for soil, and topography. The potential scores had a range from 0 to 1, where 0 pertains to non-suitable areas and 1 refers to optimal sites. The vineyard potential score for the vineyards that have been established in the state of Oregon were obtained from the Crop Scape land cover maps and used as a measure for evaluation of the calculated scores. The spatial site selection system was able to classify the study area to five regions based on their vineyard potential. The results of this study can help decision makers, growers, and others with conducting a more precise land-use assessment for potential grapevine production.

ORAL

RESTORING MIXED-SEVERITY FIRE-PRONE LANDSCAPES. John D. Bailey, College of Forestry, Oregon State University, Corvallis, OR 97331; john.bailey@oregonstate.edu

Wildfire spatial extent and associated fire intensity has become unprecedented recently in the PNW, as with much of the inland West, and is likely to continue or worsen into the near future with projected climate change. Larger fires with higher percentages of stand-replacement are clearly linked to issues around: 1) fuel abundance and continuity in less-managed landscapes; 2) longer fire seasons and more extreme fire weather; and 3) how these interact to reduce the likelihood of early suppression and containment. Growing interests in fuel treatments, and in the context of active management and collaboration across ownerships, continues to be met by misguided preservation notions/actions that perpetuate the problem – preservation of high-biomass multi-story older forests for recreational and wildlife habitat, which also is good habitat for wildfire; preservation of high-biomass riparian buffers, which serve as fuel-rich conduits for wildfire; preservation of undisturbed scenic vistas, which burn as uniformly as they look; and finally reflex suppression, which preserves a fuel-rich landscape until conditions are such that suppress is impossible. All the while more humans move out and into the wildlands. This is a pathologic cycle that must be broken by thoughtful, active restoration combined with a more realistic understanding of and relationship with mixed-severity fire. Restoration of some semblance of historic structure and composition is only part of the solution; over time and space, we also must restore fire as a keystone ecological process to truly restore and maintain fire-prone landscapes. This approach translates into vastly larger areas tied to broad, active land management and inevitable wildfires. Indeed, large “box-and-burn” (PODs) approaches that blend prescribed fire and restoration of resilient landscapes with altered suppression strategies may be the only way to break out of the current pathology.

ORAL

LICHENS IN THE MIST: INVESTIGATING CALIFORNIA’S FOG LICHENS. Shelly Benson, PO Box 658 Woodacre, CA 94973; Shelly.Benson@yahoo.com

Along the California coast, atmospheric and oceanic forces interact to create a unique habitat known as the coastal fog zone, characterized by frequent summer fog. A distinctive group of lichens called fog lichens (*Niebla* species) is restricted to rock outcrops within the fog zone. These lichens require reliable summer moisture supplied by fog drip. In the face of climate change, there is a possibility that the frequency of summer fog will diminish and fog lichens, as

well as other fog-dependent species, will be negatively affected. I conducted a pilot study to evaluate the use of fog lichens as biological indicators of coastal fog. Pilot data were supplemented with herbarium records and iNaturalist citizen science observations to map the distribution of California's fog lichens. *Niebla homalea* was the most frequently documented fog lichen along the California coast. I found this species farther from the ocean than expected. *Niebla homalea* occurrences coincided with summer fog, following the path of fog as it flows inland through breaks in the topography. Distribution of *N. homalea* appears to be strongly associated with the amount of summer fog (hours/day), suggesting that this species has potential as an indicator of change in California's coastal fog regime. The purpose for using biological indicators, in comparison to mechanical instruments, is that they measure the ecosystem's response to changes in environmental factors. Lichens are widely used as biological indicators because they are considered one of the most sensitive organisms in many ecosystems.

ORAL

NEW OPPORTUNITIES FOR CONSERVATION AND FIELD RESEARCH IN OAK ECOSYSTEMS OF SOUTHWEST OREGON. **Maia Black**, Evan Frost, Selberg Institute LLC, P.O. Box 1236, Ashland, OR 97520; selberginstitute@icloud.com.

Oak woodlands in western Oregon are ecologically important because they represent unique natural communities and support extraordinary biodiversity, including many at-risk species. Despite their numerous values, only a very small portion of Oregon's oak-dominated habitats are managed for biodiversity, because the vast majority are located on private lands. Strategies to conserve oak ecosystems focus on encouraging private landowners to manage oak woodlands using ecological principles, and/or pursuing opportunities to protect high quality examples of oak-dominated habitats. Adopting the latter of these two approaches, the 2015 acquisition of a historic cattle ranch in the Rogue Valley foothills of Jackson County (OR) led to the creation of the Sampson Creek and Grizzly Peak Preserves. Totalling over 9,200 acres, these preserves are managed for conservation by the Selberg Institute and protect relatively large expanses of Oregon white oak and California black oak woodlands within a diverse vegetation mosaic. At the landscape scale, their location at the crossroads of the Siskiyou Mountains and southern Cascades make these preserves a waypoint for wildlife migrating between these two ecoregions. Their regional importance to connectivity was recognized when these lands were included within the newly expanded outer boundaries of the Cascade-Siskiyou National Monument. A long-term goal is to facilitate scientific research and education that contributes to sustainability across the region. Utilizing citizen science efforts, baseline inventories for several taxonomic groups at Sampson Creek have been initiated and more are planned. The Selberg Institute invites inquiries to collaboratively carry out biological inventory, research and education projects in these oak-dominated ecosystems.

UTILIZING CITIZEN SCIENCE TO INVENTORY BIOLOGICAL RESOURCES ON THE SAMPSON CREEK PRESERVE. Maia Black, Evan Frost, Selberg Institute LLC, P.O. Box 1236, Ashland, OR 97520; selberginstitute@icloud.com

Oak woodlands in western Oregon are ecologically important because they represent unique natural communities and support extraordinary biodiversity, including many at-risk species. Because the vast majority are located on private lands, only a very small portion of Oregon's oak-dominated habitats are managed for biodiversity conservation. The 2015 acquisition of a historic cattle ranch in the Rogue Valley foothills of Jackson County, OR led to the creation of the Sampson Creek and Grizzly Peak Preserves. Totalling over 9,200 acres, these preserves are managed for conservation by the Selberg Institute and protect relatively large expanses of Oregon white oak and California black oak woodlands within a diverse vegetation mosaic. Utilizing citizen science efforts, baseline inventories for several taxonomic groups at Sampson Creek have been initiated and more are planned. The goal is to utilize results of biological inventory work to help develop adaptive conservation management plans for each preserve. This poster will share the results of our inventories thus far, the highlights of which include the recent return of Roosevelt elk to the property, discovery of the imperiled foothill yellow-legged frog (*Rana boylei*; USFWS Species of Concern), three moths in the *Geometridae* family (*Eusarca falcate*, *Depanulatrix nevadaria*, *Eumacaria madopata*) that were all state records for Oregon, and two other rarely documented moths, *Sympistis goedeni* and *Apamea albina*, that are locally endemic and associated with oak savanna habitats. The Selberg Institute invites inquiries to collaboratively conduct additional biological inventory, research and education projects in these oak-dominated ecosystems.

ORAL

THE EFFECT OF POST-FIRE REFORESTATION ON THE UNDERSTORY PLANT COMMUNITY. Gabrielle N. Bohlman, Department of Environmental Science and Policy, University of California, Davis, CA 95616, USDA Forest Service, 1711 South Main Street, Yreka, CA 96097; Malcolm North, Department of Plant Sciences, University of California, Davis, CA 95616, USDA Forest Service, 1731 Research Park Drive, Davis, CA 95618; Hugh D. Safford, Department of Environmental Science and Policy, University of California, Davis, CA 95616; USDA Forest Service, 1323 Club Drive, Vallejo, CA 94592; gbohlman@fs.fed.us

As large, high-severity fires become more prevalent in Sierra Nevada mixed-conifer forests, the need for restoration after fire also increases. While long-established reforestation methods are effective in promoting conifer survival and growth by reducing competing shrub cover, we have limited knowledge surrounding the effect these practices have on understory plant species richness and composition. In 2014, we established 341 plots in three different-aged fires that burned in the South Fork of the American River canyon. The three fires, ranging in age from 10- to 41-years-old, had extensive high severity patches that were reforested with conifers in some areas and left unplanted in others. In these areas we compared the effects of treatment and time since fire on native and exotic plant species richness, plant community composition, and stand

structure. Our study suggests that while retaining some shrub cover for post-fire habitat may be desirable, some level of shrub reduction favors native plant species richness and overall herbaceous cover. Differences in shrub cover and soil moisture were found to be the most important drivers of these herbaceous richness patterns. Post-fire restoration may be a useful tool in mitigating the loss of fine scale heterogeneity and the associated loss of biodiversity caused by modern, high severity fires while also ensuring the establishment of future forests.

POSTER

14-YEAR SEEDLING RESPONSE OF THREE CONIFEROUS SPECIES TO VARYING LEVELS OF OVERSTORY RETENTION. Leslie C. Brodie, PNW Research Station, 3625 93rd Ave. SW, Olympia, WA 98512; J. Bradley St. Clair, PNW Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; lbrodie@fs.fed.us

In recent years, interest has increased in silvicultural systems that retain partial overstories, but there are few data available on the growth of the understory trees in such stands. We studied the response of overstory trees and underplanted seedlings (Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*)) to a range of residual overstory densities. The Douglas-fir seedlings included 24 full-sib families to investigate the role genetics plays in response to overstory density. Forty to 70-year-old Douglas-fir stands in western Washington were harvested, leaving retention levels of 0, 8, 16, 24, 32, and 40% of full stocking. After 14 growing seasons, the growth of the overstory trees varied significantly by treatment. DBH growth was greatest in the lighter retention levels. Although height growth was greatest in the heavier retention levels, it was not enough to compensate for the greater DBH growth—volume growth was greatest in the lighter levels. The three species planted in the understory responded differently to the treatment levels. Douglas-fir, as the least shade-tolerant species, exhibited the greatest growth differences with respect to treatments (64% reduction in diameter growth), yet, mortality levels still remained relatively low (<20%) even in the densest treatment. The full-sib Douglas-fir families did not respond differently to the treatments, implying that seed sources grown in tree improvement programs and selected in an open environment are among the most vigorous under any overstory retention level. Tree improvement programs need not cultivate different stock to be included in alternative silvicultural systems.

ORAL

THE IMPACT OF INTRODUCED CRAYFISH ON A UNIQUE POPULATION OF SALAMANDER IN CRATER LAKE, OREGON, AND MECHANISMS FOR REPLACEMENT. Mark W. Buktenica, Scott Girdner, and David K. Hering, Crater Lake National Park, Crater Lake, OR 97604; Andrew. M. Ray, NPS Greater Yellowstone Network, Bozeman MT; John Umek, Aquatic Ecosystems Analysis Laboratory, Department of Biology, University of Nevada, Reno; mark_buktenica@nps.gov

The signal crayfish (*Pacifastacus leniusculus*) introduced to Crater Lake in 1915 threatens the local extinction of an endemic salamander. The Mazama newt (*Taricha granulosa mazamae*) found only within Crater Lake, Oregon, is morphologically, genetically, and physiologically

distinct from populations of rough-skinned newts (*T. granulosa*) outside the lake. An increase in signal crayfish distribution and abundance with a concurrent decline in Mazama newts led us to investigate behavioral interactions between crayfish and newts as well as study impacts on aquatic food webs. Crayfish have expanded in distribution to occupy nearly 80% of the lakeshore although the rate of signal crayfish spread is lower than other systems. Newts remain in areas that crayfish have yet to invade but are almost entirely absent in crayfish occupied areas. Isotopic signatures of newt and crayfish tissue indicate the two species eat similar food items and occupy a similar position in the food web. Abundance of benthic macroinvertebrates was dramatically reduced in locations with crayfish compared with areas of the lake without. Mesocosm experiments conducted with newts and crayfish revealed that crayfish prey on newts, displace newts from cover, and generally alter newt behavior. This evidence suggests that further crayfish expansion likely will cause additional declines in newt abundance and distribution, and could lead to extinction of the unique Mazama newt.

ORAL

SCYTINIUM SINGULARE, A NEW LICHEN SPECIES FROM COASTAL CALIFORNIA.

Tom Carlberg, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, CA 94118 (mail to 1959 Peninsula Drive, Arcata, CA 95521); Per M. Jørgensen, Tor Tønsberg, Department of Natural History, University Museum of Bergen, Allegt. 41, Box 7800, N-5020 BERGEN, Norway; tcarlberg@calacademy.org.

Scytinium singulare T. Carlberg & P.M. Jørg., is described from coastal California, where it is found on low cut banks along trails in mature mixed hardwood/conifer forests. It has marginal and laminal globose to lobulate isidia that superficially resemble soredia. Prior to recent new generic delimitations in Collemataceae, it would have been placed in the genus *Leptogium*, where another species, *Leptogium insigne*, also has organized asexual propagules that resemble soredia. However examination of the internal structure of each of these species shows clear differences in their anatomy. While the ranges of the two species barely overlap, it should be looked for in southwest Oregon, a region rich in Collemataceae. Additional sites should also be sought in northwest California, near the current limit of the species' range.

ORAL

PALEO-FORENSIC-LIMNOLOGY: TRACKING LONG-DISTANCE DEPOSITION OF AIRBORNE SMELTER EMISSIONS IN REMOTE LAKES.

Andrew W. Child, Barry C. Moore; Jeffrey Vervoort, School of the Environment, PO Box 642812, Pullman, WA 99164; Marc Beutel, University of California-Merced, School of Engineering, 5200 N. Lake Road, Merced, CA 95343; Andrew.child@wsu.edu

Heavy metal pollution from mining and smelting operations into aquatic ecosystems can cause long-term biological and ecological impacts. The upper Columbia River valley is a highly contaminated with heavy metal waste from nearby smelting operations in Trail, British Columbia, Canada and Northport, Washington, USA. Since 1896, one of the largest non-ferrous zinc/lead smelters in the world, located in Trail B.C., has been discharging metal laden airborne emissions. The LeRoi smelter operated sporadically in Northport, WA from 1898 to 1921

processing copper and lead ores. Emissions from both smelters were historically transported down the Columbia River canyon, where particulate metals were deposited into lakes and watersheds. Lake sediment cores contain records of past environmental conditions within watersheds, and may provide a timeline of fundamental chemical and biological relationships within aquatic ecosystems. We analyzed the metal concentrations and lead isotope compositions of sediment cores from six remote eastern Washington lakes to determine possible sources of atmospheric heavy metal deposition. Our results suggest that the depositional footprint of the LeRoi smelter can be detected at least 66 km downwind of the smelter and may stretch as far as 112 km, and emissions from the Trail smelter can be detected 144 km downwind of the smelter. Lead, arsenic, antimony, and cadmium were correlated with lead isotopic compositions, which suggest that the source these metals are likely the direct result of smelting operations in the upper Columbia River valley.

POSTER

FRESHWATER FOOD POISONING: TRACKING AVAILABILITY AND BIOACCUMULATION OF HEAVY METALS IN FRESHWATER ZOOPLANKTON IN NORTHEASTERN WASHINGTON LAKES. Andrew W. Child, Barry C. Moore, Jeffrey Vervoort, School of the Environment, PO Box 642812, Pullman, WA 99164; Marc Beutel, University of California-Merced, School of Engineering, 5200 N. Lake Road, Merced, CA 95343; Andrew.child@wsu.edu

Metal pollution from mining and smelting operations into adjacent aquatic ecosystems can cause long-term biological impacts. Several studies have addressed the biological effects of both direct discharge of slag and diffuse atmospheric metal deposition into freshwater environments near metallurgic facilities. The upper Columbia River valley is highly contaminated with metal waste from nearby smelting operations in Trail, British Columbia and Northport, Washington. However, no studies have addressed whether metal contaminants are biologically available to aquatic organisms. Heavy metals are powerful biological contaminants, and if these metals are biologically available in aquatic food webs, there is potential for bio-magnification and transfer across aquatic and terrestrial food webs. Previous studies used Pb-isotopes to track depositional patterns of emissions from these smelters to lake sediments. Pb-isotopes have also been used to track transfer of metal contamination in terrestrial and marine food webs. However, these techniques have not yet been utilized in freshwater food webs. We analyzed the biological extent of emissions by analyzing the metal body burdens and lead isotope composition of zooplankton in lakes ranging from 20 to 144 km and 1 to 126 km downwind of the Trail and LeRoi smelters, respectively. We found evidence that metal concentrations and isotope compositions in lakes' sediment are tightly correlated with distance from the LeRoi smelter. Isotope results suggest the presence of contamination from both smelters. Emissions are biologically available, and actively assimilated by zooplankton in lakes at least 86 km and 66 km downwind of the Trail and LeRoi smelters, respectively.

ACCELERATING DIVERSITY THROUGH VARIABLE DENSITY THINNING IN A COASTAL TEMPERATE RAINFOREST. **Carla Cole**, Chris Clatterbuck, Lewis and Clark National Historical Park, 92343 Fort Clatsop Road, Astoria, Oregon 97103; *Carla_cole@nps.gov*

Lewis and Clark National Historical Park is engaged in restoring recently purchased second and third growth industrial timberlands to ecosystems that more closely approximate the forests experienced by the Corps of Discovery during their stay at Fort Clatsop in 1805-1806. This is being achieved through Variable Density Thinning (VDT), snag creation, biomass retention, and underplanting of species made rare through past management practices. Forestry modeling software was utilized to provide visualizations of various treatment scenarios, which inform stand prescriptions. Unlike drier forests where fire and disease outbreaks are a serious concern, wind is the primary driver of ecosystem dynamics in the temperate Sitka spruce rainforests we are working in. This allows us to leave all biomass in place to provide wildlife habitat and build soils. To achieve this we utilize small hand-crews, which also limits impacts to visitors and wildlife while accelerating structural and biological diversity.

ORAL

INFLUENCE OF POST-FIRE VEGETATION AND FUELS ON FIRE SEVERITY PATTERNS IN REBURNS: IMPLICATIONS FOR RESTORATION. **Michelle Coppoletta**, Kyle E. Merriam, USDA Forest Service, Sierra Cascade Province Ecology Program, 159 Lawrence Street, Quincy, CA 95971; Brandon M. Collins, Center for Fire Research and Outreach, University of California, Berkeley, CA 94720-3114; *mcoppoletta@fs.fed.us*

In areas where fire regimes and forest structure have been dramatically altered, there is increasing concern that contemporary fires have the potential to set forests on a feedback trajectory with successive reburns, one in which extensive stand-replacing fire could promote more stand-replacing fire. Our study utilized an extensive set of field plots established following four fires that occurred between 2000 and 2010 in northern California and were subsequently reburned in 2012. The information obtained from these field plots allowed for a unique set of analyses investigating the effect of vegetation, fuels, topography, fire weather, and forest management on reburn severity. Our results suggest that high to moderate severity fire in the initial fires led to an increase in standing snags and shrub vegetation, which in combination with severe fire weather promoted high severity fire effects in the subsequent reburn. Our findings confirm that although fire behavior is largely driven by weather, components of post-fire vegetation composition and structure are also important drivers of reburn severity. In the face of changing climatic regimes and increases in extreme fire weather, these results may provide managers with options to create more fire resilient ecosystems in post-fire landscapes.

ORAL

INTEGRATING PYRODIVERSITY AND FIRE MANAGEMENT: WHAT HAPPENED TO BIODIVERSITY? **Dominick A. DellaSala**, Geos Institute, 84-4th St., Ashland, OR 97520; *dominick@geosinstitute.org*

Existing fire policy encourages maintenance of ecosystem integrity in fire management decisions, yet this is difficult to achieve on public lands managed for competing interests and for traditional fire management approaches that lack biodiversity perspectives. I discuss fire management for biodiversity in the Klamath and Sierra ecoregions, among the most biodiverse conifer forests in the world. I show how coarse-filter (landscape-level) and complementary fine-filter (species-level) approaches can be used to integrate forest management with conservation biology perspectives. At the coarse-filter level, mixed-severity fires create pyrodiversity associated with high levels of biodiversity that can be maintained in reserve networks. At the fine-filter level, focal species and species of conservation concern can be used to monitor efficacy of coarse filters and provide for species viability. Black-backed Woodpecker is an ideal focal species for monitoring ecological integrity of forests restored through mixed-severity fire, and California Spotted Owl, a species of conservation concern that uses post-fire mosaics, is particularly vulnerable to logging. I present a comprehensive approach for integrating wildland fire use for ecosystem integrity and biodiversity with strategic deployment of fire suppression and ecologically based restoration. The approach seeks to achieve broader recognition of fire-mediated biodiversity in fire management decisions.

ORAL

EXPANDING OUR UNDERSTANDING OF FOREST STRUCTURAL RESTORATION NEEDS IN THE PACIFIC NORTHWEST. **Tom DeMeo**, US Forest Service, Pacific Northwest Region, 1220 SW Third Avenue, Portland, OR 97215; Ryan Haugo, The Nature Conservancy, 32 N 3rd St, Ste. 412, Yakima, WA 98901; Chris Ringo, Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331; Jane Kertis, US Forest Service, 3200 SW Jefferson Way, Corvallis, OR 97331; Steve Acker, US Forest Service, 3106 Pierce Parkway, Suite D, Springfield, OR 97477; Mike Simpson, US Forest Service, 63095 Deschutes Market Rd., Bend, OR 97701; Mark Stern, The Nature Conservancy, 821 SE 14th Ave, Portland, OR 97214; *tdemeo@fs.fed.us*

Ecological departure, or how much landscapes have changed from a natural range of variation (NRV), has become a key metric in forest planning and restoration efforts. We define restoration need as the specific areal change in seral stage structure necessary to move landscapes into the NRV. While local treatments always require consideration of many factors and constraints, landscape assessments of this departure provide context and can shape the direction of treatments. While most restoration projects in the forested ecosystems of the Pacific Northwest (Oregon and Washington) have embraced this paradigm, our understanding of what treatments to apply where, when, and in what magnitude is evolving and continues to be refined. We build on a body of existing LANDFIRE/Fire Regime Condition Class (FRCC) work on ecological departure to assess the ecological departure of all forested landscapes in the region. Departure results show a substantial need for disturbance-related treatments in the drier fire-dependent

portion of this region (east of the Cascade Crest plus southwest Oregon), with over half of this treatment type falling on Federally-administered land. Rather than disturbance, the need for succession is more pronounced west of the Cascades, probably because past logging history has removed much of the late seral structural stage. Results can be used in broad planning strategies; planning at local scale will need to include a much wider range of considerations. The lack of pronounced disturbance need west of the Cascade Crest suggests restoration there may require strategies more nuanced than in the fire-dependent zone.

ORAL

VEGETATION CHANGE FOLLOWING THE FOREST RESERVE HOMESTEAD ACT OF 1906 IN THE APPLIGATE RIVER WATERSHED, OREGON. Dominic A. DiPaolo, Southern Oregon University, 1250 Siskiyou Boulevard, Ashland, OR 97520; Paul E. Hosten, Kalaupapa National Historic Park, P.O. Box 2222, Kalaupapa, HI 96742; dipaolod@sou.edu

Vegetation structure, composition, and community patterns on the landscape of southwest Oregon have changed since Euro-American settlement began in the mid-1800s. Much of this change has been attributed to the transition of land management strategies from those dominated by Native American practices, through the early Euro-American settlement period, and on to the post World War II era of industrial scale timber harvest and fire suppression. Using homestead patent applications and associated land classification maps generated under the Forest Reserve Homestead Act of June 11, 1906, we add to the understanding of historic vegetation conditions and evaluate vegetation change over time for land applied for by homesteaders in the Applegate River watershed of southwest Oregon. These homesteads were predominantly located on areas now supporting chaparral, *Pinus* and/ or *Quercus* woodlands, mixed conifer forests, pastures, and agricultural land. Our study presents primary source documentation that describes stands dominated by broadleaf trees and shrubs as dense at the time of patent application, contrary to the assumption that such stand structures are an artifact of fire suppression efforts of the last century. Historic vegetation polygons cross tabulated with current classified imagery in GIS indicate that conifer forests and shrublands each retain most of their former extents within their same locations on the landscape. The persistence of shrub stands to current times implies longer-term stability of these communities and indicates that a transition to conifer domination is not evident in all shrublands.

ORAL

BEYOND PATCH-SIZE DISTRIBUTIONS: AN EMERGENT PROPERTY OF MIXED-SEVERITY FIRE REGIMES. Christopher J. Dunn, 280 Peavy Hall, Oregon State University, Corvallis, OR 97331; chris.dunn@oregonstate.edu

Much of our scientific investigation surrounding mixed-severity fire regimes focus on patch-size distributions or proportions of burned area by severity class. Landscape patch-dynamics are but one of a multitude of ecological attributes influenced by fire, such that our focus on this attribute could be missing emergent properties associated with mixed-severity fire effects. In addition, dry-forest ecosystems have received the greatest attention for characterizing these fire regimes. Typically, these forests use dendroecology to infer disturbance processes from fire scars and age

structure and composition because they missed one or more fire cycles. These methodologies prevent direct observation of fire effects on forest structure and the resultant ecosystem response. Fortunately, there are opportunities to investigate mixed-severity fire in the more mesic Douglas-fir/western hemlock (Douglas-fir) forests of the Pacific Northwest. We leveraged fires that burned 10 and 22 years prior to sampling in mature/old-growth Douglas-fir forests to quantify mixed-severity fire effects and the subsequent ecosystem response in forests burning within their historical fire return intervals. Here I present fire effects to these forests from the individual tree to the landscape, and report the discovery of an emergent property of moderate-severity fire that can lead to long-term forest resilience. Since most forests burn with mixed-severity at some spatial or temporal scale, I contend we must begin to look for emergent properties unique to the central tendency of burn severity at a specific fireshed or geographic location before characterizing it as having a particular fire regime.

ORAL

RESTORATION AND MAINTENANCE OF DECIDUOUS OAK WOODLANDS ON TWO KLAMATH NETWORK PARKS IN NORTHERN CALIFORNIA. Eamon Engber, Redwood National Park, 121200 HWY 101, Orick, CA 95555; Jennifer Gibson, Whiskeytown National Recreation Area, 14412 Kennedy Memorial Drive, Whiskeytown, CA 96095; *eamon_engber@nps.gov*

Oak woodlands and mixed conifer forests in NW California are experiencing shifts in species composition that favor relatively shade tolerant, often coniferous species over deciduous oaks. These landscape scale shifts have been noted at a number of sites throughout California and the Pacific Northwest in Oregon white oak and California black oak woodlands and mixed conifer sites. Mostly attributed to a lack of frequent fire in recent decades, these shifts have resulted in a loss of biodiversity and wildlife habitat and have initiated a response by land management agencies and others. Two National Park Service units in the Klamath Network (Redwood National Park and Whiskeytown National Recreation Area) have managed oak woodlands and encroaching conifers with fire and mechanical methods for up to 3 decades. Mechanical treatments have proven successful as a first entry in heavily encroached stands, and prescribed fire has been implemented on a frequent cycle to maintain un-encroached woodlands and restored areas. We discuss lessons learned from oak woodland restoration project implementation, monitoring efforts, and avenues for future research.

ORAL

STUDENT WORKSHOP ON BEST PRACTICES FOR SUBMITTING AND PUBLISHING MANUSCRIPTS IN SCIENTIFIC JOURNALS. Dylan G. Fischer, Northwest Science Editor in Chief, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA, 98505; *fischer.nwscience@gmail.com*

This workshop will cover the basics of submitting manuscripts for publication in scientific journals, and specifically to the journal Northwest Science. What is the mission of a scientific journal? What makes a manuscript publication worthy? What is an editor looking for, and how

can an author pre-empt reviewer criticisms? How can authors prepare their work for Northwest Science? What are the “do’s” and “don’ts” of manuscript preparation and submission? We will cover answers to these basic questions in a workshop designed to help students and new authors prepare for submitting manuscripts for publication. We will also discuss the elements of successful papers, elements of effective figures, simple rules for getting published, and writing papers that get widely read, and widely cited. You will have a chance to meet directly with the current editor of Northwest Science and ask questions about publication in the journal, expected timelines, and expectations of authors.

POSTER

IDENTIFICATION OF FUNGI ASSOCIATED WITH POLLEN IN CRATER LAKE.

Meghan Flannery, Kathleen Page, Department of Biology, Ashland, OR 97520;
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Seasonal pollen input to Crater Lake provides a burst of nutrients for primary production and heterotrophic microbes. Aquatic fungi, known as chytrids, are unique in their ability to attack pollen’s exine wall, a first step in pollen decomposition. In June 2016 we undertook a project aimed at identification of lake pollen associated fungi. Lake pollen was collected from surface waters and examined microscopically. Chytrids were evident on nearly all pollen grains. Culture of pollen grains on chytrid growth medium allowed isolation of a chytrid fungus in the order *Rhizophydiales*. In addition, DNA was extracted from lake pollen and a large subunit rRNA gene clone library was prepared. DNA sequences obtained from the clone library indicated that several different chytrid fungi were present on the pollen, most of which could not be cultured. Pollen is rich in fatty acids, protein, and phosphate. To assess nutrients released by pollen decomposition we purified Crater Lake surface water containing varying amounts of pollen by filtration through 0.2 micron filters and measured the amount of dissolved organic carbon (DOC), phosphate and nitrate in the water. The amount of decomposing pollen in the water was directly correlated with the amount of DOC, phosphate, and nitrate. Dissolved nutrients increased more than 100 fold in water with high amounts of pollen. These results confirm the functional significance of chytrid colonization of lake pollen with regards to allochthonous nutrient input.

POSTER

LONG-DISTANCE JUMP DISPERSAL BUT SLOW RANGE INFILLING OF MOUNTAIN HEMLOCK IN THE INTERIOR PACIFIC NORTHWEST.

Erin M. Herring, **Daniel G. Gavin**, Department of Geography, University of Oregon, Eugene, Oregon 97403; Solomon Z. Dobrowski, Department of Forest and Landscape Ecology, Missoula, Montana 59812; Matias Fernandez, Feng Sheng Hu, Department of Plant Biology, University of Illinois, Urbana, Illinois 61801; *dgavin@uoregon.edu*

In northern Idaho, more than 100 vascular plant species are disjunct by more than 200 km from their main distribution along the coast. It remains unclear whether most species within this interior mesic forest disjunction, including *Tsuga mertensiana*, survived the last glacial period in a north-Idaho refugium or whether these species colonized the region via long-distance dispersal

during the Holocene. Sediment cores were extracted from three mid- to high-elevation lakes within *T. mertensiana* dominated forests in the Northern Rocky Mountains of Idaho. Pollen and macrofossils were used to reconstruct forest composition, determine the timing of *T. mertensiana* establishment, examine the hypothesis that the region was a glacial refugium, and contrast how climate, competition and/or dispersal limitation has influenced its modern distribution. We constructed a range map and modeled its potential species distribution. *T. mertensiana* first appears in the pollen and macrofossil record at the highest elevation site at ca. 4100 years ago, then at the next-highest-elevation site at ca. 1600 years ago, and last at the mid-elevation site at 800 years ago. *T. mertensiana* pollen occurs continuously at $\geq 1\%$ at all three sites by ca. 300 years ago suggesting regional presence. The timing of arrival suggests that *T. mertensiana* is a recent component of the forests of Idaho, having arrived during the Holocene via long-distance dispersal from coastal populations over 200 km away. Comparison with palaeoclimate reconstructions suggest that climate was a greater limiting factor than dispersal in the Holocene establishment in the interior, indicating little difficulty overcoming a large dispersal barrier. However, *T. mertensiana* remained at low abundances for millennia until Little Ice Age climates promoted its recent increase in abundance. Unoccupied areas of suitable habitat suggest that competition is limiting range-infilling in the interior mesic forests today.

ORAL

CYANOLICHEN DISTRIBUTION ALONG A WEST-EAST CLIMATE GRADIENT IN OREGON. Abby L. Glauser, Bruce McCune. Department of Botany and Plant Pathology, Oregon State University, 2701 SW Campus Way, 2082 Cordley Hall, Corvallis, OR, 97331; abby.glauser@oregonstate.edu

Cyanobacterial lichens not only add biodiversity and habitat to forest ecosystems, but provide nutrients to flora and fauna through nitrogen fixation. Although lab studies demonstrate physiological moisture requirements of cyanolichens, the literature lacks a climate-based distribution model for these organisms in the Pacific Northwest. This study supplements preexisting datasets and documents lichen community composition in a west-east climate gradient across Oregon, from coastal forest to steppe. Both epiphyte and ground-layer lichen communities are sampled in 32 plots, including some from the Forest Inventory and Analysis (FIA) program. By combining epiphyte and ground-layer data, we address questions such as: 1) How does total plot diversity compare to epiphyte-only measurements in different climate zones? 2) Where are cyanolichens relatively more abundant in Oregon? 3) Do patterns of cyanolichen abundance in the epiphyte layer match the patterns of cyanolichens in the ground-layer? Lichen communities were analyzed in relation to climatic and topographic variables. Results from preliminary ordination analyses suggest that epiphytic lichen communities with higher proportions of cyanobacterial lichens tend to occur in plots with a higher ratio of hardwoods to conifers, and at sites with lower elevation and higher precipitation. We present preliminary results that explore community composition in a variety of forest ecosystems, and propose exploratory field measurements of lichen moisture sources as an addition to this study. Future work will extend and intensify the sampling across the state and lead to a cohesive distribution model for cyanobacterial lichens in Oregon.

EFFECTS OF SALINITY REGIMES ON COASTAL BREEDING AMPHIBIANS IN

OREGON. Amanda Goddard, Department of Environmental Science, 725 SW Chickadee St. #306 Corvallis, OR 97333; Paul Adamus, Department of Water Resources 6028 NW Burgundy Drive, Corvallis, OR 97330; Andrew Blaustein, Department of Integrative Biology, 3029 Cordley Hall, Oregon State University, Corvallis, OR 97331-2914; goddaram@oregonstate.edu

Over 70% of the world's amphibian populations are in decline, in part due to decreased recruitment rates to the mating population (2). Future saltwater intrusion into near-coast freshwater breeding sites from sea level rise is likely to contribute to population declines, as increased salinity has been seen to delay metamorphosis and limit size in adults (1,3). This thesis is investigating how increasing frequency and intensity of saltwater intrusion in freshwater tidal wetlands of the Oregon coast will affect three native amphibians.

The main question examined is "To what degree does salinity impact breeding site selection of the Pacific treefrog, Northern red-legged frog, and Roughskin newt?" Additional questions for investigation include "How are these species developmentally affected by differing salinities that are found in their natural habitats?" and "Do these species have any tolerance to salt in their larval stages given their coastal breeding habitats?"

Investigations are being performed at 12 field sites on the Oregon Coast. Field methods areas described in *Sampling Amphibians in Lentic Habitats* (4) for complete surveys collecting abundance data with two observers. In addition, laboratory experiments are being conducted that involve observations of larval development until stage Gosner 25 of study species in 3 experimental salinity treatments of environmentally relevant concentrations.

We are ascertaining the ways increasing intensity and frequency of salinity gradients in the study species' natural breeding grounds may affect these species, and the degree to which these species have the natural variation and potential to adapt to changing salinity regimes.

ORAL

MANAGING SUDDEN OAK DEATH IN OREGON TANOAK FORESTS: PAST,

PRESENT, AND FUTURE. Ellen Michaels Goheen, USDA Forest Service, Forest Health Protection, Southwest Oregon Forest Insect and Disease Service Center, 2606 Old Stage Road, Central Point, OR 97502; egoheen@fs.fed.us

Sudden oak death (SOD), caused by a non-native pathogen *Phytophthora ramorum*, is lethal to tanoak and threatens this species throughout its range. First discovered in the forests of coastal southwest Oregon in 2001, hundreds of thousands of tanoak trees have since died. Genetic evidence indicates that the pathogen was introduced into Curry County on three separate occasions, most likely on nursery stock. *Phytophthora ramorum* causes disease in over 130 species of trees, shrubs, herbs, and ferns. Many SOD hosts are important nursery and landscape plants; others are collected for the floriculture industry. In Curry County the pathogen mainly infects tanoak, Pacific rhododendron, evergreen huckleberry, and less commonly, Oregon

myrtlewood. *P. ramorum* spreads naturally when clouds and rain move spores within forest canopies—from treetops to stems and shrubs below, or across landscapes from treetop to treetop. Human-assisted spread occurs when people transport infected plants or plant parts or infested soil. The pathogen survives in infested plant material, litter, soil, and water. An interagency team attempted to eradicate the pathogen on all lands through a program of early detection surveys followed by destruction of infected and nearby host plants. Eradication treatments eliminated disease from many infested sites but the disease continues to spread slowly. In 2012, State quarantine regulations were revised. The current program goal is to slow further disease spread by: 1) early detection and rapid eradication of new infestations that are epidemiologically important; 2) reducing inoculum levels wherever practical; and, 3) improved education and outreach to prevent spread by humans.

ORAL

SOIL CARBON AND NITROGEN RESPONSE TO THINNING AND FERTILIZATION TREATMENTS IN A COASTAL PACIFIC NORTHWEST FOREST. Cole D. Gross, Jason N. James, Eric C. Turnblom, Robert B. Harrison, School of Environmental and Forest Sciences, University of Washington, Box 352100, Seattle, WA 98195-2100; cole144@uw.edu

Intensive forest management can impact soil nutrition by shortening rotation intervals, degrading soil structure, and decreasing organic matter retention at the site. This study examines soil carbon (C) and nitrogen (N) response to thinning and fertilization treatments. Soil was sampled at an intensively managed Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) plantation in northwestern Oregon, USA. Management regimes – no treatment, thinning treatments, and fertilization treatments – were randomly assigned to nine 0.2-ha plots within an area of 5 ha. Fertilized plots received a total of 1120 kg N ha⁻¹ as urea over 16 years. Soil bulk density and chemical analysis samples were taken in the middle of succeeding soil layers at depths of 0.1, 0.2, 0.5, 1.0, and 1.5 m. Three pits were sampled per plot and averaged to account for within plot variation. Thinning treatments significantly (Tukey's HSD, $P < 0.1$) reduced total soil C (Mg ha⁻¹) and N (kg ha⁻¹) compared to no treatment by 31% and 32%, respectively. Most of this loss (65% and 73%, respectively) occurred in the subsoil (below 20 cm in depth). Fertilization treatments tended to reduce soil pH throughout the entire soil profile compared to both thinning treatments and no treatment, indicating the potential for nitrate leaching. Across all management regimes, the subsoil contained over 50% of total soil C and N. This study shows: (1) over a relatively short period (< 30 years), thinning treatments significantly reduced soil C and N stocks; and (2) accurately assessing soil C and N stocks requires sampling deep soil.

ORAL

OREGON WHITE OAK RESPONSE TO THINNING: 12-YEAR RESULTS. Constance A. Harrington, USFS Pacific Northwest Research Station, 3625 93rd Ave SW, Olympia, WA 98512, Warren Devine, Washington Department of Natural Resources, 1111 Washington St SE, Olympia, WA, 98504-7014; charrington@fs.fed.us

Oregon white oak (*Quercus garryana*) is an important component of oak woodlands and savannas from central California to southern British Columbia, but little information exists on its

response to thinning. In a trial on Joint Base Lewis-McChord near Tacoma, WA, we established two adjacent plots in a dense, 45-50-year-old pure oak stand (3,689 stems ha⁻¹; mean diameter=8.9 cm in both plots). We removed 80% of the stems (57% of basal area) in one plot. Twelve years later, mortality of stems in the thinned plot was 3.9% compared to 9.9% in the unthinned plot. After thinning, mean diameter of residual trees was 14.1 cm; 12 years later it had increased by 4.1 cm to 18.2 cm. In the unthinned plot, diameter increased by only 1.7 cm, to 10.6 cm. Mean crown diameter also increased more for trees on the thinned plot (from 7.0 to 9.1 m) than for trees on the unthinned plot (4.5 to 5.6 m). Initially, most cut stems sprouted, but over time many sprouts died or did not grow well; after 12 years, 65% were alive with a mean height of 2.4 m (tallest sprout was 4.5 m tall and 4.6 cm diameter). Because the uncut stems averaged 11.0 m tall, the sprouts are not competing for light or growing space. An ice storm 8 years after thinning damaged 62% of the trees in the unthinned plot and only 2% of trees in the thinned plot. Overall, thinning was effective in improving tree vigor and increasing growth rates.

ORAL

KLAMATH-SISKIYOU PLANT DIVERSITY: PATTERNS, CAUSES, AND A HISTORICAL PERSPECTIVE. Susan P. Harrison, Department of Environmental Science and Policy, University of California-Davis, Davis, CA 95616; *spharrison@ucdavis.edu*

The Klamath-Siskiyou Region of southern Oregon and northern California has long been known as one of North America's most important centers of plant diversity and endemism. Here I will first consider some general ideas and evidence linking climate and geology to plant diversity; then consider some of the 'classic' explanations by mid-20th century botanists for the high diversity of this region; and finally, discuss some of the work my collaborators and I have done in the past decade using functional and phylogenetic approaches to better understand the region's diversity.

ORAL

ERADICATION OF NONNATIVE TROUT AND THE RESPONSE OF THREATENED BULL TROUT IN SUN CREEK: WORKING WITH PARTNERS TO CONSERVE NATIVE FISH DIVERSITY IN AND AROUND CRATER LAKE NATIONAL PARK. Dave Hering, Mark Buktenica, PO Box 7, Crater Lake, OR 97604; *david_hering@nps.gov*

In a multi-phased adaptive management project that began in the 1990s, Crater Lake National Park has used exclusion barriers, electrofishing, and piscicide to remove nonnative trout that competed with ESA-listed bull trout (*Salvelinus confluentus*) in Sun Creek. To date, nonnative fish have been eradicated from 23.5 km of stream on national park and state forest land, and bull trout abundance has increased from fewer than 200 to approximately 2000 fish. The population, once limited to 2 km in the headwaters, now occupies at least 18 km of stream. Sun Creek restoration is continuing through a collaborative partnership with state agencies, conservation groups, and private landowners. Partners are restoring stream habitat, transferring water rights, screening irrigation diversions, and improving irrigation efficiency on Sun Creek downstream of the national park boundary. The growth and effectiveness of this project required sustained commitment to restoration, which was made possible by the enduring conservation mission of

the National Park Service, and the project exemplifies how partnerships can build on that mission to restore native trout across administrative boundaries on a landscape scale.

POSTER

GROWTH AND SITE FIDELITY OF INDIVIDUALLY MARKED AND RECAPTURED JENNY CREEK SUCKERS IN THE CASCADE SISKIYOU NATIONAL MONUMENT, OREGON. David Hering, PO Box 7, Crater Lake, OR 97604; Chris Volpe, Bureau of Land Management, 3040 Biddle Road, Medford, OR 97504; david_hering@nps.gov

The Jenny Creek Sucker is a unique sub-population of dwarf Klamath smallscale suckers (*Catostomus rimiculus*), isolated above a waterfall in the Jenny Creek drainage of southern Oregon. The population is a BLM strategic species, a USFWS species of concern, and a unique component of the biodiversity protected within the Cascade-Siskiyou National Monument. During September 2013, 2014, and 2015, we used electrofishing to capture Jenny Creek suckers at 14 sites in mainstem Jenny Creek. Fish were individually marked with passive integrated transponder tags and released at the site of capture. Suckers tagged in 2013-2014 (n = 844) ranged 80 mm to 246 mm fork length. We recaptured 25 individuals one or two years after initial tagging. Of these, 80% were recaptured within 500 m of the initial capture location, suggesting reach-scale fidelity to summer rearing habitats. One individual, however, moved over 6 km between capture occasions. There was no relationship between movement distance and fish size. Growth rate of recaptured individuals ranged 3 to 45 mm/year (median 20 mm/year). Variability in growth rate among individuals of similar body size indicates previously reported length-age relationships for the population require further validation.

ORAL

EARLY LANDSCAPE PHOTOGRAPHY & HISTORICAL (GLO) VEGETATION MAPPING OF THE CENTRAL ROGUE VALLEY NEAR MEDFORD, OREGON. Gene Hickman, 61851 Dobbin Road, Bend, Oregon 97702; ghickman@bendcable.com

Historical vegetation research based on the original General Land Office (GLO) cadastral surveys was conducted to develop a landscape perspective during early European settlement. This historical record is increasingly important as baseline information for natural resource management and aiding restoration ecology. The original GLO field survey notes beginning in the 1850's, were transcribed and used to create an Access data base in order to recover vegetation and other landscape records. Plant data was classified into broad cover types and subdivided into coarse plant communities based on witness tree data at section corners and survey "line descriptions." GLO notes, topographic maps and USDA soil surveys were used to correlate GLO vegetation types with local landscapes and create historical vegetation maps for over 1.5 million acres of central SW Oregon. This presentation will focus primarily on very old landscape photography which has been used to supplement local GLO data and is itself an excellent source of historical information visible from a careful study of the pictures. Photographs can be difficult to locate but are an excellent visual aid for displaying remnants of natural vegetation as well as disturbed landscapes altered by the impacts of early development in the central Rogue Valley.

AVERAGE ANNUAL RECESSION AND VARIABLES AFFECTING RECESSION RATE OF SHAKES GLACIER IN SOUTHEASTERN ALASKA. Reyn A. Hutten, Shakes Glacier Survey Team, Wrangell High School, P.O. Box 2311, Wrangell, AK 99929; *reynhutten@gmail.com*

Shakes Glacier is a lake-calving glacier located 30 miles east of Wrangell, in Southeastern Alaska. Students of Wrangell High School (WHS) have measured the location of the glacier terminus since 2011. I combined student measurements with remotely sensed and historical data to evaluate the recession rate of Shakes Glacier over time. I also analyzed the influence of annual average temperature adjusted for six possible glacier lag times at ten-year intervals and the influence of lake width at glacial contact; an increase in lake width results in a larger terminal area exposed to thermally conductive fresh water. Shakes Glacier recession has varied since 1698, but has been stable at 107 m/year in the period between 1948 and 2016, almost twice the rate of other lake-calving glaciers in the area for reasons presently unknown. I did not find a correlation between terminus retreat and local annual temperature, suggesting that other variables may influence glacial melt, such as seasonal temperature and precipitation, or glacier volume below the lake surface. In future years, I recommend that the WHS glacier team measure depth data of the glacial lake, and the glacier terminus height above the lake to better estimate annual volumetric loss.

ORAL

BEDLOAD DISPERSION THROUGH CONFLUENCES IN A GRAVEL-BED RIVER HEADWATERS. Kurt S. Imhoff, Inter-Fluve Inc., 501 Portway Avenue, Hood River, OR 97031; Andrew Wilcox, University of Montana, Department of Geosciences, 32 Campus Dr. #1296, Missoula, MT 59812; *kimhoff@interfluve.com*

Sediment routing fundamentally influences channel morphology and the propagation of disturbances such as debris flows. The transport and storage of bedload particles across headwater channel confluences, which may be significant nodes of the channel network in terms of sediment routing, morphology, and habitat, are poorly understood, however. We investigated patterns and processes of sediment routing through headwater confluences by comparing them to published results from lower-gradient confluences and by comparing the dispersive behavior of coarse bedload particles between headwater confluence and non-confluence reaches. We addressed these questions with a field tracer experiment using passive-integrated transponder and radio-frequency identification technology in the East Fork Bitterroot River basin, Montana, USA. Within the confluence zone, tracers tended to be deposited towards scour-hole and channel margins, suggesting narrow, efficient transport corridors that mirror those observed in prior studies, many of which are from finer-grained systems. Coarse particles in some confluence reaches experienced reduced depositional probabilities within the confluence relative to upstream and downstream of the confluence. Our results suggest that variation in the spatial distribution of coarse-sediment particles may be enhanced by passing through confluences, though further study is desired to evaluate and confirm confluence effects on dispersive regimes and sediment routing on broader spatial and temporal scales.

ORAL

BLACK-BACKED WOODPECKER AND WOOD-BORING BEETLE ASSOCIATES WITH POST-FIRE BURN SEVERITY FOLLOWING THE NATIONAL CREEK FIRE.

Alyssa Gunning, **Jherime L. Kellermann**, Environmental Sciences, Oregon Institute of Technology, Crater Lake National Park Science & Learning Center, 3201 Campus Dr., Klamath Falls, OR 97601; jherime.kellermann@oit.edu

Short-term habitat conditions and mosaics created by wildfire can be critical for many species. Black-backed woodpeckers (*Picoides arcticus*) are considered a fire specialist where they predate wood-boring insect larvae that colonize forests immediately following a fire. Research on BBWO has primarily focused on breeding season dynamics and boreal regions with little attention to other seasons and populations such as those of the Oregon Cascades, which have been recently proposed for listing under the Endangered Species Act. From late August to early September, 2016 we surveyed a range of fire severities and forest types within the 2015 National Creek fire boundary, the largest historic fire in Crater Lake National Park, OR. At each point we surveyed for Black-backed Woodpeckers using playback and performed area searches for wood-boring beetle adults and larva within a 25m radius using nets, visual detections, and bark peeling. We used classification trees and logistic regression to assess the association of forest type, fire severity, and beetle presence with BBWO presence. Presence of BBWO depended on interactions of vegetation type, fire severity, and was phenologically synchronized with the presence of beetles within the order *Cerambycidae*, particularly the species *Ergates spiculatus*, but not the order *Buprestidae*. Post-breeding dispersal of BBWO in late summer could partially drive the distribution and life cycle of wood-boring *Cerambycidae* which rapidly colonize recent burn areas. Understanding phenological synchrony of seasonal resources associated with ecological disturbance is important for identifying and managing habitat for species of conservation concern especially in light of climate change.

ORAL

SNOWMELT, PHENOLOGY, AND GROWING SEASON LENGTH IN CRATER LAKE NATIONAL PARK.

Jherime L. Kellermann, Natural Sciences Dept., Oregon Institute of Technology, 3201 Campus Dr., Klamath Falls, OR 97601; Donal S. O'Leary III, Department of Geography, Huxley College, Western Washington University, 516 High Street, Bellingham, WA, 98225; Chris Wayne, Crater Lake National Park, Division of Resource Preservation and Research, PO Box 7, Crater Lake, OR 97604; jherime.kellermann@oit.edu

Anthropogenic climate change is having significant impacts on montane and high elevation areas globally. Warmer winter temperatures are driving reduced snowpack in the western US with broad potential impacts on ecosystem dynamics of particular concern for protected areas. Monitoring climate impacts can be resource prohibitive for land management agencies. Vegetation phenology is a sensitive indicator of ecological response to climate change and is associated with snowmelt timing, while both can be assessed at large spatiotemporal scales using freely available remote sensing data. Little work has been done in regions dominated by evergreen conifer cover, which represents many mountain regions at temperate latitudes. We used data derived from MODIS satellite instruments to assess annual snowmelt date and five phenology metrics across 10 conifer dominated ecosystems within Crater Lake National Park (CRLA), Oregon, USA from 2001-2012. Earlier snowmelt was associated with

earlier onset of green-up in all but the lowest elevation forest ecosystems, as well as earlier peak phenology in subalpine and alpine forests and longer growing seasons in subalpine and volcanic soil forests. Snowmelt date and green up were increasingly later and growing seasons were shorter over the 12 year period of study, although this likely represents a short-term cooling fluctuation within a longer term trend of declining snowpack. These results have important implications for ecosystem dynamics, management, and conservation, particularly of species such as whitebark pine (*Pinus albicaulis*) in alpine and subalpine areas.

ORAL

ESTIMATING AGE OF ROCK CAIRNS IN SOUTHEAST ALASKA BY COMBINING EVIDENCE FROM SUCCESSIONAL METRICS, LICHENOMETRY, AND CARBON DATING. Bruce McCune, Nijmah Ali, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331; Ralph J. Hartley, William J. Hunt, Department of Anthropology, University of Nebraska-Lincoln, Lincoln, NE; mccuneb@oregonstate.edu

We estimated ages of rock cairns in alpine tundra in southeast Alaska by combining information from three general classes of methods, each of them imperfect, but considered together providing better estimates than any of the three alone. We used lichenometry, radiocarbon dating, and five successional metrics: score on a nonmetric multidimensional scaling axis of vegetation composition, cover-weighted average successional class of organisms, overgrowth of contact points between rocks, sum of species cover, and species richness. Lichenometry estimated absolute ages, but with considerable error because we violated key assumptions. Successional metrics provided relative ages, probably with more precision than lichenometry, but did not provide absolute ages. Although the relative age estimates from traditional lichenometry seemed least reliable, collectively they supported the hypothesis of prehistoric origins for the cairns with a range of possible absolute ages of 258-892 yr. Similarly, radiocarbon dates for the cairns suggested cairn construction before European settlement, about 450 to 1500 ybp. The five successional metrics were in general agreement with each other on relative ages. Combining all methods provided more information than any of the methods alone. We conclude that the cairns were built over a range of times, probably over centuries, most likely 500-1500 ybp.

ORAL

EFFECTS OF FIRE SEVERITY ON HERBACEOUS PLANT BIODIVERSITY. Jesse E. D. Miller, Department of Environmental Science and Policy, University of California, Davis, 1 Shields Ave, Davis, CA 95616; Hugh Safford, USDA Forest Service Regional Ecology Program, 323 Club Drive, Vallejo, CA 94592; kawriver@gmail.com

High-severity (stand-replacing) wildfires have become larger and more common in parts of the western United States in recent decades. The effects of severe fire on biodiversity remain poorly understood, in part because most post-fire plant diversity studies have focused on low-severity prescribed fires. Here, we analyze plant community responses to the full fire severity spectrum in recent fires in the Sierra Nevada. We also review the broader literature on plant diversity responses to fire severity in western conifer forests to identify general patterns in plant community responses to fire severity. We find that low and moderate severity fires typically

have neutral to positive effects on species richness and beta diversity (species turnover among sites) in the first decade following fire. High severity fire can have either positive or negative effects on species richness, depending in part on forest type. Positive effects on species richness often occur in forest types where the natural fire regime includes a notable component of high severity fire, while negative effects may occur in forests where fires historically burned at higher frequencies but lower severities. High-severity burn areas may exhibit a substantial homogenization of the herbaceous flora due to strong filtering of fire-sensitive species. Pre-fire management to reduce burn severity may promote post-fire plant diversity in forests that are adapted to low-severity fire, but may decrease diversity in forests that are adapted to high-severity fire.

ORAL

LICHEN-INVERTEBRATE INTERACTIONS IN TROPICAL DRY FORESTS. Ricardo Miranda-Gonzalez, Andrew R. Moldenke, Bruce McCune. Department of Botany and Plant Pathology, Oregon State University, Cordley Hall 2082, Corvallis, OR 97331-2902; *mirandar_g@yahoo.com.mx*

The tropical dry forest is characterized by a dry season of 6 continuous months in which more than 95% of the plants lose their leaves completely. The remaining months of the year are marked by a fast greening of the canopy. During our studies in this ecosystem, we noticed that crustose lichen communities constitute an abundant resource that is available regardless of seasons. Our study area in the Pacific coast of Mexico has around 300 lichen species, which cover most of the bark surface of most trees. We asked, if lichens provide so much biomass to the system, then who is using those resources and how? Using behavioral observations, we tested which animals interact with lichens. Our results showed invertebrates as the primary consumers of lichens, specifically land snails, oribatid mites, and caterpillars of the families Batrachedridae and Psychidae. One of the species of caterpillars also used lichens to construct mobile houses in which the caterpillar lives until it becomes an adult. Using molecular techniques, we identified the lichens used to build several of these mobile houses and found a high selectivity of lichens species. Currently we are following the study by analyzing the invertebrate feces with molecular techniques to categorized the lichen component in their diet at the species level. Our results showed a diverse trophic network that uses lichens as the primary producer. Given the high seasonality of the tropical dry forest, lichens may constitute a useful resource that helps to maintain the functionality of the ecosystem.

POSTER

EVALUATION OF TRACE ELEMENT CONCENTRATIONS IN OREGON'S EDIBLE WILD-FORAGED MUSHROOM SPECIES. Christina Murphy, Alyssa E. Shiel, College of Earth, Ocean, and Atmospheric Sciences, 104 CEOAS Administration Bldg., Oregon State University, Corvallis, OR 97331; *ashiel@ceoas.oregonstate.edu*

Levels of arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) were investigated in 36 samples from 9 species of edible wild-foraged mushrooms harvested from urban and forested regions of Linn and Lane Counties in Oregon. Trace element concentrations were measured on

an ICP-MS with the exception of Hg which was measured using a direct thermal decomposition mercury analyzer. The concentrations of As, Cd, Hg, and Pb varied widely between species and ranged from below detectable levels to 71.765 ppm, 0.012 to 2.351 ppm, 0.015 to 7.973 ppm, and 0.004 to 0.778 ppm, respectively, as determined on a dry weight basis. Using an estimated weekly intake of 60g of dry mushrooms per week, trace element concentrations were compared to the provisional tolerable weekly intakes (PTWI) for As, Cd, Pb, and Hg as specified by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in order to provide useful information for consumers and regulators. Species were well below the PTWI for As, Cd, Pb, and Hg in most cases. The PTWI for As was exceeded in specimens of *Tricholoma magnivelare* (American matsutake) collected from the Siuslaw National Forest (Sutton Recreation Area), with an average of 306% the PTWI. Concentrations of Hg were high in *Boletus edulis* (porcini), *Chlorophyllum rhacodes* (parasol), and *Clitocybe nuda* (blewit) at 53.5%, 82.8%, and 94.5% of the PTWI, respectively. The harvest location and the trophic strategy both appeared to have an effect on the trace element concentrations among and within the species sampled.

ORAL

BIODIVERSITY AND FLORISTIC PATTERNS OF EPIPHYTIC MACROLICHENS ON *QUERCUS GARRYANA* IN THE CASCADE-SISKIYOU NATIONAL MONUMENT. Nils Nelson, 349 ½ N Main Street, Ashland, OR 97520; John Villella, Siskiyou Biosurvey, 324 Avery Street Ashland, OR 97520; Lalita Calabria, 2700 Evergreen Parkway NW, Olympia WA 98505; Daphne Stone, 30567 Le Bleu Rd., Eugene OR 97405; Tom Carlberg, 1959 Peninsula Drive, Arcata, CA 95521; nilscbnelson@gmail.com

We surveyed for epiphytic macrolichens in 53 plots of *Quercus garryana*-dominated habitats within the Cascade-Siskiyou National Monument. We report a rich flora of *Quercus garryana* epiphytes with 103 species. Macrolichen species richness in our plots ranged between 12 and 49 species with an average of 26.5 species per plot. The most frequently occurring genera included: *Usnea*, *Physconia*, *Physcia*, *Hypogymnia*, *Melanohalea*, and *Scytinium*. We assessed rarity based on records from the Consortium of North American Lichen Herbaria and established conservation categories. Three taxa recorded in our survey are on the current Oregon Natural Heritage Program list of rare lichens. These taxa are *Hypotrachyna revoluta* (S3-vulnerable), *Collema curtisporum* (S1-critically imperiled), and *Rostania quadrifida* (S2-imperiled). Two species, *Physcia subalbinea* and *Placidium fingens*, were recorded for the first time as epiphytes in Oregon and should be recommended for conservation. We found a regionally rare species, *Scytinium teretiusculum*, widely distributed. We also found four rare to Oregon members of *Physciaceae* including *Physciella cf. chloantha*, *Physconia californica*, *Physconia cf. leucoleiptes* and *Physconia fallax*, all species characteristic of the California floristic province. We observed floristic patterns that indicate a species mix typical east of the Cascade Mountain range. For example, *Collema curtisporum* was found in 27 plots. In addition *Platismatia wheeleri*, a species known from western intermountain NA was found in 14 plots. We discuss how these new findings influence our current knowledge of lichen biodiversity in the CSNM and Oregon.

ORAL

PRESENCE/ABSENCE SURVEY OF *RANA BOYLI* COMPARING TRADITIONAL VISUAL ENCOUNTER VS eDNA DIGITAL PCR DETECTION. Steve Niemela, Mathew Vargas, Oregon Department of Fish & Wildlife, 1495 E. Gregory Rd, Central Point, OR, 97502; steve.a.niemela@state.or.us

Environmental DNA (eDNA) is a technology that allows researchers to confirm the presence of a species simply by analyzing samples from the environment for fragments of its DNA. Along with additional benefits prior research has demonstrated that eDNA has a higher detection probability than traditional visual surveys. *Rana boylei*, commonly known as the Foothill Yellow-legged Frog (FYLF), is a small frog with rough, brownish-gray skin, and a pale yellow wash under the hind limbs. Unlike most native frogs in Oregon, it breeds in flowing water on valley bottoms, making it a good surrogate species to evaluate the health of low gradient streams. *R. boylei* once ranged from the Willamette Valley to southern California, and from the Sierra Nevada and Cascade Range west to the coast. Recent research indicates that *R. boylei* only occurs at half of its historic sites and has undergone significant range contraction. We randomly selected twenty historic FYLF sites in the Applegate and the upper Illinois Watersheds and used a traditional visual survey technique to look for frogs while on site; in addition we collected water samples for later eDNA laboratory analysis. We expected all of the sites with a visual encounter to be positive for eDNA and possibly several sites with no visual confirmation. We detected frogs at eleven (55%) of our historic sites using visual surveys, which is similar to the range wide average. However, we only detected frogs at 9 sites using eDNA, including one with no visual confirmation of *R. boylei*.

ORAL

MICROBIAL ECOLOGY OF CRATER LAKE'S DEEP-WATER MOSS. Kathleen Page, Meghan Flannery, Department of Biology, Southern Oregon University, Ashland, OR 97520; page@sou.edu

Deep-water moss supports a complex microbial community in Crater Lake. We collected samples of deep-water moss with the aim of identifying and quantifying microbial epiphytes and possible nitrogen-fixing symbionts. Nitrate, a limiting nutrient in Crater Lake, is almost undetectable at the depths where moss is most abundant, 40 to 100 meters beneath the lake surface. Nitrogen-fixing cyanobacteria can supply nitrate to plants by converting dissolved nitrogen gas into nitrate. Nitrifying bacteria and fungi can supply nitrate to plants by converting decaying biomass into nitrate. Microbial epiphytes on moss were studied using four different methods. Freshly collected moss leaves were examined by microscopy and epiphytes were classified and counted. We found that diatoms and filamentous algae were the most abundant epiphytes on moss, with cyanobacteria present in fewer numbers. Heterotrophic bacteria and fungi were also present. Microbial epiphytes were rinsed from moss, classified, and counted by microscopy. Results from this approach generally corresponded with the results of leaf assessment. DNA was extracted from moss and a large subunit rRNA gene library was prepared. This approach allowed genetic "barcode" identification of several algae and fungi that were associated with moss. Individual moss leaves were inoculated into cyanobacterial growth

medium and the associated cyanobacteria that grew were identified. The cultures allowed detection of cyanobacteria that may have been present in low numbers on leaves or possible cyanobacteria endophytes. Several different types of nitrogen fixing cyanobacteria were found to be associated with moss leaves, but we did not find evidence of mutualistic symbiosis.

ORAL

STATUS AND CONSERVATION OF THE THREATENED OREGON SPOTTED FROG (*RANA PRETIOSA*) AT PARSNIP LAKES, CASCADE-SISKIYOU NATIONAL MONUMENT. Michael S. Parker, Biology Program, Southern Oregon University, Ashland, OR 97520; parker@sou.edu

The Parsnip Lakes Oregon spotted frog population was discovered in April 2003 and currently represents the southern and western range limits for the species. This system is a spring-fed interconnected series of wetlands and ponds. Temperature monitoring has revealed the most likely adult and juvenile frog overwintering sites and 15 years of breeding season surveys have revealed the timing and distribution of breeding activity. The breeding population is very small and fluctuates between 0-21 females breeding per year. Breeding success, including number of oviposition sites and number of ponds used for breeding, is strongly correlated with winter snowfall and late winter snowpack but is not correlated with total precipitation or other environmental variables. Heavy snowfall packs down phreatophytic vegetation creating more near shore open water habitat for oviposition and reducing the risk of egg masses being stranded as pond levels recede. The primary breeding sites were historically maintained by beavers, but the absence of beavers over the past decade has led to a reduction in water level and proliferation of vegetation, reducing both breeding and tadpole rearing habitat. Deterioration of the former beaver dam at the primary breeding pond has resulted in a surface level decline of 6-10 cm over the breeding season and resulted in frequent egg mass strandings in recent years. Analog beaver dams have been used to restore hydrologic function in a variety of stream systems and will be used at the Parsnip Lakes in an attempt to restore breeding habitat for the threatened Oregon spotted frog.

POSTER

QUANTIFYING SEASONAL VARIABILITY IN NITROGEN-FIXATION BY CYANOBACTERIA ASSOCIATING WITH MOSSES *NIPHOTRICHUM ELONGATUM*, *PLEUROZIUM SCHREBERI* AND *RHYTIDIADELPHUS TRIQUETRUS* IN A NORTHWEST PRAIRIE ECOSYSTEM. Kate S. Petersen, Lalita M. Calabria, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505; Amanda Bidwell, School of Environmental and Forest Sciences, University of Washington, Box 352100, Seattle, WA 98195-2100; katespetersen@hotmail.com

Moss-cyanobacteria associations provide substantial N input in northern latitude forests, but whether the association extends into temperate latitude ecosystems remains largely unstudied. In 2016, we discovered that common moss species from Puget Sound prairies harbor symbiotic associations with N-fixing cyanobacteria. We established the presence of cyanobacteria living epiphytically on three common moss species using epi-florescence and light microscopy. We

utilized an acetylene reduction assay and gas chromatography–flame ionization detection (GC-FID) to quantify N-fixation from the cyanobacteria-moss associates. Based on these data, we determined that rates of N-fixation varied seasonally and by moss species over a 12-month period. Of the 453 moss samples tested, 18% exhibited acetylene reduction rates above $10 \mu\text{mol m}^{-2} \text{ day}^{-1}$, a value widely accepted as background N-fixation levels found in environmental samples. Acetylene reduction rates for samples above this threshold were extremely patchy across the landscape ranging from 10.5 to $579.1 \mu\text{mol m}^{-2} \text{ d}^{-1}$ over a 12-month period.

Niphotrichum elongatum exhibited the highest average rate of acetylene reduction annually at $27.1 \mu\text{mol m}^{-2} \text{ d}^{-1}$, which would equate to an ecosystem level N-fixation rate of $0.04 \text{ kg N ha}^{-1} \text{ yr}^{-1}$ (based on an average percent moss coverage of 7.4 and an assumed acetylene to nitrogen ratio of 3:1). *Pleurozium schreberi* ($4.67 \mu\text{mol m}^{-2} \text{ d}^{-1}$) and *Rhytidiadelphus triquetrus* ($4.0 \mu\text{mol m}^{-2} \text{ d}^{-1}$) exhibited significantly lower annual average acetylene reduction rates. To our knowledge, this is the first report of N-fixing moss-cyanobacteria associations in a temperate grassland ecosystem and the first record of this symbiosis occurring in the common prairie moss, *Niphotrichum elongatum*.

ORAL

MACRO-PHOTOGRAMMETRY USING STRUCTURE-FROM-MOTION (SfM) TO CAPTURE LICHENS WITH HIGH-PRECISION POINT CLOUDS. Eric B. Peterson, Botany Department, California Academy of Sciences, San Francisco, CA, 94118; epeterson@calacademy.org.

Structure-from-Motion photogrammetry (SfM) is a suite of image analysis algorithms from computer vision sciences. SfM enables feature detection and matching across multiple images, with triangulation to create three-dimensional (3D) point clouds. It is the primary method used for processing drone photography into 3D data, but can be used with oblique imagery from a ground view-point. SfM is broadly used in geomorphology for constructing terrain models and calculating volumetric change. I have learned SfM largely through needs for topographic data to support river restoration; but the potential for detail far exceeds the needs for topography. Application of SfM to ecology, forestry, and other sciences seems almost limitless, yet incorporation of SfM into life sciences has been slow. SfM can match features among photos with sub-pixel accuracy. Using oblique photography within riparian vegetation, and with survey-grade spatial control, photos taken across hundreds of meters can be assembled into models with root-mean-square error (RMSE) < 3 cm. Resulting point clouds typically include hundreds of millions of points with sufficient detail to see bark texture. Applying the same techniques at a more detailed level, I have photographed lichens with a standard camera and macro-lens, then modeled them in 3D. Using stainless steel pins for spatial control, the relationships between images can be modeled to within 0.1 mm RMSE and can be repeated over time. Possible applications include documentation of form, sub-seasonal growth studies, reproductive phenology, quantification of herbivory, community dynamics, and undoubtedly much more.

IDENTIFICATION OF NITROGEN-FIXING CYANOBACTERIA-MOSS SYMBIONTS OF THE SOUTH PUGET SOUND PRAIRIES, WASHINGTON STATE. **Stephanie**

Pierce, Cody Allison, Lalita Calabria, 2700 Evergreen Parkway, Olympia, WA 98505;
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We investigated the extent of bryophyte-cyanobacteria associations in common ground-dwelling mosses of a northwest prairie ecosystem in Washington State. Using light and epifluorescence microscopy, we conducted a leaf count to estimate the percentage of leaves displaying cyanobacteria present in each sample. Of the seven taxa examined, three (*Niphotrichum elongatum*, *Rhytidiadelphus triquetrus* and *Pleurozium schreberi*) were associated with cyanobacteria. *Niphotrichum elongatum* exhibited the greatest percentage of leaves colonized (86.3%, n=117) whereas *R. triquetrus* displayed slightly lower colonization levels (81.2%, n=69) and *P. schreberi* exhibited the smallest percentage of leaf colonization (33.2%, n=73). We identified the cyanobacteria as *Nostoc* and *Stigonema* based the presence of heterocysts and by comparing morphological features with literature data. The moss species with cyanobacterial associations exhibited N-fixation that fluctuates seasonally, as measured by an acetylene reduction assay and quantified using gas-chromatography flame ionization detection (GC-FID). To our knowledge we are reporting for the first time the association between the N₂-fixing cyanobacterium, *Nostoc*, and the moss species *Niphotrichum elongatum*.

ORAL

OVERSTORY STRUCTURE DEVELOPMENT AND COMMUNITY CHARACTERISTICS OF OREGON ASH (*FRAXINUS LATIFOLIA*) FORESTS OF THE WILLAMETTE VALLEY, OREGON. **Sean Prive**, Lomakatsi Restoration Project, 1287 Oak

Street, Ashland, OR 97520; David Shaw, Department of Forest Engineering, Resources and Management 280 Peavy Hall, Oregon State University, Corvallis, OR 97333;
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I described the current state of Oregon ash-dominated forested wetlands and their associated vegetation communities in the Willamette Valley, Oregon. I also quantified successional dynamics among stands in varying stages of structural development, and compared ash forest community composition to that of regional open wetlands where ash forest development has been suppressed via anthropogenic disturbance. Additionally, I related differences in both successional dynamics and community composition to a soil moisture gradient. Nearly 70% of sampled ash-dominated stands initiated more than 80 years ago, and are in advanced stages of successional and structural development. The remainder typically initiated between 30 and 80 years ago in small isolated wetlands that have been designated for conservation. Ash was the sole overstory tree species in approximately 76% of sampled stands. Oregon white oak was the only other dominant tree species observed, and tended to be present on sites with a relatively low annual high water table. All forests exhibited moderate levels of tree or partial crown mortality, though understory ash regeneration, primarily in the form of vegetative sprouting, was abundant. Plant communities within ash forests were typically dominated by native species and exhibited high levels of between-stand (beta) diversity. Species richness was not significantly different

when compared to open wetlands. However, composition differed between wetland types, and exotic species cover was significantly lower in closed-canopy forested wetlands. In both open and closed canopy wetland systems, soil moisture was identified as an environmental gradient that highly influenced community composition and richness.

ORAL

SPATIAL AND TEMPORAL RESPONSE OF WILDLIFE TO RECREATIONAL ACTIVITIES IN THE SAN FRANCISCO BAY ECOREGION. Michelle Reilly, U.S. Fish & Wildlife Service, Yreka, CA, M. W. Tobler, San Diego Zoo Global Institute for Conservation Research, Escondido, CA, D. L. Sonderegger, Department of Mathematics and Statistics, Northern Arizona University, Flagstaff, AZ, P. Beier, Department of Forest Science, Northern Arizona University, Flagstaff, AZ; *michelle_reilly@fws.gov*

Non-motorized human recreation may displace animals from otherwise suitable habitat; in addition, animals may alter their activity patterns to reduce (or increase) interactions with recreationists. We investigated how hiking, mountain biking, equestrians, and recreationists with domestic dogs affected habitat use and diel activity patterns of ten species of medium and large-sized mammals in the San Francisco Bay ecoregion. We used camera traps to quantify habitat use and activity patterns of wild mammals and human recreationists at 241 locations in 87 protected areas. We modeled habitat use with a multi-species occupancy model. Species habitat use was most closely associated with environmental covariates such as landcover, precipitation, and elevation. Although recreation had less influence on habitat use, the presence of domestic dogs was negatively associated with habitat use of mountain lions and Virginia opossum. We also compared diel activity patterns of species at sites with no observed recreation to the activity patterns of species at sites with high (\geq eight per day) levels of non-motorized recreation. Coyotes were more active at night and less active during the day in areas with high levels of recreation. Striped skunks were slightly more active later into the morning in areas that allowed human recreation. Smaller carnivores with nocturnal activity patterns may not be directly affected by recreational activities that are limited to daylight hours. We suggest that by maintaining habitat free of domestic dogs, and creating trail-free buffers, land managers can manage recreation in a way that minimizes impacts to wildlife habitat and preserves the value of protected areas to people and wildlife.

ORAL

ANOTHER LICHEN-LIKE POST-EDIACARAN VENDOBIONT FROM THE DEVONIAN OF NEW YORK. Gregory J. Retallack, Department of Earth Sciences, University of Oregon, Eugene, OR 97403-1272; *gregr@uoregon.edu*

Protonympha is an enigmatic fossil represented by two species from the Middle (*P. transversa*) and Late Devonian (*P. salicifolia*) of New York. Although interpreted in the past as a polychaete worm or starfish arm, *Protonympha* is not found with marine fossils, but with fossil plants of a community dominated by lycopsids. This community was a swamp woodland of *Lepidosigillaria whitei*, with ground cover of *Haskinsia colophylla*, fringing brackish to freshwater coastal lagoons of the Catskill Delta. *Protonympha* shares with Ediacaran Vendobionta a quilted body of

unskeletonized biopolymer that is unusually resistant to burial compaction. In overall form, *Protonympha* is most like the Ediacaran genus *Spriggina*. *Protonympha* has branching and tapering tubular structures radiating from the bottom. These rhizine-like structures, thallus stratification, and internal chambers revealed by petrographic thin sections, suggest affinities with lichenized Fungi. As for Cambrian *Swartpuntia*, and Ordovician-Silurian *Rutgersella*, *Protonympha* may have been a post-Ediacaran vendobiont.

ORAL

THE CASCADES BUTTERFLY PROJECT: MONITORING BUTTERFLIES AND PLANT PHENOLOGY AS INDICATORS OF CLIMATE CHANGE. Regina M. Rochefort, North Cascades National Park Service Complex, 810 State Route 20, Sedro-Woolley, WA 98284; regina_rochefort@nps.gov

The Cascades Butterfly Project (CBP) is a long-term monitoring program in which citizen scientists and National Park Service biologists monitor butterfly abundances and plant phenology in subalpine meadows of the Cascade Mountains. Our broad goals are to understand the influence of climate change on high-elevation ecosystems, document changes in species distributions and abundances, communicate these impacts to the public, and provide these data to inform protection of National Park Service and U.S. Forest Service lands.

We are monitoring butterflies and plant phenology because both are extremely sensitive to changes in temperature and precipitation and may provide us with an early warning into future ecosystem changes. Additionally, butterflies and plant flowering stages are easily identified and widely monitored allowing us to invite citizen scientists to collect data and facilitating comparisons with ecosystems changes being observed in other geographic areas. Butterflies and plants are monitored weekly throughout the summer using the Pollard walk methodology, an international standard supporting comparisons with other regions. Ten, 1-km survey routes are located along trails in subalpine meadows in North Cascades National Park, Mount Baker-Snoqualmie National Forest, Okanogan-Wenatchee National Forest, and Mount Rainier National Park. All butterflies observed along survey routes are identified and recorded. Over the last six years, we have averaged 35 volunteers per summer, conducted 339 surveys, recorded 37 butterfly species, and counted over 13,400 butterflies. We have been able to document annual changes in butterfly emergence times and abundances.

INFLUENCE OF FLOWER NATIVE STATUS, COLOR, AND MORPHOLOGY ON VISITING PREFERENCES OF BEES IN RIPARIAN AREAS OF EASTERN OREGON.

Samantha M. Roof, Sandra J. DeBano, Department of Fisheries and Wildlife, Oregon State University, Hermiston Agricultural Research and Extension Center, 2121 South 1st Street, Hermiston, OR 97838; Mary M. Rowland, USDA Forest Service Pacific Northwest Research Station, La Grande Forestry and Range Sciences Laboratory, 1401 Gekeler Lane, La Grande, OR 97850; Skyler Burrows, Bee Biology and Systematics Lab, Utah State University, Logan, UT 84322; roofs@oregonstate.edu

Effectively restoring or conserving bee habitat requires a better understanding of the complex relationship between bees and flowering plants, but information about bee preferences is currently lacking. The purpose of this study was to examine bee-plant associations in a riparian area of Starkey Experimental Forest and Range (Starkey) in eastern Oregon. Our objectives were to determine which blooming plants were most attractive to bees, and examine whether the species composition of bee visitors differed depending on a plant's flower color, morphology, or status as native or non-native. This research was part of a larger, multidisciplinary project evaluating the effectiveness of riparian restoration within Starkey. We found that different plant species were associated with different communities of bee visitors, but neither native status nor flower color significantly affected visiting bee species composition. The average number of bees visiting native and introduced plant species also did not differ significantly. However, flower morphology did influence the types of bees visiting each plant species. Bilaterally symmetrical flowers, with nectar and pollen typically more difficult to reach, tended to be associated with larger bees with longer tongues. In contrast, small, easily accessible flowers in the Asteraceae family attracted smaller bees with shorter tongues. Our results suggest that certain plants will be particularly useful for supporting an abundant and diverse bee community and that providing diversity in the morphology of blooming plants is a key factor to consider when restoring riparian areas for bee pollinators.

ORAL

SITE SUITABILITY EVALUATION FOR TRANSLOCATING THE FEDERALLY ENDANGERED LICHEN, *CLADONIA PERFORATA*.

Roger Rosentreter, Biology Department, Boise State University, 1910 West University Drive, Boise, ID 83725; Ann DeBolt, Idaho Botanical Garden, 2355 Old Penitentiary Road, Boise, ID 83712; roger.rosentreter0@gmail.com

The federally endangered lichen, *Cladonia perforata*, known from about 30 sites in Florida, continues to decline at many locations, largely due to habitat loss from land development and alien plant encroachment. Many of the reserves and parks where *C. perforata* is protected are small, or suitable habitat is limited, diminishing this ground-dwelling fruticose species' ability to disperse and colonize new sites. The suitability of potential *C. perforata* translocation receptor sites were evaluated on the 120 acre Jupiter Inlet Lighthouse Outstanding Natural Area (ONA), a Bureau of Land Management preserve in southeast Florida. While *C. perforata* naturally occurs as several distinct subpopulations on 5 acres of the ONA, all are vulnerable due to an adjacent

outdoor sports complex. To bolster the ONA *C. perforata* population and reduce the risk of extirpation from a catastrophic (hurricane, fire) or human-related event, translocation experiments were successfully conducted in the past, and are proposed again. Two common, co-occurring vagrant *Cladonia* taxa with a similar growth form were used as experimental surrogates to test site suitability prior to translocation of *C. perforata*. Testing site suitability in advance of translocating this rare lichen provided an opportunity to better understand environmental factors that would ultimately determine success or failure of a given site for successful colonization by *C. perforata*. Expansion into a “new” portion of the ONA, where exotic plants have been controlled since 2012, and where seemingly “suitable” scrub sites have been opened up, we hope to increase species recovery opportunities for *C. perforata* within the ONA.

ORAL

HISTORIC OSBORNE LOOKOUT PHOTOS. HISTORIC PHOTOGRAPHS AND LANDSCAPE CHANGE IN THE APPLGATE WATERSHED. Luke Ruediger, 17607 Elliott Creek Road, Jacksonville, Oregon 97530; elliottcreek@yahoo.com

It is often assumed that historic landscape conditions in the Applegate River watershed were much more open than they are today. The assumption is that open forest types were prevalent throughout much of the area due to a more active fire regime dominated by low-severity fire. By studying the historic fire lookout photographs of William Bushnell Osborne (circa 1930-1936) from locations throughout the Applegate River watershed, and comparing them to the contemporary habitat mosaic, we can identify historic landscape conditions and track change over an eighty-year timespan. My findings show that historic landscape conditions were extremely diverse and heavily influenced by mixed-severity fire. The Osborne lookout photographs show that open forest, although present, was relatively rare. Much of the historic forested landscape consisted of closed forest interspersed with both fire-mediated and edaphic, non-forest plant communities. The forests of the Applegate River watershed have expanded and densified to some extent in the eighty years since the Osborne lookout photographs were taken, yet the reference condition does not include large swaths of open forest maintained by low-severity fire.

ORAL

CATALOGING THE LICHENS OF LAVA BEDS NATIONAL MONUMENT. Steve Sheehy, 4227 Alpine Drive, Klamath Falls, OR 97520; Sheehy.s@charter.net

Lava Beds National Monument in Northeastern California has a diverse community of lichens. Many unique habitats exist within the 73 square miles of the Monument from sagebrush steppe to mixed conifer forest to lava flows and lava tube openings. Volcanic substrate ranges in age from 1,100 years at Callahan Flow’s to over 2 million years at Gillum Bluff, and lichen community structure differs between these areas. Lava tube collapses have a multitude of microhabitats. Sun drenched rock colonies are entirely different than the shaded areas even though they may only be separated by a few inches. The pumice rich soils are home to multiple species of soil crusts. In 2012 there were only 19 lichen species on the NPS list for Lava Beds

NM; this prompted me to begin a more in depth lichen survey of the Monument. Through my survey and the engagement with other lichenologists the list has grown to over 200 species, including several new records for the state and species new to science. The presentation will delve into some of the unique lichens found in this understudied area of northern California.

POSTER

CARBON SEQUESTRATION IN A NORTHWEST FOREST: AN EXAMINATION OF SPECIES-SPECIFIC CONTRIBUTIONS. Chris Shipway, Christina Muller-Shinn, Dylan Fischer, Justin Kirsch, Gabriel Chavez, Abir Biswas, The Ecosystem Ecology Laboratory, Lab 1 3051, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA, 98505; cjsshipway@gmail.com

Forest tree diversity and species composition in northwest forests can exert strong effects on carbon (C) sequestration. We used permanent plots in a lowland western Washington forest to examine tree carbon accumulation rates over various measurement intervals from 2006 to 2016. Field measurements, as well as dendrological methods, were used to estimate total plot biomass C and annual biomass increments in individual species. Based on previous work, we hypothesized that overstory diversity would be a significant predictor of plot productivity, and that species would exhibit distinct contributions to total productivity of the forest over time. We find that higher carbon sequestration rates were occasionally found in high diversity stands, but did not find evidence supporting the hypothesis that overstory richness or diversity is a significant factor in the productivity of this forest. Our cumulative data suggest forest-wide net C sequestration increment of around $6 \text{ Mg ha}^{-1} \text{ yr}^{-1}$ between 2006 and 2016, but with a significant drop in the last few years. These values are consistent with high sequestration values for the region. Preliminary analysis shows that tree species' contributions to forest C have changed over the course of the study. *Tsuga heterophylla* increased in relative biomass, while both *Pseudotsuga menziesii* and *Alnus rubra* suffered. In combination, these data provide a unique lens on changing species dominance and forest C patterns through secondary succession in one of the most carbon-dense forests in North America.

ORAL

MIXED SEVERITY \neq MIXED SEVERITY \neq MIXED SEVERITY. Carl Skinner, Pacific Southwest Field Station, Redding, CA; rxfuego@gmail.com

Mixed-conifer forests of the west are often described as being characterized by complex, mixed-severity fire regimes. This is due to most fires in the general type ending up neither completely low-intensity, surface-fires or stand-replacement, crown-fires. However, by itself, this label (mixed-severity) is essentially meaningless unless accompanied by descriptors (e.g., patch scales, proportions of severity levels, etc.) as by itself it is simply stating that burned areas lie somewhere on the gradient between being mostly dead and mostly alive following fire. Where on that gradient the landscape ends up is important. Forest types characterized by mixed-severity can be classified according to their more typical proportions of high to low severity patches, which increases from relatively dry to relatively mesic site conditions. For example, in the Klamath Mountains bioregion, though fires were largely quite heterogeneous, the central

tendency of fire effects was for them to generally fall on the end of the gradient with mostly low-moderate-severity surface fires due to the long, dry summers coupled with variation influenced by topography resulting in a complex mosaic of fire effects. Geography (place) matters in terms of how influences such as climate and topography tend to affect the nature of mixed-severity fires.

ORAL

VULNERABILITY OF FOREST LICHEN COMMUNITIES TO SPECIES LOSS

UNDER CLIMATIC WARMING. Robert J. Smith, Bruce McCune, Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis, Oregon 97331-2902, USA; Sarah Jovan, USDA Forest Service, Portland Forestry Sciences Lab, 620 SW Main, Suite 400, Portland, OR 97205, USA; *smithr2@oregonstate.edu*

Resolving how climatic constraints differ among species can help anticipate how global changes will cause range shifts. Communities may be vulnerable to species losses when many species approach their niche limits, suggesting that niche-based measures can inform vulnerability assessments. In a two-stage process, we first estimated realized climate niches for 443 epiphytic macrolichen species based on rasterized herbarium records (46,343 sites in Mexico, Canada and the U.S.). We then estimated thermal vulnerability using three new indices, based on systematic, whole-community surveys from the U.S. Forest Inventory and Analysis (FIA) program (6,474 U.S. sites). Herbarium data addressed possible niche truncation, while systematic FIA data resolved sampling bias concerns. Vulnerability indices were fairly insensitive to uncertainty in climate variables. Present-day thermal vulnerability was greatest in north-central California, along the western Colorado Plateau, and on the Southeastern coastal plain, suggesting that warming-induced species losses will become most evident in these areas. Under proposed warming scenarios (increases of +0.5 to +3.6 °C), the percentage of U.S. lichen communities exceeding thermal safety margins grew from about 2% to 20%. In all scenarios the most vulnerable communities were concentrated in low-elevation and southerly locations, which suggests that lichens otherwise assumed to be “warm-adapted” may nevertheless be commonly on the verge of exceeding their upper thermal limits. Our findings indicate that warming will modify community compositions through the loss of warming-intolerant species pushed beyond their niche limits. Assessing vulnerability of bioindicators will help prioritize locations where the greatest climate-induced changes in forest diversity will occur.

POSTER

VASCULAR PLANT HYPERDIVERSITY IN HIGH-ELEVATION RIPARIAN COMMUNITIES OF NATIONAL PARK SERVICE UNITS IN THE KLAMATH NETWORK.

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We analyzed vascular plant species richness in 0.1 ha (0.25 acre) plots collected in probabilistic samples of upland and riparian systems of four National Park Service units, Crater Lake National Park, Lassen Volcanic National Park, Redwood National and State Parks, and Whiskeytown National Recreation Area, to compare patterns of vascular plant species diversity. We found that

riparian plots were richer in species than upland environments in all four parks. Contrary to the typical global pattern of declining species richness with increasing elevation, we noted an increase in average richness of riparian plots from 0 to 2,382 m (7,815 ft) elevation, and a hyperdiversity of species in riparian plots at Crater Lake and Lassen Volcanic (riparian plots had over three times the mean species richness of upland plots). Higher-elevation riparian plots had a higher proportion of native herbaceous perennial species than lower-elevation riparian plots. The rich flora of moisture- and cold-adapted herbs in riparian areas of Crater Lake and Lassen Volcanic suggests that these montane riparian zones act as biodiversity refugia. A fundamental driver of these systems appears to be winter snowpack, which delays runoff and continually recharges groundwater reservoirs, feeding perennial streams through the summer. Snowpacks in the mountains of northern California and southern Oregon are known to be highly sensitive to temperature, and projected changes in snowpack suggest that in future decades a larger proportion of precipitation may fall as winter rain, which could impact the hydrological underpinnings of these systems, with unknown consequences for biodiversity.

ORAL

USING NATURAL GENETIC VARIATION TO MAINTAIN FOREST TREE SPECIES IN THE FACE OF NON-NATIVE DISEASES, INSECTS, AND CLIMATE CHANGE. **Richard A. Sniezko**, USDA Forest Service, Dorena Genetic Resource Center, 34963 Shoreview Drive, Cottage Grove, OR 97424; rsniezko@fs.fed.us

Genetic variation within a species provides the underlying basis for the survival of a species in the face of threats from pathogens, insects and a changing climate. The presence of non-native tree diseases and insects pose a particularly tough challenge to the health and survival of our forest trees and associated ecosystems. Examples affecting trees of the Pacific Northwest include white pine blister rust (WPBR) (all eight 5-needle pine species of western U.S. and Canada are susceptible), and Port-Orford-cedar (POC) root disease. One of the species affected by WPBR, whitebark pine, is proposed for listing under the Endangered Species Act. Applied genetic resistance breeding programs and active forest management are being used to help mitigate the impact of these non-native diseases. The successes to date are encouraging and strive to increase the level and frequency of natural genetic resistance while maintaining genetic variation and adaptability of populations, to help buffer against other biotic and abiotic agents. The programs involve short-term seedling trials to find resistance, field trials to confirm the efficacy and durability of resistance, research on genetic variation, and genetic conservation measures. The progeny of thousands of parent trees of 5-needle pines and POC have been screened for resistance, most are highly susceptible (100% mortality), but the frequency of resistance varies by species and some families show 50 to 100% survival. Examples from whitebark pine, western white pine, sugar pine, foxtail pine, limber pine and POC will examine the progress and its current utility for restoration and reforestation.

GENETIC VARIATION IN HEIGHT AND RESISTANCE TO WHITE PINE BLISTER RUST IN FOXTAIL PINE (*PINUS BALFOURIANA*) AND LIMBER PINE (*P. FLEXILIS*)

Brianna A. McTeague, Robert S. Danchok, Angelia J. Kegley, **Richard A. Sniezko**, USDA Forest Service, Dorena Genetic Resource Center, 34963 Shoreview Drive, Cottage Grove, OR 97424; rsniezko@fs.fed.us

The nine white pine species native to the U.S. and Canada are highly susceptible to the introduced fungal pathogen *Cronartium ribicola*, the cause of white pine blister rust. Here we report early results from our first resistance screening trial of foxtail pine (*Pinus balfouriana*), and a parallel screening trial of limber pine (*P. flexilis*) from the northern portion of its range (Oregon and Canada). Early results indicate that both foxtail pine and limber pine are highly susceptible. For foxtail pine, all seedlings were cankered by 14 months post-inoculation (mpi), and mortality reached nearly 80% by 18 mpi. Limber pines from the isolated population in eastern Oregon and Canada were also highly susceptible, with family means ranging from 95 to 100% cankered at 17 mpi, except for progeny of a parent tree with major gene resistance (MGR) (24% cankered) and a neighboring selection (75% cankered), which is likely a MGR pollen receptor. Rust mortality was much lower for limber pine at this time than for foxtail pine, averaging 27% (mean of family means), with family means ranging from 5% to 71%. In addition, both species demonstrated significant family differences for height. The high susceptibility of in foxtail pine and northern limber pine populations indicates that proactive management is warranted in these species, including more extensive rust resistance screenings, field trials to validate resistance ratings, seed collections to preserve genetic diversity, increasing information about adaptive genetic variation, and rating sites for rust hazard under anticipated future climates.

ORAL

THE INFLUENCE OF BURN SEVERITY ON BAT SPECIES OCCURRENCE IN POST-FIRE LANDSCAPES.

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Fire drives landscape pattern and wildlife community composition across many ecosystems in the western United States. Dry conifer forests in the region experienced frequent fires dominated by low-moderate severity, which maintained relatively open forests characterized by large fire-resistant trees. However, following a century of fire exclusion and climate change, wildfires in many parts of the west, including the Sierra Nevada mountains, have increased in size and severity. At the same time, large gaps remain in our understanding of how fire patterns affect the ecology of these forests. Forest bat species have been particularly difficult to study in the past, and the influence of fire on bat habitat quality is largely unknown. To address this knowledge gap, we used automated recording units and classification software to survey forest bat species over three seasons in and around two large wildfires that burned approximately a decade prior. Bat activity was generally greater within burned areas as compared to unburned controls. However, both the direction and magnitude of this effect varied by species. Likewise, individual

species diverged in their response to the level of fire severity within the burned areas. These findings suggest that diversity of the Sierra Nevada bat community may benefit from fire in the aggregate. Furthermore, a mix of fire effects such as those found in a natural fire regime may be necessary to maintain the range of habitats utilized by the various species observed.

ORAL

CHAPARRAL LANDSCAPE AMOUNT AND LOCAL PATCH SIZE INFLUENCE SONGBIRD OCCUPANCY. Jaime L. Stephens, Caitlyn R. Gillespie, John D. Alexander, Klamath Bird Observatory, PO Box 758, Ashland, OR 97520; jlh@klamathbird.org.

Oak ecosystems, including oak woodland with a chaparral understory, are among the most imperiled habitats in the Pacific Northwest. Chaparral plant communities provide important habitat for wildlife, but they also are likely to burn at high severity and threaten large, old oaks in the event of wildfire. Reducing fire risk and promoting healthy oak woodland habitat sometimes calls for the removal of chaparral, yet managers attempting to meet fuel-reduction objectives lack key information for both landscape and site level planning. We examine whether chaparral-associated songbird occupancy is affected by: 1. landscape habitat amount and configuration using distribution models and 2. patch size and nearby chaparral amount with a field study. Using stacked species distribution models to define chaparral “habitat amount”, we find a significant interaction between local (150m radius) and landscape (10000m radius) habitat amount predicts local occupancy for a suite of chaparral-associated birds. Field study results indicate significant patch-area sensitivity for Bewick’s Wren, California Towhee, Lazuli Bunting, and Spotted Towhee, but not Blue-gray Gnatcatcher. For small patches (< 2 ha) we found a positive relationship between patch occupancy and the total area of chaparral within a 100m radius for three of the focal species. Prioritization of oak restoration sites in southern Oregon and northern California should consider chaparral landscape habitat amount along with assessments of threat and connectivity. When chaparral removal is warranted for the restoration of oak woodlands, our results suggest retaining patches of at least 2-5 ha will benefit the suite of chaparral associated species we examined.

ORAL

UNDERSTORY VEGETATION RESPONSES TO FIRE AND FOREST MANAGEMENT IN CALIFORNIA MIXED-CONIFER FORESTS. Jens T. Stevens, Department of Environmental Science, Policy and Management, University of California Berkeley, 130 Mulford Hall, Berkeley, CA 94720; stevensjt@berkeley.edu.

By changing the understory microclimate, forest canopy disturbances such as thinning and wildfire may shift the composition of understory native plant communities toward species tolerant of increased temperatures and climatic water deficit, a process termed “thermophilization”. Working in yellow pine and dry mixed-conifer forests influenced by fire suppression, we sampled understories in plots that had been factorially thinned and burned in wildfires. We found that these four treatments generated a gradient of disturbance severity and canopy closure, with untreated plots the least disturbed and most closed, and wildfire-only plots the most disturbed and open. Along this gradient, we found that the proportion of flora with

evolutionary affinity to northern-mesic environments decreased, while the proportion of southern-xeric flora increased, with increasing disturbance severity and decreasing canopy closure. Canopy disturbance caused a greater reduction of mesic flora in forests with higher levels of precipitation, where mesic species were initially most common. Species with low foliar carbon-nitrogen (C:N) ratios were favored in high-severity disturbance stands, and the elevated water deficit in these stands appeared to favor species with lower specific leaf area at a given C:N level. Forests with intermediate disturbance intensities, where abundances of mesic and xeric species were nearly equal, had higher within-plot alpha diversity than the unburned forests, and higher within-stand beta diversity than the wildfire-only forests. These findings suggest that fuel-reduction treatments in concert with the reintroduction of wildfire can promote taxonomically and functionally diverse native plant communities.

POSTER

BREAKING BUD: THE DRIVING FORCES BEHIND OREGON WHITE OAK'S BUDBURST PHENOLOGY. **Teresa M. Vail**, Constance Harrington, Pacific Northwest Research Station of US Forest Service, Olympia Forestry Sciences Laboratory, 3625 93rd Ave SW, Olympia, WA 98512-1101; Kevin Ford, Bureau of Land Management Oregon/Washington State Office, 1220 S.W. 3rd Ave, Portland, OR 97204; tmvail@fs.fed.us

Quercus garryana, also known as Garry oak or Oregon white oak, occurs from southern California to southwestern British Columbia, and on the west side of the Cascades in Oregon and Washington. It is one of the last tree species in the region to burst bud in the spring. Exposure to increased temperatures, such as those that may be experienced due to climate change, causes other tree species to break bud earlier. To test if Oregon white oak responds similarly, or if the timing of its bud burst is constrained by photoperiod, we divided seventy-three 1-yr. old Oregon white oak seedlings among two photoperiod treatments with three different temperature settings. The two photoperiod treatments were ambient (typical Olympia, WA's photoperiod) and accelerated (2 times faster than the ambient treatment). The three temperature treatments were cool (5°C nights, 10°C days), warm (20°C nights, 25°C days), and intermediate (4 days of cool and 3 days of warm temperatures per week). The experiment occurred in late December of 2015 to mid-April of 2016, when the last tree burst bud. The results show that the photoperiod had no significant effect on the timing of bud burst, whereas temperature had a strong influence on budburst timing. The results also show that the Oregon white oaks has a minimum chilling requirement, which is roughly 250 chilling hours, for budburst to take place. We found no evidence of photoperiod limitations on advances in budburst timing, though lack of chilling may constrain advancement.

TARDIGRADES IN THE CANOPY: LIVING WITH THE RED TREE VOLE.

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Several theories exist about dispersal strategies of canopy dwelling meiofauna, but patterns of tardigrades dispersal with respect to animal vectors are rarely reported. Red tree voles (*Arborimus longicaudus*) (RTV) are small rodents that live in the canopy of old-growth Douglas-fir trees in forests of western Oregon and northwest California. They build nests of discarded resin ducts derived from their food, conifer needles. If tardigrade-rich samples are observed in RTV nests, a relationship between the mammal and dispersal of tardigrades could be inferred. To test whether tardigrades use RTV nests as habitat we analyzed 43 nest samples gathered from the canopies of Douglas-fir in a longitudinal transect across the range of the RTV in southwestern Oregon. A total of 167 tardigrades were extracted from nest collection. 65% of the samples contained at least one tardigrade. Inactive nests made up 57% of the tardigrade positive nests but contained 78% of the tardigrades. Twelve species of tardigrades were found including members of seven genera: *Echiniscus*, *Hypsibius*, *Macrobiotus*, *Milnesium*, *Murrayon*, *Pilatobius*, and *Ramazzottius*. Seven of the species are new records for Oregon, increasing the documented tardigrade diversity for the state by 30% from 23 to 30. These data document a relationship between RTV and tardigrades; suggesting a possible dispersal vector both vertically and horizontally within tree crowns. The occurrence of so many new state records suggests future sampling within canopy habitats could increase knowledge of tardigrade diversity in Oregon. Samplings of other animal nests may help explain the complexity of regional and intercontinental dispersal.

THE EFFECTS OF MICROCLIMATE ON SPRING PHENOLOGY AT THE H.J. ANDREWS EXPERIMENTAL FOREST IN WESTERN OREGON.

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Spring plant phenology is especially sensitive to changes in local climate (microclimate), yet most climate models are at a regional scale, and are too coarse to predict changes in microclimate. Changes in the timing of plant phenology can result in trophic asynchrony and population declines of higher level consumers. We conducted standardized weekly spring phenology surveys at 16 sites from 2009-2015 to examine the effects of microclimate on the phenology of 17 native forest plants in Western Oregon. The 16 sites varied in elevation, aspect and slope and were located at the H.J. Andrews Experimental forest in the western Cascades. Preliminary analyses showed a high degree of inter-annual variability of

microclimate within and across sites, resulting in a changing pattern of microclimate diversity across the landscape from year to year. Overall plant phenology generally tracked this variability in microclimate, but individual species' phenological responses to microclimate varied substantially. This study highlights the importance of understanding the interactions between regional and local processes that determine microclimate conditions and how those conditions influence patterns of plant phenology within forest communities, across mountain landscapes, and over time. Mountain microclimates are variable within and across years, and higher resolution climate models are needed to predict the local effects of climate change on spring phenology.

ORAL

FROM PLANTS TO PEOPLE: HOW DO CALIFORNIANS INTERACT WITH REGENERATING POST-FIRE LANDSCAPES? **Alexandra M. Weill**, Andrew M. Latimer, Department of Plant Sciences, University of California, Davis, CA 95618; amweill@ucdavis.edu

Despite advances in fire science that argue for less emphasis on total fire suppression and more fire on the ground, existing United States policy still largely defaults to suppression. Recent arguments for a major change in fire policy have suggested that public opinions have a role to play in creating such a shift. Public opinion of wildfire is often perceived to be largely negative and in support of fire suppression; however research suggests that public opinions are more nuanced than previously thought. In this study, we were specifically interested in the opinions of those who live and recreate in fire prone regions: how does interacting with a post-fire landscape shape public opinion of fire? We focused on hikers in the chaparral-dominated Stebbins Cold Canyon Reserve, which burned at high severity in the 2015 Wragg Fire. From re-opening in May 2016 through March 2017, we surveyed hikers and participants in guided walks before and after their hike about their knowledge and perceptions of local fire and wildfire in the nation at large. We found that hikers were knowledgeable about issues that frequently appear in national media, like fire suppression and prescribed fire, but knew little about local ecology or fire regimes. Participants frequently reported discussing wildfire during their hikes, and post-hike perceptions of fire were nuanced, not negative. Contrary to our expectations and frequent media descriptions of post-fire landscapes as “devastated” or “moonscapes,” participants described the burned landscape with awe and admiration. These results suggest new directions for fire outreach and education.

ORAL

INCREASING FIRE SEVERITY CHALLENGES FOREST RESILIENCE IN CALIFORNIA'S MID-ELEVATION MIXED CONIFER FORESTS **Kevin R. Welch**, Department of Plant Sciences, University of California, Davis, CA 95616; Hugh D. Safford, Department of Environmental Science and Policy, University of California, Davis, CA 95616; Truman P. Young, Department of Environmental Science and Policy, University of California, Davis, CA 95616; kevin.boca@gmail.com

Plants that evolved in Mediterranean climates have developed mechanisms to persist in a variety of fire regimes, including fire-resistant bark, fire-triggered seed germination, self-pruning of

branches, and varying mechanisms of sexual reproduction and/or vegetative sprouting. Many hardwood trees and shrubs quickly capitalize on conditions associated with high severity fire through fire-stimulated resprouting and fire-enhanced seed germination. In contrast, conifers' persistence in our study sites is dependent on seeds stored in the seed bank or dispersed from surviving trees within or directly outside the fire perimeter. Vegetative resprouting may give hardwood trees and shrubs a disturbance advantage that increases across the fire severity gradient. We established 1329 plots on 13 fires that burned in 10 National Forests in California and examined regeneration patterns of 4 functional groups (conifer seedlings, hardwood seedlings, hardwood resprouts, and shrubs) across a fire severity gradient. Preliminary results suggest 1) high severity fires confer a disturbance advantage to hardwoods in the first decade of regrowth, 2) fire-stimulated shrub cover may accentuate the competitive advantage of hardwood resprouts in severely burned areas, and 3) changing fire regimes may lead to increases in hardwood density where conifers currently dominate. Regeneration patterns were consistent with known species-specific differences in shade tolerance, drought tolerance, and adaptation to fire in low to moderate severity plots only; severely burned plots had far fewer conifer and hardwood seedlings regardless of ecological constraints. Hardwood resprouts had their highest densities in severely burned plots.

ORAL

POST-FIRE RECRUITMENT OF TWO CONIFER SPECIES UNDER MANIPULATED DROUGHT AND SHRUB COMPETITION CONDITIONS. Chhaya M. Werner, Derek Young, and Truman Young, Department of Plant Sciences and Center for Population Biology, University of California Davis, 1 Shields Avenue, Davis, CA 95616; cwerner@ucdavis.edu

Recruitment after fires is a vital part of renewal in mixed-conifer forests for many dominant species, and areas where initial recruitment is poor can suffer regeneration failures that last for decades. We have found evidence from analysis of a large-scale Sierra Nevada dataset that post-fire conifer recruitment is sensitive to variations in climate. As a controlled test of the impacts of winter precipitation on conifer recruitment and conifer-shrub competitive interactions, we set up a manipulative experiment in the King fire area. We crossed a competition treatment (shrub removal) with manipulated drought (precipitation reduction by rain-out shelters) and planted 1200 *Pinus ponderosa* and *Abies concolor* seeds. The drought treatment had 17% fewer seedlings germinate (mixed effects ANOVA, $F = 3.657$, $p = 0.057$) but the ones that did successfully germinate were 23% taller and had 33% larger canopies (both $p < 0.001$). The effects of the drought treatment differed by species and by source population. Conifer seedlings with shrubs in the non-herbicide treatment were 8% taller ($p = 0.029$), possibly due to competitive pressures to rise above shading. We present the first year survival and growth of these seedlings, and the role shrub interactions play in the recruitment and survival of drought-stressed conifer seedlings. With climate change projections predicting increasing drought stress and increasing climatic variation for California regions, forest recruitment may become increasingly tied to post-fire climate, and understanding the patterns of those effects will be vital for management efforts to protect and restore forest communities.

SPATIAL AND TEMPORAL CONTINGENCY IN RAPID PRIMARY SUCCESSION FOLLOWING REMOVAL OF THE ELWHA RIVER DAMS. Chhaya M. Werner,

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Over a thousand dams have been removed from American waterways, with the plans for many more ahead. These removals present an opportunity to restore rivers and their surrounding environments, but can be complicated by novel abiotic conditions, slow establishment of riparian vegetation, and invasion by exotic species. This project examined the interplay of environmental influences, and spatial and temporal contingencies on naturally assembling communities in drained reservoirs following the removal of two dams on the Elwha River, Washington. I sampled forty 5m x 10m plots in 2013 for species abundance and soil composition, and resampled species abundance in 2015. Species' composition differed between the two reservoirs and by soil exposure age, and shifted in the two years of sampling without converging (PERMANOVA, all $p < 0.001$). Alpha diversity decreased from 2013 to 2015 ($F = 57.7$, $p < 0.001$), while dissimilarity between plots (beta diversity) increased ($F = 14.9$, $p < 0.001$). Plant functional trait literature suggests that even when contingencies result in divergent species composition, trait-based functional groups may show more deterministic patterns. I found that community-weighted functional trait metrics did vary with deterministic drivers of soil characteristics, but also displayed contingency-based patterns, based on reservoir identity and date of exposure. Specific leaf area (SLA), maximum canopy height, and seed mass differed by reservoir, and SLA, maximum canopy height, and SLA differed by soil exposure timing. As early succession progressed, leaf area decreased and seed mass increased.

ATTRACTION OF RED TURPENTINE BEETLE AND OTHER SCOLYTINAE TO TRAPS RELEASING ETHANOL, 3-CARENE, OR BOTH IN AN OREGON PINE FOREST. Douglas J. Westlind, Rick G. Kelsey, USDA Forest Service, Pacific Northwest

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Pioneering red turpentine beetles (RTB) (*Dendroctonus valens*) like other beetles use oleoresin monoterpenes to select and colonize multiple pine species. 3-Carene is one of the most abundant monoterpenes in the oleoresin of ponderosa pine (*Pinus ponderosa*). When used as a trap lure it attracts more RTB than α -pinene, β -pinene, or a 1:1:1 mix of all three compounds. This beetle prefers to colonize weakened, dying, or recently dead trees, logs and stumps that are known to synthesize and accumulate stress induced ethanol. After a fire RTB attack trees and bole positions where damaged tissues contain high ethanol concentrations. To determine how lures using ethanol+3-carene combined would impact primary attraction, we baited funnel traps with four lures: ethanol, 3-carene, ethanol+3-carene and a blank, in a randomized complete block design near La Pine, Oregon, with 15 traps per lure. We statistically compared the response to lures for the most abundant 7 species and 3 genera (not identified to species) captured. Two groups of five each were found to exhibit similar responses. The first group responded either with positive synergism (3 species, including RTB) to EtOH+3-carene lures, or with an additive

response (2 species) equal to the sum of beetles captured by separate EtOH and 3-carene lures. The second group responded with either no additive (4 species) or a negative synergism response to EtOH+3-carene (1 species). The strong synergistic attraction of RTB to EtOH+3-carene when combined increases the likelihood pioneering beetles will find stressed ponderosa pine with compromised chemical defenses, allowing successful colonization.

ORAL

FUNGAL ENDOPHYTE-INFECTED ACER MACROPHYLLUM LITTER ALTERS IN-STREAM MICROBIAL DECOMPOSER COMMUNITIES. Emily R. Wolfe, Brett S.

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In headwater streams, allochthonous litter inputs are an important source of energy that drive nutrient cycling. Litter decomposition is a microbially-mediated process that progresses in stages as first fungi and then bacteria colonize and degrade litter. However, initial microbial colonization is affected by the original litter chemistry, which can be altered by the presence of endophytes. *Rhytisma punctatum* is a fungal endophyte of *Acer macrophyllum* that causes black stromata patches that persist in litter. We hypothesized that endophyte-infected tissues would not only decompose more slowly, but have decreased sporulation rates of aquatic hyphomycetes compared to uninfected tissues. We also hypothesized that microbial communities would vary by litter treatment (leaf discs infected by either *R. punctum* or an unknown bullseye lesion, or without symptomatic infection) and over time. Litter bags were deployed in a small stream and harvested periodically. Upon harvest, discs were either incubated to induce sporulation of aquatic hyphomycetes, combusted for ash-free dry mass to determine decomposition rates, or processed for amplicon-based sequencing of epiphytic microbial decomposer communities. Symptomatic endophyte infection did not significantly affect decomposition rate (ANCOVA treatment \times time interaction: $F_{2,49}=2.936$, $p=0.0625$). However, significantly lower sporulation rates were observed for discs with symptomatic endophyte infections (Kruskal-Wallis, $\chi^2=6.1682$, $df=2$, $p=0.0458$) than for uninfected tissue. Additionally, both fungal and bacterial colonizer communities differed by litter treatment and harvest (perMANOVA, $F_{\text{fungal}}=4.2029$ and $p_{\text{fungal}}=0.0002$; $F_{\text{bacterial}}=9.4800$ and $p_{\text{bacterial}}=0.0002$). These results suggest that factors other than symptomatic endophyte presence may mitigate overall decomposition effects, but that endophyte presence alters microbial decomposer communities.

ORAL

TARGETED RESTORATION: HELPING RECOVER CRITICAL HABITAT FOR COHO SALMON. Lance Wyss, The Freshwater Trust, 81 Central Avenue, Ashland, OR

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In 2013, The Freshwater Trust signed an agreement with Bureau of Reclamation to undertake a set of proposed actions in the Rogue Basin to improve critical habitat for coho salmon (*Oncorhynchus kisutch*). Identified “recovery reaches” are required to have projects implemented in the Bear Creek and Little Butte Creek sub-basins, fulfilling obligations such as restored

acreage, weighted useable area, and minimum flow requirements. These details are outlined in National Marine Fisheries Service's Biological Opinion (2012) with target dates for riparian zone restoration by 2017 and instream flow and habitat improvements by 2020. To date, we have eight active restoration projects, and the projects' success has depended in part on the collaboration of voluntary landowners, local sub-contractors, and Bureau of Reclamation. Riparian zone restoration has been fulfilled by noxious weed suppression and native tree and shrub plantings on 18 acres along 1.5 miles in Bear Creek. As part of the instream obligation, improvements to aquatic habitat must be completed through the addition of large wood. During 2015 and 2016, a total of 2.5 miles of the Little Butte and Bear Creek sub-basins have been treated with the placement of 115 engineered large wood structures and an additional revegetation of 6.5 acres with native tree and shrub plantings. We are observing immediate results from large wood additions such as pool scouring and gravel sorting as well as multiple species using this new habitat for cover. With lessons learned from these projects, we continue to build on this work and collaboration through 2020.

ORAL

ZONATION OF EPIPHYTE DWELLING MEIOFAUNA IN A DOUGLAS-FIR FOREST CANOPY. Alexander Young, 116 Homeland Ave Baltimore MD 21212; Jesse E. D. Miller Department of Zoology, University of Wisconsin, Madison, WI 53706; John Villella, Greg Carey, Siskiyou Biosurvey, LLC, 268 Myer Creek Rd., Ashland, OR 97542; William Miller, Department of Biology and Chemistry, Baker University, Baldwin City, KS 66006; alexyoung.116@gmail.com

Branches and trunks of Douglas-fir in the Pacific Northwest can be carpeted with mats of epiphytic vegetation, providing a periodically saturated environment that allows meiofauna (nematodes, rotifers, and tardigrades) to thrive. Although resident meiofauna likely exhibit habitat preferences structured by small-scale environmental factors, few studies report associations between meiofauna and habitat type. We asked if meiofauna abundance and/or tardigrade community composition differ among epiphyte functional groups, canopy position (trunk or branch), height in canopy, and epiphyte patch size. We sampled from the ground to the upper crowns of nine mid-sized Douglas-fir trees in the Six Rivers National Forest. We identified 12 tardigrade species across all epiphyte functional groups. Our results indicate that nematode, rotifer, and tardigrade abundance are significantly greater in bryophyte samples than in alectoria functional group samples. Furthermore, tardigrade species *Macrobiotus hufelandii* associated with bryophytes ($p=0.001$), *Echiniscus quadrispinosus* and *Rammazzottius oberhauseri* associated with alectoria and hypogymnia functional groups ($p=0.025$, $p=0.047$), and *Pilatobius nodulosus* is associated with the top 10 meters of the canopy ($p=0.002$). Microenvironmental factors including epiphyte functional groups and canopy position likely impact the distribution of meiofauna.

**POST-FIRE FOREST REGENERATION IN A CHANGING CLIMATE:
OBSERVATIONAL INSIGHTS FROM THE NORTHERN SIERRA NEVADA AND
SOUTHERN CASCADES. Derek J. N. Young, Chhaya M. Werner, Kevin R. Welch, Truman
P. Young, Hugh D. Safford, Andrew M. Latimer, University of California, Davis, One Shields
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In fire-prone forests, the post-fire regeneration period represents an important opportunity for tree communities to respond to changing environmental conditions, particularly changes in climate. However, little is known about the effects of weather and climate on tree recruitment in the years following wildfire. We examined the effect of post-fire weather conditions on tree recruitment in fire-adapted forests in northern California, USA by surveying regenerating vegetation 4-5 years after 14 wildfires that burned between 2004 to 2012, a period that captured a wide range of post-fire weather conditions. We related the presence and abundance of seedlings at 456 severely burned plots to the average climate at each plot and to annual departures from the average. For tree species to effectively track changes in climate, we would expect that recruitment of a given species at its wet range limit would be stronger when post-fire weather is unusually dry and weaker when it is unusually wet. We generally observed the opposite pattern, suggesting limited capacity for forest community composition to track climate change via post-fire recruitment dynamics. In contrast to tree recruitment patterns, shrub recruitment was greater under dry post-fire conditions. However, post-fire recruitment patterns were generally explained more strongly by long-term topoclimatic variables and adult tree species abundance than by post-fire weather conditions. This observation is consistent with the existence of “biological legacies” that influence forest response to disturbance, and it implies that even when disturbance creates an opportunity, forest community composition may not readily track changes in climate through recruitment.