Living on the Edge of Change:

Exploring the Dimensions of Restoring Fire Resilient Landscapes, Culture, and Economies on the Cascade Range's Eastside

87th Annual Meeting of the Northwest Scientific Association
March 23 - 26, 2016
Central Oregon Community College, Bend, OR

B & B Fire Landscape – 12 years after

Cover photograph by Kyle Dodson

This photo was taken north of Oregon Highway 20 (east of Santiam Pass) in May of 2015, in the vicinity of Square Lake, near the origin of the B&B Fire that burned August 19–September 26, 2003. The B&B Fire burned in 2003, so it's nearly 12 years after the fire. Major mountains on the skyline (from right to left) are Mount Washington, North Sister, Middle Sister, and then Broken Top in the background left. The lower mountain in the left foreground (also burned) is Cache Mountain. Note the well-developed understory of snowbrush ceanothus (*Ceanothus velutinus*), and the brown litter from the previous year's bracken fern (*Pteridium aquilinum*), that were just starting to sprout new fronds. The height of the ponderosa pine regeneration is beginning to get above the ceanothus. Look closely to see multiple stems in the background clump of ponderosa pine regeneration, which was very common in this stand. The snag casting the shadow provides not only wildlife habitat but ameliorates soil temperature and moisture conditions for post-fire conifer regeneration. Note the sentinel Douglas-fir (*Pseudotsuga menziesii*) snag in the background (center left). See what other things you can notice in this picture!

We thank Kyle for his generous donation of the cover image and for providing interpretation of the photo.

Program and Abstracts
Northwest Scientific Association
87th Annual Meeting

Central Oregon Community College, Bend, OR
March 23 - 26, 2016

Held in Cooperation with

Central Oregon Community College
Oregon State University-Cascades
Central Oregon Fire Management Services
Northwest Lichenologists
U.S. Forest Service
Bureau of Land Management

Thank You to all who helped!

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

NWSA Local Planning Committee

Gregg Riegel, Program Chair, USDA Forest Service, Deschutes National Forest
Dan Gavin, Department of Geography, University of Oregon
Robin Lesher, USDA Forest Service (retired); Burke Museum - Univ. of Washington

Symposia Organizers

COFSS
- Geoff Babb
- Janean Creighton
- Catia Juliana
- Carrie Fisher

Arts/Humanities/Ecology
- Fred Swanson

COCC and OSU-Cascades

- Michael Fisher
- Ron Reuter
- Sarah Fuller
- Lisa Bacon
- Eric Weller
- Ron Boldenow
- Rebecca Franklin
- Natural Resources Club

Cascade Culinary Institute and Elevation Restaurant

- Chef Julian Darwin
- Sam La Duca
- Scott Lewis
- Deena Cook
- Culinary Students

University of Oregon

- Material Science Institute

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 2015-2016 Board of Directors

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WELCOME FROM THE PRESIDENT OF THE ASSOCIATION

It is my pleasure to welcome you to the **87th Annual Meeting of the Northwest Scientific Association (NWSA)**, held in conjunction with the **Central Oregon Fire Science Symposium (COFSS)**, and **Northwest Lichenologists**. We are very pleased to be running our meeting jointly with COFSS, as the natural sciences, restoration, and management in the ecosystems of the Northwest form a broad common ground for both of our groups. This is reflected in the theme for this year's meeting: "*Living on the Edge of Change: Exploring the Dimensions of Restoring Fire Resilient Landscapes, Culture, and Economies on the Cascade Range's Eastside."*

Organizing a meeting such as this takes many contributors and volunteers to make it happen. Our host for this meeting, and local organizing committee Chair, is Gregg Riegel (USDA Forest Service-Bend), and we thank him for bringing us to this beautiful region of the Pacific Northwest. Working with Gregg, board members Robin Lesher and Dan Gavin organized the scientific program and social events. We are very grateful to our sponsors, Central Oregon Community College and Oregon State University Cascades, for providing space and help with organization of the meeting.

Thursday morning begins with the joint plenary session addressing our meeting's theme on forests, people, and fire in the eastern Cascades, and the restoration of dry-forest landscapes in the Northwest. Following lunch, NWSA and COFSS split into separate sessions. NWSA's symposium *Convergence of Arts, Humanities, & Ecology in Inspiring Northwest Landscapes* will showcase the works of artists, poets, and scientists in a series of short talks organized by longtime NWSA member Fred Swanson. NWSA and COFSS rejoin for a poster session. As an association we continue to be all encompassing when it comes to science in the Northwest, and nothing demonstrates this quite as well as the diversity of research interests on display at our poster session. During the poster session there will be a reading and signing of the newly released book *Forest Under Story* edited by organizers of the preceding symposium. The opening day concludes with the Evening Banquet from 6:30-9:30 pm, featuring Professor Gordon Grant's timely talk on "Wetting our appetites; the changing landscape of water in the West."

Friday we are back at it in Cascades Hall with four concurrent sessions in the morning and two in the afternoon. COFSS sessions continue in parallel in Wille Hall all day. Don't forget to attend the NWSA Business Lunch at noon… open to all current members of the Association.

The schedule on Saturday features field trips to some of the incredible diversity of the high desert and eastern Cascades of Central Oregon. Our highly recommended field trips this year will examine forest restoration in mixed-conifer forests, visit the incomparable regional volcanic history (from cinder cones to super volcanoes), discuss rangeland restoration issues in the Crooked River Grasslands and sample lichens in juniper woodlands on volcanic landscapes.

Finally, if you are new to the yearly Northwest Scientific Association meetings, and not yet a member, I enthusiastically encourage you to join us in the Association. Through annual conferences such as this, our peer-reviewed journal *Northwest Science* (ISI-indexed and in print for almost 90 years!), website, student grants and awards, and Facebook pages we seek to inclusively bring together scientists in the Northwest to share their research interests and disciplines. Instructions for joining the Association are available on our website at: *http://www.northwestscience.org*.

I hope you enjoy your experience at this meeting. Our annual meetings are always a fantastic chance to see what's new in Northwest scientific research, and a wonderful opportunity to reconnect with old friends and colleagues, and to make new acquaintances and network with fellow researchers in your discipline. Thank you for attending our Bend 2016 meeting. We look forward to seeing you at future meetings as well.

Bax R. Barton, President (2015-2016)

NWSA 87th Annual Meeting - Program Overview

Wednesday March 23, 2016

2:00 pm - 5:00 pm	NWSA Spring Board Meeting (COCC campus: Cascades Hall Rm 112)
6:00 pm - 9:30 pm	Evening Social: complimentary appetizers & no-host bar at McMenamins Rambler Ambassador Rm, Old St. Francis School, 700 NW Bond St.

Thursday March 24, 2016

8:00 am - 11:40 am	Welcome & Joint Plenary Session with COFSS (Wille Hall, Campus Center - COCC)
1:00 pm - 4:20 pm	Concurrent Symposia: NWSA (Cascades Hall Rm 117/118), COFSS (Wille Hall)
1:00 pm - 4:00 pm	Fire Symposium (COFSS)
1:20 pm - 4:20 pm	Convergence of Arts, Humanities, & Ecology in the Inspiring NW Landscapes
4:30 pm - 6:30 pm	NWSA - COFSS Joint Poster Session with appetizers & no-host bar (Cascades Hall)
5:00 pm - 6:00 pm	"*Forest Under Story*" Book Reading (Cascades Hall Rm 103)
6:30 pm - 9:30 pm	Evening Banquet with guest speaker, Gordon Grant (USFS PNW Station) "*Wetting our Appetites: the Changing Landscape of Water in the West*" (Off campus: Cascade Culinary Institute's Elevation Restaurant)

Friday March 25, 2016

8:00 am - noon	Concurrent, Contributed Oral Sessions (NWSA-Cascades Hall); Invited Speakers (COFSS – Wille Hall)
Noon - 1:40 pm	NWSA Business Lunch and Annual Meeting of the Corporation (Cascades Hall) Free to NWSA members & those interested in engaging with NWSA
1:40 am - 5:00 pm	Concurrent, Contributed Oral Sessions (NWSA); Invited Speakers (COFSS)
1:40 pm - 5:00 pm	Workshop: Lichens on the East-Side - *Rare, Threatened, Endangered, New Finds, & Interesting Species* (Science Hall Rm 120)

Saturday March 26, 2016 - Field Trips: Meet at Cascades Hall (meeting times below)

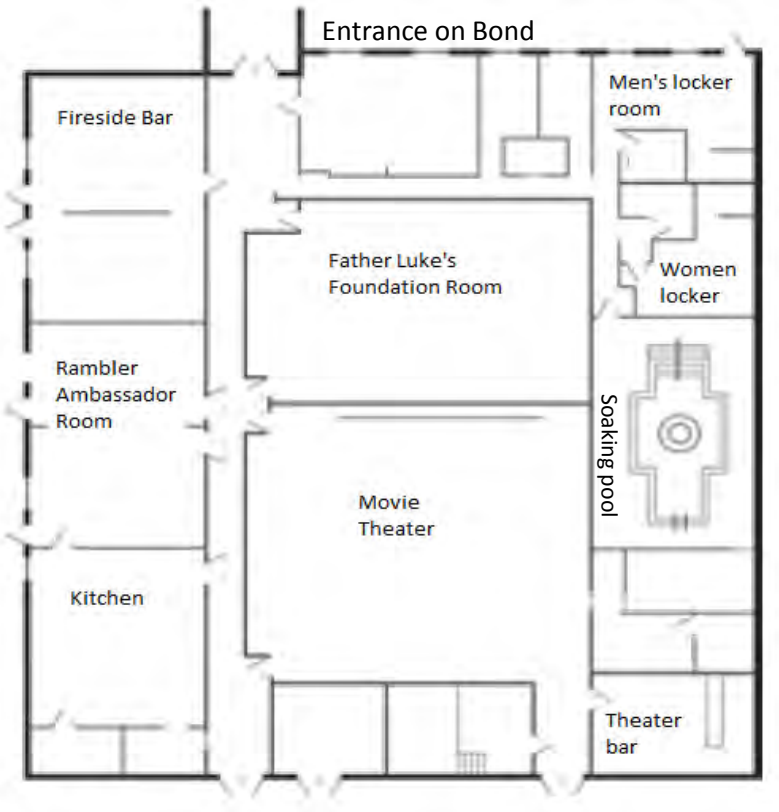
8:00 am	Lichens of Juniper Woodlands on a Volcanic Landscape
8:30 am	Rangeland Restoration on the Crooked River National Grassland
9:00 am	Cinder Cones to Super Volcanoes: The Diverse Volcanic History of Central Oregon
9:00 am	Bridging Science & Collaborative Forest Restoration in the Mixed-Conifer Forests of Central Oregon

NWSA Evening Social, Wednesday, March 23, 2016, 6:00 – 9:30 pm

Location: McMenamins Old St. Francis School, downtown Bend

Rambler Ambassador Room, 700 NW Bond Street

Map of McMenamins Old St. Francis School facility:



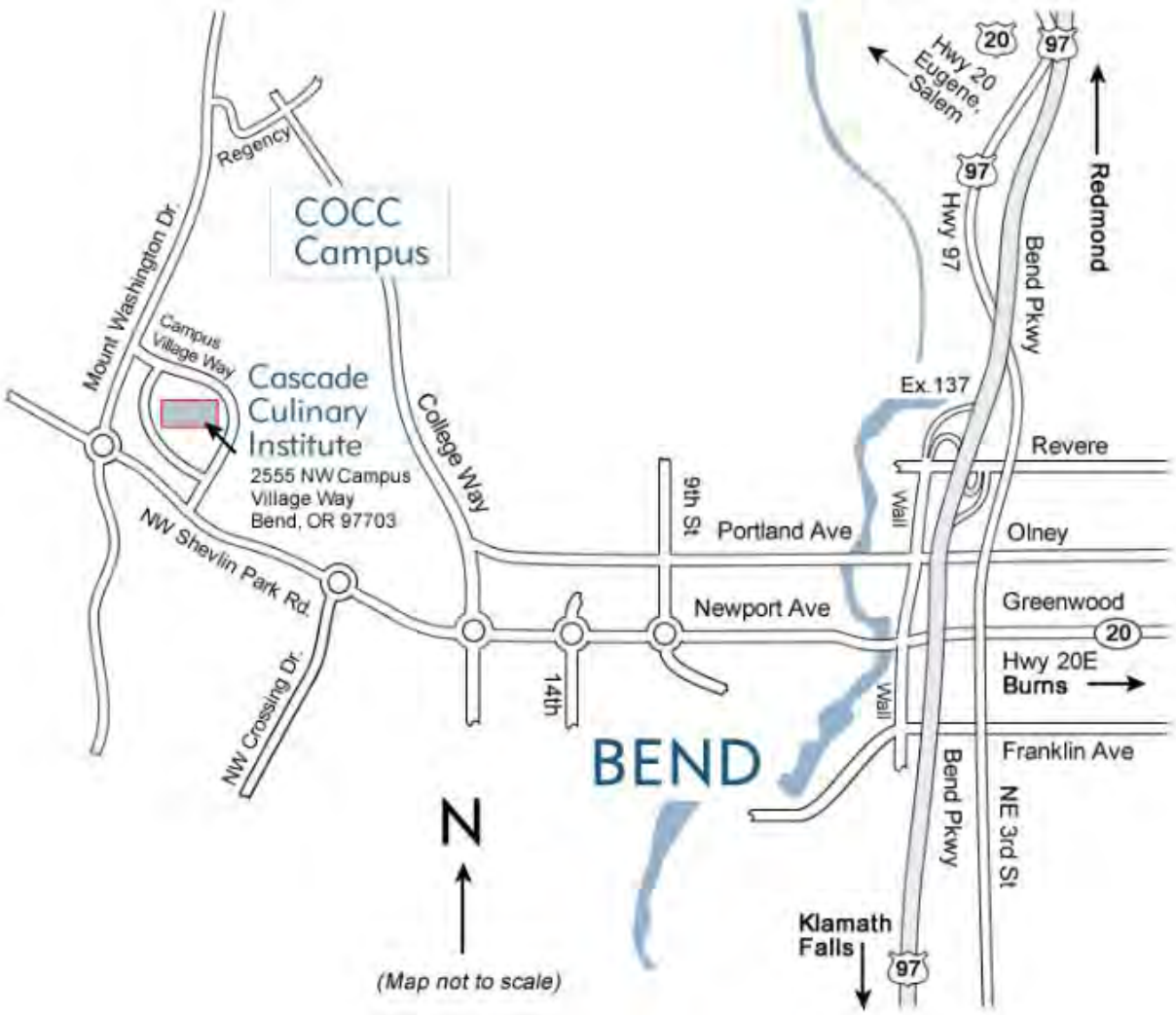
Patio area

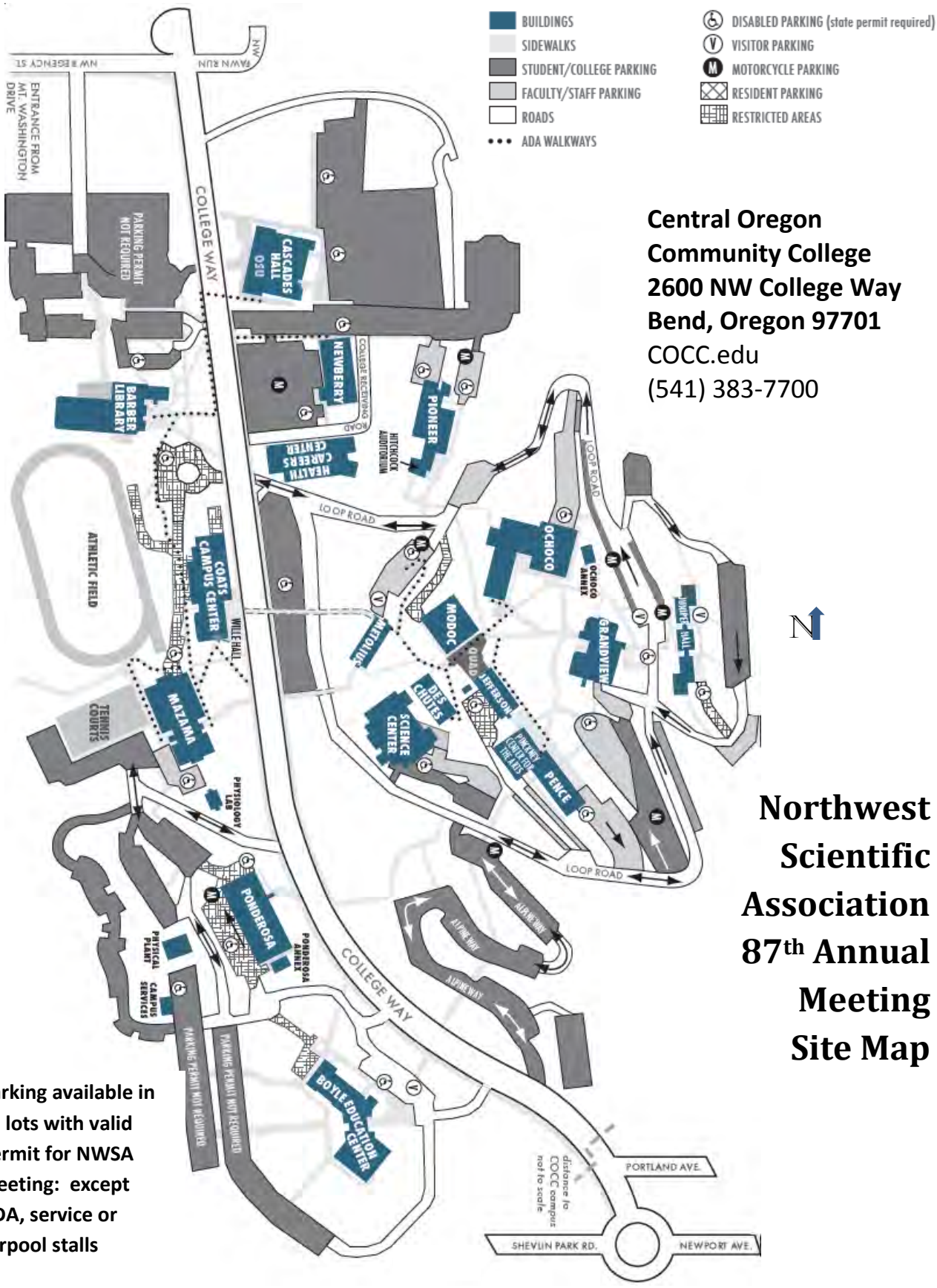
⬅ Brewery and Pub next door

Central Oregon Community College Campus and Elevation Restaurant at the Cascade Culinary Institute

Restaurant opens at 6:30 for Social Hour and Dinner Served at 7:30

NWSA Banquet will be held at the Elevation Restaurant – a student operated restaurant at the Cascade Culinary Institute, located southwest of COCC's Bend-campus on Campus Village Way near NW Shevlin Park Road and Mount Washington Drive roundabout. Shuttle vans are available to transport banquet attendees roundtrip from Cascades Hall (COCC) to the Elevation Restaurant.

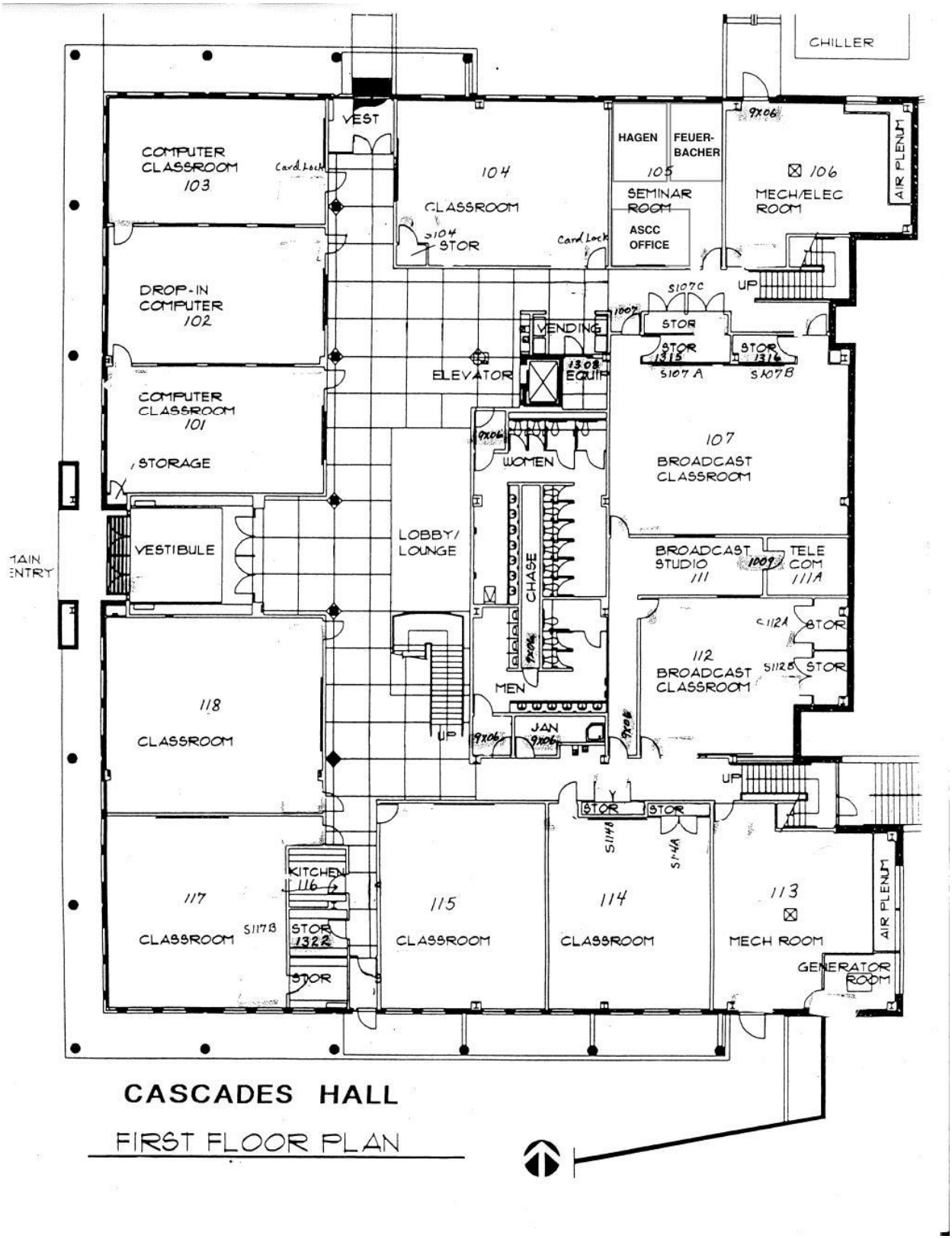




Central Oregon Community College
2600 NW College Way
Bend, Oregon 97701
COCC.edu
(541) 383-7700

Northwest Scientific Association 87th Annual Meeting Site Map

Parking available in all lots with valid permit for NWSA meeting: except ADA, service or carpool stalls



Floor plan showing location of 1st floor meeting rooms for NWSA sessions.

Rooms 246-247-248 located on 2nd floor above Rooms 117-118.

Thursday March 26

Time	Wille Hall Lobby	Wille Hall - Campus Center	Cascades Hall Rm 103	Cascades Hall Rm 117/118	Cascades Hall Rm 114/115	Cascades Hall Lobby
7:30	Registration (7:30-12:00)					
8:00-8:15		Opening Remarks				
8:15-9:35		Joint **PLENARY** Session COFSS & NWSA				
9:30-10:00		**BREAK**				
10:15-11:40		Joint **PLENARY** Session COFSS & NWSA (cont.)				
12:00-1:20		**LUNCH**				
1:20-4:20		COFSS Symposium (1:00 - 4:00)		NWSA Symposium: Convergence of Arts, Humanites & Ecology in Inspiring NW Landscapes (*break 2:40-3:00*)	Poster Session setup	Registration (1:00 - 3:00)
4:30-6:30			"Forest Under Story" Book Reading 5:00-6:00		Joint Poster Session NWSA & COFSS	Poster Session Reception Refreshments, No-Host Bar
6:30 - 9:30		Social Hour and Banquet at Elevation Restaurant - Cascade Culinary Center Banquet Speaker: Dr. Gordon Grant, Research Hydrologist (USFS PNW Research Station) "Wetting our Appetites: the Changing Landscape of Water in the West"				

Friday March 25

	Technical Sessions	Cascades Hall Lobby	Cascades Hall Rm 107	Cascades Hall Rm 114/115	Cascades Hall Rm 117/118	Cascades Hall Rm 246/247/248	Science Hall - Fuller Lab Rm 120	Wille Hall - Campus Center
	Time							
	8:00-8:20	Registration (8:00 - ?)						
1	8:20-8:40		Lichen and Bryophyte Ecology	Plant, Soil and Climate Interactions	Ecology and Restoration of Wetland and Riparian Systems	Management and Restoration in Fire Adapted Ecosystems		
2	8:40-9:00							
3	9:00-9:20							
4	9:20-9:40							
5	9:40-10:00							COFSS Symposium
	10:00-10:20		**BREAK**	**BREAK**	**BREAK**	**BREAK**		
6	**10:20-10:40**		Lichen and Bryophyte Ecology	Biogeoscience and Paleontology	Ecology and Restoration of Wetland and Riparian Systems	Management and Restoration in Fire Adapted Ecosystems		
7	10:40-11:00							
8	11:00-11:20							
9	11:20-11:40							
10	11:40-12:00							
	12:00-1:40		**LUNCH**	**NWSA Business Lunch**				**LUNCH**
11	1:40-2:00				Wildlife Ecology	Historical and Pre-Historical Ecosystem Baselines	Workshop: Lichens on the East Side - Rare, Threatened, Endangered, New Finds and Interesting Species	COFSS Symposium
12	2:00-2:20							
13	2:20-2:40							
14	2:40-3:00							
	3:00-3:20				**BREAK**			
15	3:20-3:40				Wildlife Ecology	Historical and Pre-Historical Ecosystem Baselines		
16	3:40-4:00							
17	4:00-4:20							
18	4:20-4:40							
19	4:40-5:00							

Thursday morning, March 24

Joint Plenary Session
NWSA and Central Oregon Fire Science Symposium

Wille Hall – Campus Center

8:00 Geoff Babb/Gregg Riegel Opening Remarks

Forests, People, Fire: Interactions, Dynamics and Adaptation in Fire-prone Landscapes of the eastern Cascades of Oregon

8:15 Tom Spies *Forests: Exploring alternative futures for fire-prone forest landscapes, eastern Cascades*

8:40 Eric White *People: Human systems in complex fire-prone landscapes*

9:05 Ana Barros *Fire: Fire occurrence under climate change in central Oregon*

9:30 Break

Restoration of Dry-forest Landscapes in the Pacific Northwest

10:00 Paul Hessburg *Restoring fire-prone Inland Pacific landscapes: Seven core principles*

10:25 Ryan Haugo *Applying the principles of landscape restoration within the east Cascades*

10:50 Andrew Merschel *Historical fire regimes across dry to moist forest ecotones in central Oregon, and the role of landscape context*

11:15 Paul Anderson *Tree vigor responses to restoration thinning and fuels reduction at Lookout Mountain*

11:40 LUNCH

Thursday afternoon, March 24

Central Oregon Fire Science Symposium (continued)

Wille Hall – Campus Center

Beyond the Sagebrush Rebellion: Contemporary Issues Impacting the Sage Steppe of Oregon

1:00 **Lisa Ellsworth** *Fire in the sagebrush steppe: 21st century challenges, successes and opportunities*

1:25 **Christian Hagen** *Sage grouse in a post-wildfire landscape: The high price of site fidelity*

1:50 **BREAK**

2:20 **Roger Rosentreter** *Forbs: sage grouse food or just another pretty weed?*

2:45 **Jesse Abrams** *When two worlds collide: Rangeland fire protection associations, federal agencies, and the politics of resilience*

3:10 **Rick Miller** *Fire and Climate: Past, present and future*

Convergence of Arts, Humanities, and Ecology in Inspiring Northwest Landscapes

A Series of Short Talks by Writers, Artists, and Scientists

Northwest Scientific Association Meeting – Bend, Oregon
Cascades Hall (Rm 117/118), Central Oregon Community College
1:20 to 4:20 – Thursday – March 24, 2016

Leah Wilson, "Beetle Drawing I"

Jay Noller "Split Rock"

Speakers will include poet Charles Goodrich; writers and river guides Becca Lawton and Dick Linford; artist and Executive Director of Playa Deborah Ford; and forest and soil scientists with arts/humanities connections Sarah Greene, Mark Harmon, Jay Noller, and Fred Swanson.

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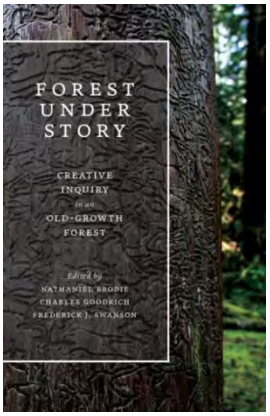
Forest Under Story: Creative Inquiry in an Old-Growth Forest

New Book Reading – March 24, 5-6 pm Cascades Hall

Reflections and readings from *Forest Under Story* (UW Press), a collection of works by writers in residence at the H.J. Andrews Experimental Forest.

"To learn one place in the world may be the beginning of learning our place in the world. Like the old-growth forest where they were written, these wonderfully thoughtful descriptions, essays, poems, and meditations offer rich and vigorous variety, exquisite detail, and broad vistas of time and possibility." Ursula Le Guin



Thursday afternoon, March 24

Cascades Hall

NWSA Symposium

Convergence of Arts, Humanities, & Ecology in Inspiring Northwest Landscapes

Cascades Hall Rm 117/118

Moderator: Frederick J. Swanson

1:20 **Frederick J. Swanson** *Confluence of Arts, Humanities, and Ecology at Sites of Long-Term Ecological Inquiry*

1:40 **Charles Goodrich** *Confluence of arts, humanities, and ecology at H.J. Andrews Experimental Forest*

2:00 **Sarah Greene** *The intersection of art and ecology at the Sitka Center: an uncontrolled experiment*

2:20 **Deborah Ford** *Confluence and collaboration: Art and science at Playa (A Residency Program in the Oregon Outback)*

2:40 **BREAK**

3:00 **Rebecca Lawton** *Story as a way in: Response to change in climate and water.*

3:20 **Dick Linford** *America's rivers as creative stimuli*

3:40 **Mark E. Harmon** *Art inspired by the science of rot: The afterlife of trees*

4:00 **Jay Stratton Noller** *Emergence of art as a research method in a science lab*

4:30 – 6:30 **NWSA - COFSS Joint Poster Session with appetizers & no-host bar**

5:00 – 6:00 **"*Forest Under Story*" Book Reading** (Cascades Hall Rm 103)

6:30 – 9:30 **Evening Banquet** with guest speaker, **Gordon Grant** (USFS PNW Station)

"*Wetting our Appetites: the Changing Landscape of Water in the West*"

Cascade Culinary Institute's Elevation Restaurant

Thursday afternoon, March 24

NWSA and COFSS Joint Poster Session - Cascades Hall

(1st author shown only – see Abstract Section for complete abstract)

Jarrett Cellini	CLIMATE EFFECTS ON THE RELATIONSHIP BETWEEN INVASIVE ANNUAL GRASSES AND BIOLOGICAL SOIL CRUST IN EASTERN WASHINGTON
Joseph Di Meglio	*Aspicilia reptans*: MORPHOLOGICAL TRAITS SUPPORTING PHYLOGENETIC DATA
Jessica L. Dodd	TEPHRA CHRONOLOGY OF THE TONNEMAKER - FRENCHMAN HILLS MAMMOTH SITE: SHEDDING LIGHT ON ITS GEOLOGIC HISTORY
Robin Lee Gyorgyfalvy	INTERPRETING ECOLOGY BY COMMUNICATING A CONSERVATION LAND ETHIC THROUGH STORYTELLING, CULTURE, AND ART
Alex Heimerdinger	*Thamnophis* HEAD MORPHOLOGY: SIZE AND CONSTRAINTS AS A RESULT OF DIET
Elizabeth Johnson	UNDERSTORY RESPONSE TO TREATMENTS OF VARIOUS FIRE RETURN INTERVALS AND SEASONALITY IN AN OLD-GROWTH PONDEROSA PINE FOREST IN CENTRAL OREGON
Rick G. Kelsey	BRINE SHRIMP (*Artemia salina*) CYTOXICITY SCREENING OF PACIFIC NORTHWEST FOREST PLANTS
Rick G. Kelsey	ETHANOL'S KEY ROLE IN PRIMARY ATTRACTION OF *Dendroctonus valens* TO PONDEROSA PINE STEMS HEAT STRESSED BY FIRE
Kyle Krueger	SPECIES-SPECIFIC LITTERFALL INPUTS OF MERCURY TO A 2ND ORDER STREAM IN A SECOND-GROWTH TEMPERATE RAINFOREST
Neil Mara	PHOTOGRAMMETRY, CT SCANS, DIGITAL FILE MANIPULATIONS, AND 3D PRINTED REPLICAS OF SUB-FOSSIL BONES FROM SOUTH CENTRAL WASHINGTON
Ricardo Miranda-Gonzalez	CATERPILLARS AS INTERIOR DESIGNERS? USING LICHENS AS BUILDING MATERIALS FOR MOBILE HOUSES
Melissa R.A. Pingree	WILDFIRE AND WILDFIRE-DEPOSITED CHARCOAL IN RAIN-SHADOW FOREST SOILS OF THE OLYMPIC PENINSULA
Ryan W. Reihart	WHITE STURGEON (*Acipenser transmontanus*) LARVAE FEEDING ECOLOGY AND PREY AVAILABILITY IN THE UPPER COLUMBIA RIVER, USA
Chris Ringo	AVAILABLE SOIL RESOURCE INFORMATION ON FOREST LANDS IN THE PACIFIC NORTHWEST REGION - RETRIEVAL OF LEGACY FOREST SERVICE SOIL RESOURCE INVENTORY DATA

Tiffany D. Salveson	SOIL TEXTURAL ANALYSIS USING THE HYDROMETER METHOD VS. ONLINE SOIL SURVEY DATABASE FOR RESEARCH AND MANAGEMENT PURPOSES
Teresa M. Vail	HIGH-TECH TREE HUGGERS: WHAT THE ELECTRONIC DENDROMETERS' EMBRACES HAVE REVEALED ABOUT TREE GROWTH
Abby J. Watt	SMALL DIFFERENCES IN ELEVATION MAKE A BIG DIFFERENCE FOR PHYSIOLOGICAL RESPONSES OF UNDERSTORY PLANTS TO DROUGHT CONDITIONS
Douglas J. Westlind	MODELS WITH PRESENCE/ABSENCE OF RED TURPENTINE BEETLE AND WESTERN PINE BEETLE IMPROVE PREDICTIONS OF PONDEROSA PINE POST- FIRE MORTALITY IN THE PACIFIC NORTHWEST
Douglas J. Westlind	REPEATED SPRING AND FALL PRESCRIBED BURNING MAY NOT ACHIEVE DESIRED FUEL STRUCTURES FOR PONDEROSA PINE FORESTS IN THE BLUE MOUNTAINS OF OREGON
Jenae Yri	DETERMINING THE EFFECTS OF BROOK STICKLEBACK (*Culaea inconstans*) PRESENCE ON THE TURNBULL NATIONAL WILDLIFE REFUGE, CHENEY, WASHINGTON

Central Oregon Fire Sciences Symposium (COFSS) Posters

Kevin Credo	TRAJECTORIES OF FIRE HAZARD AND PACIFIC MARTEN HABITAT FOLLOWING FUEL TREATMENT IN LASSEN NATIONAL FOREST
Benjamin Hart	FUEL TREATMENTS OF PONDEROSA PINE (*Pinus ponderosa*) IN THE BLUE MOUNTAINS OF EASTERN OREGON: A MYCORRHIZAL PERSPECTIVE
Tim Ingalsbee	A 'LEOPOLDIAN' FIRE ETHIC TO INSPIRE ECOLOGICAL FIRE MANAGEMENT
Kayla Johnston	HISTORICAL PATTERNS OF STAND DEVELOPMENT IN PONDEROSA FORESTS DURING NATURAL FIRE REGIMES
Kat Morici	FUEL TREATMENT LONGEVITY IN THE BLUE MOUNTAINS OF OREGON
Dana Skelly	INNOVATIONS AND LESSONS LEARNED IN POST FIRE FUELS TREATMENT EFFECTIVENESS ASSESSMENTS, MALHEUR NATIONAL FOREST, CANYON CREEK COMPLEX
Amanda Stamper	OREGON'S PRESCRIBED FIRE COUNCIL: WORKING IN THE FUTURE WITH PRESCRIBED BURNING AND MANAGED WILDFIRE

CENTRAL OREGON community college

CASCADE CULINARY INSTITUTE

Elevation

Northwest Scientific Association 2016 Banquet

First Course

Iceberg Wedge Salad
Rogue Creamery blue | sundried tomatoes
candied apple wood smoked bacon

Second Course

Alder Wood Planked King Salmon
fresh asparagus | roasted fingerling potatoes

Wild Mushroom Risotto
fresh asparagus | roasted fingerling potatoes

Pan Seared Filet Mignon
fresh asparagus | roasted fingerling potatoes

Third Course

Salted Caramel Brownie
caramel ice cream | candied almonds
*coffee and tea are included

Beverages

No-Host Bar

WHITE WINE
Willamette Valley Vineyard Chardonnay 8 ▪ King Estate Pinot Gris 7 ▪
RED WINE
Adelsheim Pinot Noir 8 ▪ Foris Cabernet Sauvignon 8
DRAFT BEER
Good Life *Sweet As PA* 5 ▪ Good Life *Descender IPA* 5
NON- ALCOHOLIC BEVERAGES
Pepsi, Diet Pepsi, Sierra Mist 3

NWSA Banquet, Thursday Evening at the Cascade Culinary Institute's Elevation Restaurant

Featuring Northwest Grown Cuisine!

"Wetting our Appetites: the Changing Landscape of Water in the West"

Presented by Dr. Gordon Grant

The noted sage Yogi Berra once said "*It's hard to make predictions, especially about the future*".

Predicting the future of water in the West falls under this adage, but seems worth a try, given current cycles of drought and flood, scarcity and over-abundance. Drawing on a career of playing with and studying rivers, formerly as a whitewater guide and now as a research hydrologist with the USDA Forest Service, Gordon Grant will explore the causes, consequences, and possible novel solutions for where water is headed in the future, focusing primarily on the Pacific Northwest.

Gordon Grant is a Research Hydrologist with the USDA Forest Service at the Pacific Northwest Research Station in Corvallis, Oregon, and also Courtesy Professor in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. Following a decade-long career as a whitewater river guide on western rivers, he received his Ph.D. from Johns Hopkins University in 1986. His research has focused on the geomorphic response of rivers to changes in stream flow and sediment transport due to land use, dams and dam removal, volcanic eruptions, and climate change. This work has included extended collaborations with research groups in Japan, China, and Italy. He is a former Deputy and Associate Editor for the journal Water Resources Research, and a Fellow of the Geological Society of America. He also chairs the National Steering Committee for the US National Science Foundation-sponsored Critical Zone Observatories.

Friday, March 25, morning

	Cascades Hall Rm 107	Cascades Hall Rm 114/115	Cascades Hall Rm 117/118	Cascades Hall Rm 246/247/248
Time	**Lichen and Bryophyte Ecology**	**Plant, Soil and Climate Interactions**	**Ecology and Restoration of Wetland and Riparian Systems**	**Management and Restoration in Fire Adapted Ecosystems**
8:20-8:40	**Abby Glauser** *Retooling Lichenland: Outreach and Education in the Field of Lichenology*	**Roger Long** *Stable Isotopes and Determination of Nitrogen Availability in Sagebrush Steppe*		**Ryan McCarley** *Improving Landsat Estimation of Lidar Derived Changes in Canopy Cover Using Pre-Fire Beetle Outbreak and Timber Harvest on the Pole Creek Fire, Oregon*
8:40-9:00	**Daphne Stone** *Observations on Rarity and Identification of Some Soil Crust Lichens*	**Morgan Kauth** *Predicators of Soil Organic Matter in the Artemisia tridentata/Festuca idahoensis Habitat Type, Southwestern Montana*	**Emily Wolfe** *Fungal Endophyte-Infected Acer macrophyllum Leaf Litter Negatively Influences Aquatic Fungal Sporulation*	**Allison Rossmann** *Understory Responses to Dry Forest Restoration Differ in the Short and Long Term*
9:00-9:20	**Amanda Hardman** *Calicioid Lichens and Fungi from Gifford Pinchot and Okanogan National Forests: New Records and a Summary of Findings*	**Greg Retallack** *Effects of Soils on Taste of Pinot Noir Wines from the Willamette Valley, Oregon*	**Carri Leroy** *Stream Community Assembly Following the Catastrophic Eruption of Mount St. Helens, Washington*	**Anna Clark** *The Impact of Residential Development Pattern on Wildland Fire Suppression Expenditures*
9:20-9:40	**David Kofranek** *Rare Moss and Lichen Surveys of BLM Vale District, North Umatilla Co., OR*	**Chris Ringo** *An Approach to Modeling Soil Moisture Drought Potential at Regional Scales in the Pacific Northwest*	**Matt Goslin** *Modeling Species Distribution of an Ecosystem Engineer, Carex nudata, A Disturbance-Adapted Riparian Sedge*	**Benjamin Hart** *Fuels Treatments of Ponderosa Pine in the Blue Mountains of Eastern Oregon: A Mycorrhizal Perspective*
9:40-10:00	**Elisa Di Meglio** *Stereocaulon of Three Alaskan National Parks — Katmai, Lake Clark and Kenai Fjords*	**Constance Harrington** *Phenology of Pacific Northwest Tree Species*	**Joe Rocchio** *Peatland Types of Washington: Their Classification and Conservation Values*	**Becky Kerns** *Burn Season and Interval Effects on Understory Vegetation in an Eastern Oregon Ponderosa Pine Forest*
10:00-10:20	**BREAK**	**BREAK**	**BREAK**	**BREAK**

Friday, March 25, morning (continued)

	Cascades Hall Rm 107	Cascades Hall Rm 114/115	Cascades Hall Rm 117/118	Cascades Hall Rm 246/247/248
Time	**Lichen and Bryophyte Ecology** (continued)	**Biogeoscience and Paleontology**	**Ecology and Restoration of Wetland and Riparian Systems** (continued)	**Management and Restoration in Fire Adapted Ecosystems** (continued)
10:20-10:40	**Bruce McCune** *Nitrophilous Lichens Vary in Frequency along a Precipitation Gradient in Alaska*	**Geoffrey Johnson** *Environmental History of Dissolved Oxygen, Coos Bay Estuary, Oregon Coast Range*	**Maret Pajutee** *The Tale of Two Rivers – Saving the "Wild" in Wild and Scenic*	**Craig Bienz** *Improving Ecosystem Resiliency to Drought with Prescribed Fire*
10:40-11:00	**Robert Smith** *Twenty-Five Years of Climate Indication in Lichen Communities from Alaska to California*	**Ken Tabbutt** *Morphology and Spatial Character of the Mima Mounds, Thurston County, Washington*	**Rick Dewey** *Inventory and Characterization of Montane Fens on USFS Lands in Oregon and Washington*	**Steve Acker** *Biomass Dynamics and Tree Regeneration Following Wildfire in a Mountain Hemlock (Tsuga mertensiana) Forest*
11:00-11:20	**Lea Condon** *Morphometric Functional Trait Abundance of Biological Soil Crusts in Response to Fire Across the Northern Great Basin*	**Patrick Pringle** *From Native American Oral Histories to Studying Past Geologic Events and Climate History—Use of Tree-Ring-Data, Research, and Curriculum Modules in Undergraduate Science Labs and Research Projects*	**Michael Cummings** *Rain Versus Snow-Dominated Winter Precipitation and Recharge of the Perched Pumice Aquifer, Walker Rim Study Area, Fremont-Winema NF, Oregon*	**David Peter** *Heat Tolerance of Prairie Associated Native and Exotic Dormant Seeds from Western Washington*
11:20-11:40	**John Villella** *A Test of Survey Methods for an Old-Growth Tree Canopy Lichen*	**Natalie Hollis** *Tracking Late Devonian Reactivation of the Tooele Arch with Detrital Zircon Provenance, Great Basin*	**Peter Sussmann** *Restoring a Slough Floodplain of the Deschutes River*	**Justin Bastow** *Impacts of the Watermelon Hill Fire on Soil Carbon Dynamics and Food Webs a Year After the Fire*
11:40-12:00	**Diane Haughland** *East Meets West in Alberta's Grassland Lichen Communities*	**Jonathan Calede** *Mammalian Biodiversity in the Northern Rocky Mountains during the Arikareean: Five Million Years of Faunal Change Through the Cabbage Patch Beds*	**Christina Veverka** *Big Marsh Restoration: An Ongoing Success Story*	**Lalita Calabria** *Prescribed Fire Decreases Lichen and Bryophyte Biomass and Functional Group Diversity in Pacific Northwest Prairies*
12:00-1:40	NWSA Business Lunch			

Friday morning, March 25

Technical Session – Contributed Papers

Cascades Hall Rm 107

Lichen and Bryophyte Ecology

Moderator: Bruce McCune

8:20 **Abby Glauser** *Retooling Lichenland: Outreach and Education in the Field of Lichenology*

8:40 **Daphne Stone** *Observations on Rarity and Identification of Some Soil Crust Lichens*

9:00 **Amanda Hardman** *Calicioid Lichens and Fungi from Gifford Pinchot and Okanogan National Forests: New Records and a Summary of Findings*

9:20 **David Kofranek** *Rare Moss and Lichen Surveys of BLM Vale District, North Umatilla Co., OR*

9:40 **Elisa Di Meglio** *Stereocaulon of Three Alaskan National Parks — Katmai, Lake Clark and Kenai Fjords*

10:00 **BREAK**

10:20 **Bruce McCune** *Nitrophilous Lichens Vary in Frequency along a Precipitation Gradient in Alaska*

10:40 **Robert Smith** *Twenty-Five Years of Climate Indication in Lichen Communities from Alaska to California*

11:00 **Lea Condon** *Morphometric Functional Trait Abundance of Biological Soil Crusts in Response to Fire Across the Northern Great Basin*

11:20 **John Villella** *A Test of Survey Methods for an Old-Growth Tree Canopy Lichen*

11:40 **Diane Haughland** *East Meets West in Alberta's Grassland Lichen Communities*

12:00 – 1:40 **NWSA Business Lunch (**or Lunch on your own**)**

Friday morning, March 25

Technical Sessions – Contributed Papers

Cascades Hall Rm 114/115

Plant, Soil and Climate Interactions

Moderator: Connie Harrington

8:20 **Roger Long** *Stable Isotopes and Determination of Nitrogen Availability in Sagebrush Steppe*

8:40 **Morgan Kauth** *Predicators of Soil Organic Matter in the Artemisia tridentata/Festuca idahoensis Habitat Type, Southwestern Montana*

9:00 **Greg Retallack** *Effects of Soils on Taste of Pinot Noir Wines from the Willamette Valley, Oregon*

9:20 **Chris Ringo** *An Approach to Modeling Soil Moisture Drought Potential at Regional Scales in the Pacific Northwest*

9:40 **Constance Harrington** *Phenology of Pacific Northwest Tree Species*

10:00 **BREAK**

Biogeoscience and Paleontology

Moderator: Daniele McKay

10:20 **Geoffrey Johnson** *Environmental History of Dissolved Oxygen, Coos Bay Estuary, Oregon Coast Range*

10:40 **Ken Tabbutt** *Morphology and Spatial Character of the Mima Mounds, Thurston County, Washington*

11:00 **Patrick Pringle** *From Native American Oral Histories to Studying Past Geologic Events and Climate History—Use of Tree-Ring-Data, Research, and Curriculum Modules in Undergraduate Science Labs and Research Projects*

11:20 **Natalie Hollis** *Tracking Late Devonian Reactivation of the Tooele Arch with Detrital Zircon Provenance, Great Basin*

11:40 **Jonathan Calede** *Mammalian Biodiversity in the Northern Rocky Mountains during the Arikareean: Five Million Years of Faunal Change Through the Cabbage Patch Beds*

12:00 – 1:40 **NWSA Business Lunch (**or Lunch on your own**)**

Friday morning, March 25

Technical Session – Contributed Papers

Cascades Hall Rm 117/118

Ecology and Restoration of Wetland and Riparian Systems

Moderator: Joe Rocchio

8:40 **Emily Wolfe** *Fungal Endophyte-Infected Acer macrophyllum Leaf Litter Negatively Influences Aquatic Fungal Sporulation*

9:00 **Carri Leroy** *Stream Community Assembly Following the Catastrophic Eruption of Mount St. Helens, Washington*

9:20 **Matt Goslin** *Modeling Species Distribution of an Ecosystem Engineer, Carex nudata, A Disturbance-Adapted Riparian Sedge*

9:40 **Joe Rocchio** *Peatland Types of Washington: Their Classification and Conservation Values*

10:00 **BREAK**

Moderator: Gregg Riegel

10:20 **Maret Pajutee** *The Tale of Two Rivers – Saving the "Wild" in Wild and Scenic*

10:40 **Rick Dewey** *Inventory and Characterization of Montane Fens on USFS Lands in Oregon and Washington*

11:00 **Michael Cummings** *Rain Versus Snow-Dominated Winter Precipitation and Recharge of the Perched Pumice Aquifer, Walker Rim Study Area, Fremont-Winema NF, Oregon*

11:20 **Peter Sussmann** *Restoring a Slough Floodplain of the Deschutes River*

11:40 **Christina Veverka** *Big Marsh Restoration: An Ongoing Success Story*

12:00 – 1:40 **NWSA Business Lunch (**or Lunch on your own**)**

Friday morning, March 25

Technical Session – Contributed Papers

Cascades Hall Rm 246/247/248

Management and Restoration in Fire Adapted Ecosystems

Moderator: Dave Peter

8:20 **Ryan McCarley** *Improving Landsat Estimation of Lidar Derived Changes in Canopy Cover Using Pre-Fire Beetle Outbreak and Timber Harvest on the Pole Creek Fire, Oregon*

8:40 **Allison Rossmann** *Understory Responses to Dry Forest Restoration Differ in the Short and Long Term*

9:00 **Anna Clark** *The Impact of Residential Development Pattern on Wildland Fire Suppression Expenditures*

9:20 **Benjamin Hart** *Fuels Treatments of Ponderosa Pine in the Blue Mountains of Eastern Oregon: A Mycorrhizal Perspective*

9:40 **Becky Kerns** *Burn Season and Interval Effects on Understory Vegetation in an Eastern Oregon Ponderosa Pine Forest*

10:00 **BREAK**

10:20 **Craig Bienz** *Improving Ecosystem Resiliency to Drought with Prescribed Fire*

10:40 **Steve Acker** *Biomass Dynamics and Tree Regeneration Following Wildfire in a Mountain Hemlock (Tsuga mertensiana) Forest*

11:00 **David Peter** *Heat Tolerance of Prairie Associated Native and Exotic Dormant Seeds from Western Washington*

11:20 **Justin Bastow** *Impacts of the Watermelon Hill Fire on Soil Carbon Dynamics and Food Webs a Year After the Fire*

11:40 **Lalita Calabria** *Prescribed Fire Decreases Lichen and Bryophyte Biomass and Functional Group Diversity in Pacific Northwest Prairies*

12:00 – 1:40 **NWSA Business Lunch (**or Lunch on your own**)**

Friday, March 25, afternoon

	Cascades Hall Rm 117/118	Cascades Hall Rm 246/247/248	Science Hall Fuller Lab Rm 120
Time	**Wildlife Ecology**	**Historical and Prehistorical Ecosystem Baselines**	**Lichen Workshop**
1:40 – 2:00	**Audrey Taylor** *Now You See Me, Now You Don't: Shifts in Black Turnstone Migration Patterns in Prince William Sound, Alaska*	**Jim Meacham** *The Atlas: A Regional Synthesis, Translation, and Baseline of Scientific Data for the Public and Resource Managers*	*Lichens on the East Side – Rare, Threatened, Endangered, New Finds, and Interesting Species*
2:00 – 2:20	**Lindsay Hermanns** *Breeding Ecology Variations in Adult and Second-Year Female Tree Swallows (Tachycineta bicolor) at Otter Lakes, Anchorage, Alaska*	**Miles Lefevre** *Informing Forest Restoration: An Application of Spatial Reference Conditions of the Colville National Forest, Washington*	
2:20 – 2:40	**Tesia Forstner** *Linking Stable Isotopes and Geolocator Data to Infer Migratory Connectivity*	**Sean Jeronimo** *Monitoring Restoration Treatments at Stand and Landscape Scales*	
2:40 – 3:00	**Stan Sovern** *Roosting Habitat Use and Selection by Northern Spotted Owls During Natal Dispersal*	**Donald Zobel** *Environmental Relationships in Forests of Early 20th Century Coos County, Oregon, Based on Timber Cruise Data*	
3:00 – 3:20	**BREAK**		
3:20 – 3:40	**Michelle Toshack** *Diversity and Abundance of the Birds and the Bees under Intensifying Agriculture*	**Keala Hagmann** *Mixed Conifer and Ponderosa Pine Forests 90 Years Ago in Central Oregon*	
3:40 – 4:00	**David Vesely** *Conservation Status of the Kit Fox (Vulpes macrotis) in Oregon*	**James Johnston** *Successional Accretion along a Productivity Gradient Following Fire Exclusion in the Southern Blue Mountains, Oregon*	
4:00 – 4:20	**Timothy Harrington** *Effects of Variable-Retention Forest Harvesting and Soil Disturbance on Chipmunk (Tamias spp.) Abundance in Western WA and OR*	**Robin Lesher** *The Mystery of the 700 Year-Old Trees*	
4:20 – 4:40	**Johanna Thalmann** *Social Organization and Sexual Segregation in American Bison*	**Dusty Pilkington** *Two Holocene Sagebrush Steppe Fire Records at the Wildland-Urban Interface, Eastern Cascades, Washington*	
4:40 – 5:00		**Daniel Gavin** *Watershed Erosion Estimated from a High-Resolution Sediment Core Reveals a Non-Stationary Frequency-Magnitude Relationship*	

Friday afternoon, March 25

Technical Session – Contributed Papers

Cascades Hall Rm 117/118

Wildlife Ecology

Moderator: Audrey Taylor

1:40 **Audrey Taylor** *Now You See Me, Now You Don't: Shifts in Black Turnstone Migration Patterns in Prince William Sound, Alaska*

2:00 **Lindsay Hermanns** *Breeding Ecology Variations in Adult and Second-Year Female Tree Swallows (Tachycineta bicolor) at Otter Lakes, Anchorage, Alaska*

2:20 **Tesia Forstner** *Linking Stable Isotopes and Geolocator Data to Infer Migratory Connectivity*

2:40 **Stan Sovern** *Roosting Habitat Use and Selection by Northern Spotted Owls During Natal Dispersal*

3:00 **BREAK**

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4:20 **Johanna Thalmann** *Social Organization and Sexual Segregation in American Bison*

Friday afternoon, March 25

Technical Session – Contributed Papers

Cascades Hall Rm 246/247/248

Historical and Prehistorical Ecosystem Baselines

Moderator: Dan Gavin

1:40 **Jim Meacham** *The Atlas: A Regional Synthesis, Translation, and Baseline of Scientific Data for the Public and Resource Managers*

2:00 **Miles Lefevre** *Informing Forest Restoration: An Application of Spatial Reference Conditions of the Colville National Forest, Washington*

2:20 **Sean Jeronimo** *Monitoring Restoration Treatments at Stand and Landscape Scales*

2:40 **Donald Zobel** *Environmental Relationships in Forests of Early 20th Century Coos County, Oregon, Based on Timber Cruise Data*

3:00 **BREAK**

3:20 **Keala Hagmann** *Mixed Conifer and Ponderosa Pine Forests 90 Years Ago in Central Oregon*

3:40 **James Johnston** *Successional Accretion along a Productivity Gradient Following Fire Exclusion in the Southern Blue Mountains, Oregon*

4:00 **Robin Lesher** *The Mystery of the 700 Year-Old Trees*

4:20 **Dusty Pilkington** *Two Holocene Sagebrush Steppe Fire Records at the Wildland-Urban Interface, Eastern Cascades, Washington*

4:40 **Daniel Gavin** *Watershed Erosion Estimated from a High-Resolution Sediment Core Reveals a Non-Stationary Frequency-Magnitude Relationship*

Friday afternoon, March 25

Lichen Workshop
Presented by Northwest Lichenologists
Local Host - Sarah Fuller

Science Building, Room 120

Rare, Threatened, Endangered, New Finds, and Interesting Species

Listed lichens for Oregon and Washington have been revised, and more of them are from the "east side" than ever before. Come up to speed on those changes and familiarize yourself with the species of concern, with particular emphasis on species that occur east of the Cascade crest. This includes a wide variety of habitats, including forests, woodlands, rangelands, and rock outcrop areas. The region of special emphasis includes eastern Washington and Oregon, Idaho, and western Montana.

After an update by the PNW sensitive species coordinator, Kelli Van Norman, each leader will give a 5-10 minute update on the status of the east-side Rare, Threatened, and Endangered lichen species for their state: Oregon, Washington, Idaho, and Montana. We will follow this with plenty of time to examine specimens of these listed species. These include *Aspicilia rogeri, Peltigera cinnamomea, Thelenella muscorum, Umbilicaria nodulospora,* and *Umbilicaria phaea* var*. coccinea*.

Simultaneously, people can work on and consult on problem specimens from local field trips or brought from home. Bring your puzzles and stump the experts!

The Saturday field trip will complement the workshop, as we will visit some of these species in their habitat.

***Target Audience*:** The workshop will be particularly valuable for east-side agency botanists, contractors, and serious naturalists, as well as academics and students.

Prerequisites: Basic background in macrolichens.

Leaders: Bruce McCune, Roger Rosentreter, Daphne Stone, Andrea Pipp, Ann DeBolt, Jeanne Ponzetti, and Kelli Van Norman.

Friday, March 25

Central Oregon Fire Science Symposium – Invited Papers

Wille Hall – Campus Center

8:00 **Geoff Babb** Opening Remarks

Hazardous Fuels Treatments in the Inland PNW

8:05 **John Bailey** *Recent trends in wildland fires and fuels treatments in the Pacific Northwest*

8:30 **Nicole Vaillant** *An evaluation of the Forest Service hazardous fuels treatment program– Are we treating enough in the right places?*

8:55 **Ali Dean** *Lessons learned from 15 years of monitoring fire effects in Central Oregon*

9:20 **Alissa Cordner** *Waiting for the next big one: Catastrophic wildfire and other motivators of improved wildfire risk management*

9:45 **BREAK**

Smoke Management and Fire Severity

10:00 **Roger Ottmar** *Smoke management and RxFire: Fuel bed components that contribute to smoldering smoke and evening intrusions*

10:20 **Susan O'Neill** *Understanding smoke transport from prescribed burning in the wildland urban interface of Bend, Oregon*

10:40 **Michelle Agne** *Post mountain pine beetle lodgepole pine forests: Assessing fire and cumulative disturbance effects in the Pole Creek Fire*

11:05 **Bryce Kellogg** *Can satellite derived temperature data improve estimates of burn severity*

11:30 **Gordie Reeves** *Fish and wildfire: A new perspective*

11:55 **LUNCH**

Improving the Safety and Efficiency of Large Fire Management

1:30 **Tim Sexton** *Planning for wildfire management in the 21st century*

1:55 **Jennifer Anderson** *A novel application of wildfire risk assessments in land management plans (LMP)*

2:20 **William Aney** *Making long term fire analyses relevant to decision makers*

2:45 **BREAK**

3:05 **Christopher Dunn** *How do we develop optimal incident management strategies for a new large-fire management paradigm?*

3:30 **Brenda Hallmark** *Case study - 2015 Corner Creek Fire: Fuels treatment effectiveness and invasive species*

3:45 **Alex Robertson** *Case study - 2015 Corner Creek Fire: Operation planning and implementation*

4:00 **Panel Discussion** with Session speakers *Managing large fires in a changing environment*

4:30 **Geoff Babb** Closing remarks

Saturday, March 26

NWSA Field Trips

Cascades Hall – Meeting Location; carpool to sites

8: 00 am ***Lichens of Juniper Woodlands on a Volcanic Landscape***

Leader **– Rick Demmer,** Lichenologist and Biologist, NW Lichenologists

8:30 am ***Rangeland Restoration on the Crooked River National Grassland***

Leaders - **Steve Gibson**, Range Program Manager, Deschutes and Ochoco NF and Crooked River Natl Grassland

Jim David, Forest Soil Scientist, Ochoco NF and Crooked River Natl Grassland

Bryan Scholz, Asst. Fire Management Officer (retired), Central Oregon Fire Management Services, Prairie Division

Sarah Callaghan, Invasive Plant Program Manager, Ochoco NF and Crooked River Natl Grassland

Kristen McBride, Natural Resource Staff Officer, Deschutes and Ochoco NF and Crooked River Natl Grassland

9:00 am ***Cinder Cones to Super Volcanoes: The Diverse Volcanic History of Central Oregon***

Leader **- Daniele McKay,** Geologist, Instructor, Oregon State University - Cascades

9:00 am ***Bridging Science and Collaborative Forest Restoration in the Mixed-Conifer Forests of Central Oregon***

Leaders – **Andrew Merschel** and **Nicole Strong** (OSU), **Deschutes Collaborative Forest Project**

Northwest Lichenologists presents

Lichens of Juniper Woodlands

on a

Volcanic Landscape

Time: 8:π0am meeting time
Meeting Location: OSU Bend, Cascade Hall
Leader: Rick Demmer, Lichenologist & Biologist*
Transportation: car-pooling

Juniper Woodlands of central Oregon

Juniper Woodlands & Lava Blister Habitat

Explore an old-growth juniper woodland set in a mosaic of mounds and strands of extruded lava separated by areas of fine pumice sand. Here you'll find 200-year old junipers with some at over 500 years. We will find a high diversity of biological soil lichens and mosses and many crustose lichens growing on the basalt rocks and old junipers.

A lava blister (left) and the mosses & lichens that live there (above). Texosporium sancti-jacobi (below).

Rim Rock Springs

Central Oregon is the site of ancient volcanic activity – buttes that formed from rhyolitic tuff created when ash flows were generated by a super volcano. We will see a diversity of biological soil crusts including the rare *Texosporium sancti-jacobi* that is found only in western North America.

**** As a Range Manager for the BLM Rick Demmer monitored biological soil crusts on grazing allotments in central Oregon from 2001 to 2010. He retired in April 2015 as a Wildlife Biologist having served the BLM for 27 years. He earned a BS degree in Zoology from the University of Central Florida (UCF) and went on to earn two Master of Science degrees in Biology and Range Management from UCF and Washington State University, respectively.***

Rangeland Restoration on the Crooked River National Grassland

Time: 8:30 am – 1:30 return
Meeting Location: Cascades Hall, COCC campus
Leaders: Steve Gibson, Jim David, Bryan Scholz, Sarah Callaghan, Kristen Mc Bride*
Transportation: Carpool

What we will see and learn!

We will explore the history of the Grassland, from homesteaders' attempts to grow grains, to the Soil Conservation Service's crested wheatgrass rangeland improvement seeding trials, and spend the majority of our time examining current management issues.

Our discussions will focus on developing and implementing a rangeland restoration strategy to mitigate fire hazard risk, nonnative invasive annual grasses and native western juniper expansion, within the constraints of past disturbances and within guidelines governing the Grassland's commitments to the local livestock grazing association and growing recreation uses.

The Crooked River National Grassland is managed to promote the development of grassland agriculture and sustained yield management of the forage, fish and wildlife, timber, water, and recreation resources, and to demonstrate sound and practical principles of land use. Since the beginning of the land utilization projects of the 1930s, improving range management and the forage resource has been a major goal.

* Steve Gibson, Range Program Manager (Deschutes and Ochoco NF and Crooked River Natl Grassland [CRNG]); Jim David, Forest Soil Scientist, Ochoco NF and CRNG; Bryan Scholz, Asst. Fire Management Officer (retired), Central Oregon Fire Management Services, Prairie Division; Sarah Callaghan, Invasive Plant Program Manager, Ochoco NF and CRNG; Kristen Mc Bride, Natural Resource Staff Officer, Deschutes and Ochoco NF and CRNG

Celebrating 50 years
Crooked River National Grassland

Free land - Government gives away millions of acres

Today, this sounds like an internet scam; however, in 1862, it was true. Attempting to settle the Wild West, Congress enacted the *Homestead Act of 1862* authorizing 160-acre parcels of land be given to those willing to settle and cultivate it. Despite the hardships, the promise of free land lured hundreds of thousands looking for a better life. By 1904 nearly 100 million acres had been homesteaded into about 500,000 farms.

During this time, the climate was wetter and milder; homesteaders successfully raised wheat, vegetables and fruit without irrigation. However, in the 1920's and 30's the climate changed and became drier. Lands ill suited to farming had been plowed with shallow plows, wind had scoured sandy soils and hillsides, soils blew or washed away, grasshoppers stripped fields. Homesteaders watched as their crops failed year after year. Combined with the Great Depression these events proved too much to bear. One-by-one farms were abandoned as families searched for ways to survive.

As part of the Federal Emergency Relief Act of 1933, Congress enacted the Land Utilization Program that authorized the purchase of privately owned "sub-marginal" lands, those lands low in productivity or otherwise ill suited for farm crops. The Government continued purchasing these lands and by 1946 had acquired more than 11.3 million acres, mostly in the central United States. Once acquired, intensive restoration and development began. Restoring these badly damaged lands also created more than 50,000 jobs; very important as the nation was pulling itself out of the Depression.

Beginning as a sub-marginal land purchase and development effort, the Land Utilization Program evolved into a program designed to transfer land to its most suitable use. As a result, lands were transferred to the Department of Agriculture and the Department of Interior – National Park Service, Bureau of Indian Affairs, Bureau of Land Management or the U.S. Fish and Wildlife Service.

January 6, 1954, the Secretary of Agriculture transferred the administration of the Land Utilization Program lands from the Soil Conservation Service to the U.S. Forest Service. The Central Oregon Land Utilization Project became a Ranger District on the Ochoco National Forest; officially renamed the Crooked River National Grassland on June 23, 1960.

continued next page

CROOKED RIVER
NATIONAL GRASSLAND

"This celebration is more than just the anniversary of the transfer of the Grassland from the Soil Conservation Service to the Ochoco National Forest. It's a celebration of this place and all the people who loved and lived on this land." Kristin Bail, District Ranger, Crooked River National Grassland.

Through the millenia...

Many Indian tribes and explorers journeyed through, settled and established territories within the Deschutes Basin. This habitation began at least 7,000 years ago.

Peoples known as the Wascopum, Walla-Walla, Tenino, Northern Paiute, Klamath, Umatilla, Grande Rhonde and Mollala lived in this area before and during the historic period (1805 to present). Root crops of bitterroot and many lomatium species provided valuable foods, plentiful enough for drying and storage. Nearby, eastern slopes of the Cascade Range offered camas meadows and huckleberry patches. The high desert and uplands supplied mule deer, elk, antelope, mountain sheep, rabbits and waterfowl.

continued next page

1954 - 2004

1954 - 2004

Civilian Conservation Corps

President Franklin Delano Roosevelt created the Civilian Conservation Corps (CCC) as one of the New Deal programs during the Great Depression *"for the relief of unemployment through the performance of useful public work and for other purposes."*

top to bottom: bunkhouses at Lamonta CCC camp; enrollees build and repair springs; building stock trail; the camp kitchen

The CCC program had two main objectives: find immediate and useful conservation work for thousands of unemployed young men and provide vocational and educational training for enrollees.

The Lamonta CCC camp was built in 1935. These young men completed conservation projects, cleaned up abandoned homesteads, fixed springs and wells, built stock trail and seeded the land with crested wheat.

The CCC program ended in 1942 and Lamonta was shut down during World War II. Although only remnants remain those hard-working men left a legacy of restored lands, roads, bridges, trails, fire lookouts and campgrounds.

Note: The few buildings that remain have suffered from vandalism and are no longer accessible to the public. The CRNG is conducting a Facilities Master Plan to help decide what to do with these buildings. If you would like to provide any input, contact the CRNG office.

Free Land (continued)

Today the Crooked River National Grassland manages 112,000 acres to promote development of grassland agriculture and the sustained yield of its resources, including forage, wildlife, water, providing recreation opportunities and protecting cultural resources.

Managing the Grassland is increasingly complex due to increased use and multiple demands on this resource. Trash dumping, unmanaged off-highway vehicle use, invasive noxious weeds, fragmented habitat and vandalism of historic sites and archaeological resources all threaten the health and vitality of Crooked River National Grassland.

The management decisions we make now will shape the future of the Grassland. The CRNG is working on an Environmental Impact Statement (EIS) and wants your input. You can help shape the future of the Grassland. For more information on how to get involved, contact the CRNG office.

Points of Interest

McCoin Orchard Julius and Sarah McCoin met and married in Greenwood County, Kansas. In 1877 they moved west and eventually claimed a homestead near Gray Butte in 1886. The McCoins had five children, but only their youngest, Walter, was born on the homestead. The older children rode nine miles to the school at Haystack until the Gray Butte school was built 2 ½ miles away. Julius McCoin drove freight teams between Prineville and The Dalles and was often away from home. When Sarah died suddenly in 1888, nine year old Minnie McCoin cared for the children whenever Julius was away. You can visit the orchard planted by the McCoins and then hike the Gray Butte Trail.

Gray Butte Cemetary Started by homesteaders in 1893.

Rimrock Springs Members of the Meek Wagon Train camped here in 1845. Today the springs are managed as wildlife habitat. The trail from the parking area leads to viewing platforms overlooking the springs.

Through the millenia (continued)

By 1850, traditional life ways were significantly changed with the introduction of Euro-American culture. Treaties were signed with the US Government and reservation lands were established. Three principal bands, Wascopum, Tiah, and Upper DeChutes and Lower DeChutes bands of the Walla-Wallas agreed to move and settle within the reservation boundary. This became known as the Confederated Tribes of Warm Springs Reservation.

The Forest Service, in coordination with the Indian Tribes, has trust responsibilities to preserve important historic, cultural, and natural aspects of their heritage, and protect the freedom of American Indians to believe, express, and exercise their traditional religions.

The Crooked River National Grassland works with the Confederated Tribes of Warm Springs to maintain traditional plants and foods, preserve traditional cultural practices and protect archaeological and spiritual sites.

Drought, erosion and insects forced many homesteaders to abandon their homes.

Want to know more?

Contact the Crooked River National Grassland District Office at 541-475-9272 or visit our website at fs.fed.us/r6/centraloregon.com

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R6-CRNG-001-2004

Crooked River National Grassland

The Crooked River National Grassland is located in central Oregon, entirely within Jefferson County. Of 173, 629 acres encompassed by the Grassland boundary, 111,379 acres are under Forest Service administration. Other lands are privately owned or under the administration of the BLM, State of Oregon, or Jefferson County.

The Grassland is traversed from north to south by State Highways 26 and 97. West of Highway 97, the country is a high plateau interrupted by steep canyons of the Deschutes River and its tributaries. East of Highway 97, the terrain is rolling hills and buttes. Elevations range from 2,241 feet at Madras to 5,108 feet atop Gray Butte. Steep canyons border the major drainages, including the Deschutes and Crooked Rivers, and Squaw and Willow Creeks. The Grassland lies within two sub-basins of the Deschutes River drainage system: the Middle Deschutes River and the Lower Crooked River.

It is believed that the Grassland was originally vegetated with bluebunch wheatgrass and Idaho fescue, along with sagebrush, rabbitbrush, bitterbrush, and juniper. Because much of the area was cultivated and the native vegetation removed during the homesteading era, it is difficult to determine the original vegetation patterns.

The climate of the Grassland is typical for central Oregon. Annual precipitation averages 10.5 inches, but higher elevations may receive 19 inches or more per year. High intensity rain storms are likely to occur during spring and summer months. The growing season averages 100 days. Temperatures are moderate throughout the year and may fluctuate greatly between day and night. Frost may occur any day of the year.

The area was first homesteaded in the 1880s and eventually 700 homesteads were established. But by the 1930s, inadequate rainfall and poor economic conditions had caused the farms to fail and the homesteaders to abandon their land. By 1935, Federal Land Banks and private mortgage banks had taken over 35 percent of the homesteads in foreclosures. The Federal Government then began to buy the land back from the remaining homesteaders under the authority of the Resettlement Administration and Bankhead-Jones Farm Tenant Act.

Management of the land was transferred from the Soil Conservation Service to the Forest service in 1954. Originally known as the Central Oregon Land Utilization Project, the name was changed to the Crooked River National Grassland in 1960. Management direction states that "the National Grassland shall be administered under sound and progressive principles of land conservation and multiple use..." (36 CFR 213).

During the 1930s and early 1940s, many acres were seeded to provide ground cover and improve the bare ground situation that had resulted from plowing the land and attempting to raise grain. treated lands (approximately 63,000 acres) were planted to either crested wheatgrass or bearded wheatgrass. The native bluebunch wheatgrass proved impossible to restore. In the 1960s, many acres were reseeded and sprayed with herbicides to control shrubs. In the 1970s, reseeding was phased out and fire was introduced as a management tool. This management method continues today.

The Crooked River National Grassland is administered as a ranger district of the Ochoco National Forest and is the only national grassland in the Forest Service Pacific Northwest Region. There are 19 national grasslands nationwide.

The Grassland is managed to promote the development of grassland agriculture and sustained yield management of the forage, fish and wildlife, timber, water, and recreation resources and to demonstrate sound and practical principles of land use. Since the beginning of the land utilization projects of the 1930s, improving range management and the forage resource has been a major goal.

Cinder Cones to Supervolcanoes:
The Diverse Volcanic History of Central Oregon

Time: 9:00 AM meeting time, March 26, 2016
Meeting Location: OSU-Cascades, Cascade Hall
Leader: Daniele McKay, Geologist*
Transportation: Car-pooling

Lava Butte:

Lava Butte cinder cone erupted about 7,000 years ago, producing an extensive lava flow and a small ash deposit. The lava flow dammed the Deschutes River in several locations, forming a temporary lake in the Sunriver area and altering the hydrology of the Deschutes River. At this stop we'll examine the cinder cone and lava flow in detail, and explore about how cinder cone eruptions have shaped the geology, hydrology, ecology, and cultural history of central Oregon.


Q. Myers


D. Mckay

Bend Pumice and Tumalo Tuff:

Explosive eruptions from the Cascades have repeatedly buried the Bend area in multiple feet of volcanic ash, welded tuffs, and lava flows. At this stop we'll examine some of these deposits up close, and talk about the hazards of living in a volcanically active area. We'll also visit a regional fault zone and talk about seismic hazards in central Oregon.

Smith Rock State Park:

Nearly 30 million years ago one of the largest eruptions in Oregon's history occurred in the Prineville area. This eruption was highly explosive, ejecting more than 580 km^3 of ash and gas from multiple vents. A large caldera, called the Crooked River Caldera, was produced, along with the welded tuff of Smith Rock. At this stop we'll explore Oregon's explosive volcanic history and discuss how the eruption of the Crooked River Caldera helped to preserve a record of Oregon's paleoecology and paleoclimate.


Oregon State Parks

Daniele teaches geology courses at OSU-Cascades in Bend, where she involves students in a variety of local research projects. She has a PhD from the University of Oregon, and she studies recent volcanic activity in the Cascades. Much of her research has focused on cinder cones in central Oregon.

Bridging Science and Collaborative Forest Restoration in the Mixed-Conifer Forests of Central Oregon

Time: 9:00am meeting time
Meeting Location: OSU Cascade Hall
Leader: Deschutes Collaborative Forest Project
Transportation: Car-pooling

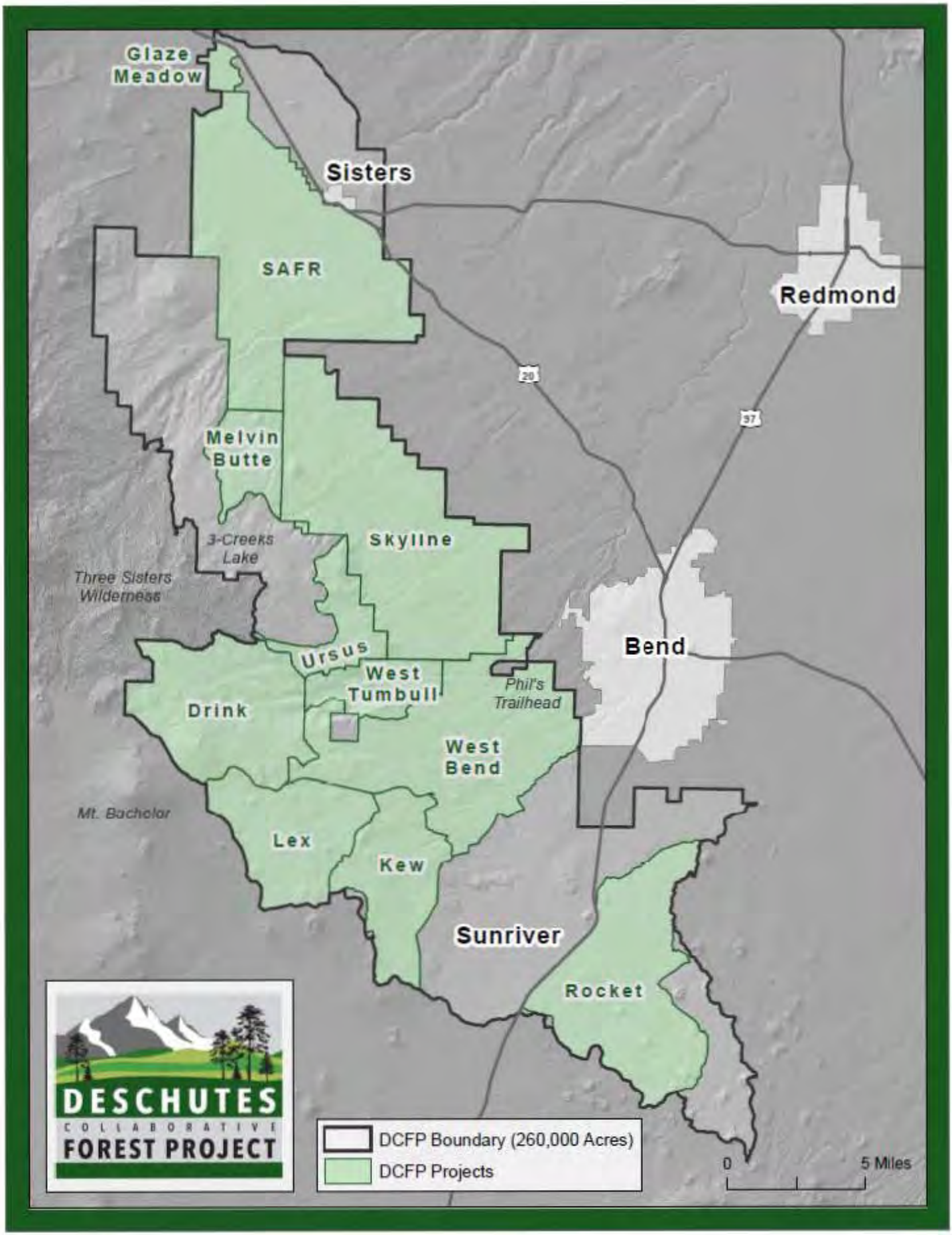
Towards a Shared Understanding of Mixed-Conifer Forest Ecology

Over 18 months in 2014 and 2015 stakeholders of the Deschutes Collaborative Forest Project engaged in an innovative research project with Oregon State University and The Nature Conservancy to develop local research on forest development and fire history for the mixed-conifer landscape of the Deschutes National Forest.

The results of this research provided an invaluable scientific foundation for collaborative members to use as they worked together to craft a shared vision for a restored, resilient forest landscape across the ~260,000 acre DCFP landscape, nearly half of which is comprised of mixed-conifer forest types.

On this field trip you will hear first-hand from researchers and diverse collaborative perspectives – from environmental group to forest product industry – who worked on this novel approach to applied science and collaborative forest restoration together.

The Deschutes Collaborative Forest Project (DCFP) was established in 2010 as one of 23 demonstration landscapes nationally funded through the Collaborative Forest Landscape Restoration Act of 2009, the purpose of which was to encourage collaborative, science-based ecosystem restoration of priority forest landscapes. In partnership with the Deschutes National Forest, the DCFP has supported restoration across more than 81,000 acres of National Forest within the ~260,000 acre DCFP landscape.


Glaze Meadow
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3-Creeks Lake
Skyline
Three Sisters Wilderness
Bend
Ursus
West Tumbull
Phil's Trailhead
Drink
West Bend
Mt. Bachelor
Lex
Kew
Sunriver
Rocket
DESCHUTES
COLLABORATIVE
FOREST PROJECT
DCFP Boundary (260,000 Acres)
DCFP Projects
0
5 Miles

ABSTRACTS

NWSA ORAL AND POSTER PRESENTATIONS

COFSS Abstracts for Joint Plenary Session and Posters

(*Arranged alphabetically by last name of presenting author*)

ORAL

BIOMASS DYNAMICS AND TREE REGENERATION FOLLOWING WILDFIRE IN A MOUNTAIN HEMLOCK (*TSUGA MERTENSIANA*) FOREST.
Steven A. Acker, Willamette National Forest, 3106 Pierce Parkway, Springfield, OR 97477; Jane A. Kertis, Siuslaw National Forest, 3200 SW Jefferson Way, Corvallis, OR 97331; Robert J. Pabst, Oregon State University, 321 Richardson Hall, Corvallis, OR 97331-5752; *stevenaacker@fs.fed.us*

Processes initiated by wildfire largely determine ecological characteristics of forested landscapes in subsequent decades, including vegetation composition, habitat quality, carbon balance, and probability of fire recurrence. Post-fire biomass dynamics have rarely been observed directly for high-elevation forests of the Pacific Northwest. We examined changes in total biomass and its components (attrition of coarse woody debris (CWD), growth of shrubs and herbaceous plants, and tree recruitment) over the first 15 years following wildfire in a mountain hemlock (*Tsuga mertensiana*) forest in Oregon, using permanent plots representing random samples of four levels of fire-severity, from unburned to >90% tree mortality. Understory vegetation was transformed by fire, inasmuch as only shrubs were detected in unburned plots, while burned plots also had significant amounts of graminoids and forbs. Conifer recruitment was sparse in plots with high fire-severity two years after fire, but was abundant after 15 years. Recruitment was predominantly mountain hemlock and most were seedlings < 1m tall. The breakage of snags and resulting increase in logs created microsites (north sides of logs) conducive to tree regeneration. Mass of understory vegetation and conifer regeneration was far outweighed by CWD. Toppling, fragmentation, and advancing decay of snags resulted in a decrease in snag mass and an increase in log mass. The loss of snag mass exceeded the increase in log mass, resulting in an overall decline. For some portions of the burned area, it may be more than a century before the growth of live trees balances the loss of mass of CWD.

ORAL

TREE VIGOR RESPONSES TO RESTORATION THINNING AND FUELS REDUCTION AT LOOKOUT MOUNTAIN.
Paul Anderson. USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331. *pdanderson@fs.fed.us*

A premise behind thinning as a means to enhance forest resilience is that decreasing overstory density reallocates limited site resources – water, nutrients, and light – to fewer trees, thus improving the vigor of individual trees and decreasing stand vulnerability to physical and biological stressors. Removal of understory vegetation as a means to decreasing fuels accumulation and fire hazard may also decrease demands on site resources. However, the duration of any overstory or understory treatment effects may be temporary as subsequent vegetation development reasserts resource demands. Experimental thinning and fuels reduction treatments in mature ponderosa pine stands at Pringle Falls Experimental Forest in central Oregon are being monitored for seasonal soil moisture depletion and individual tree water use. Early observations suggest that

decreases in stand density and understory shrub removal have distinct effects on seasonal soil moisture depletion rates and related whole tree transpiration rates that should translate over time to increased vigor and growth. The influence of varying residual stand density and the persistence of these effects as understory shrubs reassert their influence will be the focus of monitoring into the future.

ORAL

FIRE OCCURRENCE UNDER CLIMATE CHANGE IN CENTRAL OREGON. **Ana Barros**, Oregon State University, Corvallis, OR 97331; Alan Ager, USDA Forest Service Rocky Mountain Research Station, Missoula, MT 59808; Michelle Day, Oregon State University, Corvallis, OR 97331; Haiganoush Preisler, USDA Forest Service, Pacific Southwest Research Station, Albany, CA 94706; John Abatzoglou. University of Idaho, Moscow, ID 83844; *Ana.Barros@oregonstate.edu*

In this work we modeled the effect of expected climate change in future area burned and wildfire severity on a 1.2 million study area in Central Oregon that includes the Deschutes National Forest, the Warm Springs tribal reservation, lands managed by private industrial owners and extensive wildland urban interface. We simulated fire occurrence using four alternative global circulation models (GCMs) – the CanESM2, CSIRO-Mk-3-6-0, HadGem2-ES and MIROC5 - and two representative concentration pathways (4.5 and 8.5). Wildfire was simulated using the minimum travel time algorithm implemented in a command line version of FlamMap, and linked to a spatiotemporal ignition model that predicted ignition location, ignition density and fire size as a function of the energy release component (ERC), and developed based on the historical spatiotemporal ignition pattern and fire size distribution. Future ERC was calculated based on meteorological variables obtained from the statistical downscaling of the four GCM's and emission scenarios. The agent based model Envision was used to illustrate how management can potentially mitigate climate change effects. Results highlighted expected changes in overall burned area and fire severity as a function of different GCM's, emission scenarios and forest management practices.

ORAL

IMPACTS OF THE WATERMELON HILL FIRE ON SOIL CARBON DYNAMICS AND FOOD WEBS A YEAR AFTER THE FIRE. **Justin Bastow**, Department of Biology, 258 Science Building, Eastern Washington University, Cheney, WA 99004; *jbastow@ewu.edu*

Fires are a common disturbance in the west, and are expected to become more common with climate change. In July 2014, the Watermelon Hill fire burned 4,000 hectares of grassland in eastern Washington (Lincoln and Spokane Counties). I sampled soil from six paired burned and unburned sites between September 2014 and September 2015 in order to determine the impacts of the fire on soil organic matter and soil nematodes. I extracted nematodes from samples using Baermann funnels, estimated organic matter using AFDM, and measured soil respiration in the field using a Licor Infrared Gas

Analyzer. In September 2014, soil organic matter and moisture were 29% and 73% lower, respectively, in soils from burnt sites compared to unburned sites, and these differences persisted after 9 months. Soil respiration was 39% lower in burnt sites 14 months after the fire. Nematode abundances were 67% lower in burnt sites in September 2014, and the difference was similar for all functional groups. I used samples from September 2014 in a laboratory microcosm experiment to determine the capacity of nematode populations to recover under suitable abiotic conditions. In the microcosm experiment, bacterivorous and fungivorous nematodes in burnt soils recovered to the same abundances as unburned soils after 60 days, but only when grass litter was added as a substrate. These results suggest that wildfires may have large and persistent effects on the soil food web, and that their recovery may depend on the presence of plant litter that is frequently lost in such fires.

ORAL

IMPROVING ECOSYSTEM RESILIENCY TO DROUGHT WITH PRESCRIED FIRE. **Craig Bienz**, 226 Pine Street, Klamath Falls, OR 97601; Nancy Grulke, Ochoco NF/WWETAC, 3160 NE 3rd Street, Prineville, OR 97702; *cbienz@tnc.org*

Climate change poses difficult challenges for many already over-stretched natural resource managers who must deal with day-to-day crises and who are still following management plans that were developed before there was a scientific consensus that climate-change impacts were real and substantial. Climate change is altering ecological systems throughout the world, and these changes are likely to continue for decades, possibly centuries. Changes in hydrologic regimes and fire regimes will fundamentally alter ecological systems. Management of these systems in a way that ignores climate change will neither meet human goals nor sustain those ecosystems into the future. In 2005 we initiated fuels treatments in lowlands and uplands sites at Sycan Marsh Preserve in the headwaters of the Klamath Basin. In 2014 and 2015, when average annual precipitation was less than 60% of normal, we assessed forest health in the different fuels treatments. We will we provide specific examples of how managers can begin to address the threats of climate change, and provide metrics to assess forest health. We found that: (1) Fuels reduction treatments, not followed by prescribed fire had a greater proportion of trees in poor health. (2) Harvest followed by prescribed fire eliminated all poor health trees. (3) Harvest followed by two prescribed fires at 7 year intervals improved the proportion of above average health trees by 25%.

ORAL

PRESCRIBED FIRE DECREASES LICHEN AND BRYOPHYTE BIOMASS AND FUNCTIONAL GROUP DIVERSITY IN PACIFIC NORTHWEST PRAIRIES.
Lalita M. Calabria; Kate Petersen, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, Washington 98505; Sarah T. Hamman, The Center for Natural Lands Management, 120 Union Ave SE #215, Olympia, WA 98501, Robert J. Smith, Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis, Oregon 97331; *calabril@evergreen.edu*

The reintroduction of fire to Pacific Northwest prairies has been useful for removing non-native shrubs and supporting habitat for fire-adapted plant and animal species. However, very little is known about fire's influence on prairie bryophyte and lichen communities. In this study, we investigated the effects of fire on ground-dwelling bryophytes and lichens by estimating standing biomass and measuring cover, mat depth and functional group diversity in burned and unburned plots at five prairie sites located in the south Puget Sound bioregion of Washington State. After accounting for differences among sites, the bryophyte and lichen ground layer in burned plots exhibited a decrease of 72.7% in mean biomass and 38.8% in mean cover relative to the unburned plots. All ground layer functional groups had lower average biomass in burned plots, with the exception of ephemeral mosses. Forage lichens and N-fixing lichens were absent from all five burned plots. Of particular concern are the regionally rare, state-listed reindeer forage lichens (*Cladonia ciliata* var. *ciliata, Cladonia ciliata* var. *tenuis* and *Cladonia portentosa* ssp. *pacifica*), which occur at three of the five prairies we surveyed. Our results indicate that some lichen populations may be at risk for extirpation from these sites if they are not considered in prescribed burn management plans. We suggest some options that could maintain ground layer integrity while balancing other management objectives in the south Puget Sound prairies.

ORAL

MAMMALIAN BIODIVERSITY IN THE NORTHERN ROCKY MOUNTAINS DURING THE ARIKAREEAN: FIVE MILLION YEARS OF FAUNAL CHANGE THROUGH THE CABBAGE PATCH BEDS (RENOVA FORMATION).
Jonathan J. Calede, University of Washington Department of Biology and Burke Museum of Natural History, Seattle, WA 98195; *caledj@uw.edu*

The opening of the environment and the spread of grasslands initiated around 30 million years ago (mya) in North America are thought to have been major drivers of mammalian evolution. I investigate the possible link between environmental change and faunal turnover in North America during this time period. The pattern of the transition from the archaic mammalian faunas characteristic of the Eocene-Oligocene to the more taxonomically modern faunas of the Miocene and today has mostly been studied in the Great Plains. I explore the timing and pattern of this faunal turnover in the Cabbage Patch beds of Montana. I used a dataset of over 1,000 fossil mammal specimens identified to the species level to quantify biodiversity across three biostratigraphic units

representing five million years. Rarefied species richness decreases through time from as many as 20 species of mammals in some of the older assemblages to 13 species in the youngest assemblage. Heterogeneity indices (evenness, equitability, Simpson's, and Berger Parker's) are stable throughout the older two units of the beds but decrease dramatically around 26 mya. The ecological instability indicated by these declines suggests a response of mammalian communities to an extrinsic force, possibly environmental change. This interpretation is supported by changes in the relative abundance of mammalian species through time. Mammals with affinities for more closed, forested environments are common in the older unit of the beds and rare in younger assemblages. The opposite is true of mammals with affinities for more open environments.

POSTER

CLIMATE EFFECTS ON THE RELATIONSHIP BETWEEN INVASIVE ANNUAL GRASSES AND BIOLOGICAL SOIL CRUST IN EASTERN WASHINGTON. **Jarrett B. Cellini**, Rebecca Brown, Department of Biology, 258 Science Building, Eastern Washington University, Cheney, WA 99004; *Jarrett.Cellini@gmail.com*

What remains of the Columbian Basin shrub-steppe ecosystem is threatened by invasive species and climate change, which is expected to shift temperature and precipitation, both critical drivers in arid ecosystems. Biological soil crust (biocrust) has been shown to limit the spread of aggressive invasive annual grasses in arid regions of shrub-steppe ecosystems, but its effects in wetter, semiarid climates are less studied. It is also unknown how biocrust interacts with the recent invader, *Ventenata dubia*. My goal was to determine how the effect of biocrust on invasion susceptibility of shrub-steppe communities varies with precipitation. I expected biocrust to have a stronger effect of limiting invasives in arid versus semiarid regions. I documented biocrust and vascular plant species cover at 21 sites (eight 1 m^2 plots/site) across an average annual precipitation gradient ranging from 195 mm to 461 mm per year in eastern Washington. In addition, I collected long-term data on the relationship between *V. dubia* and biocrust at Turnbull National Wildlife Refuge, a semiarid prairie. Our results suggest that precipitation and biocrust cover are positively associated, while biocrust and invasive annual grass cover are negatively associated. We also found that invasive annual grass composition varies with precipitation across the Columbia Basin. Understanding how biocrust communities change and interact with invasive species across a precipitation gradient will help conserve and sustainably restore native habitat across the Intermountain West.

ORAL

THE IMPACT OF RESIDENTIAL DEVELOPMENT PATTERN ON WILDLAND FIRE SUPPRESSION EXPENDITURES. Anna M. Clark, AMC Consulting, 35721 Elida Court, Chiloquin, OR 97624; Ben Rashford, Don McLeod, Roger Coupal, Department of Agricultural and Applied Economics, University of Wyoming, Laramie, WY 82070; Shannon Albeke, Wyoming Geographic Information Science Center, University of Wyoming, Laramie, WY 82070; Scott Lieske, City Futures Research Center, University of New South Wales, Sydney, Australia; *anna.m.scofield@gmail.com*

The wildland urban interface (WUI) increases wildland fire suppression expenditures and impedes land managers' ability to reduce fire risk. Policies to reduce these WUI impacts are hindered by jurisdictional externalities — federal agencies are charged with protecting homes from wildland fires, while local governments decide where and how development can occur. Despite a growing body of literature indicating that the spatial pattern of development impacts the efficiency and cost of public service provision, the effect of WUI development pattern on fire suppression expenditures has received only cursory treatment in the literature. We address this gap by modeling the relationship between fire suppression expenditures and the spatial pattern of residential development. We use fires in the Northern Rockies (CO, MT and WY) to estimate a regression model relating suppression expenditures to fire characteristics, management characteristics, and the spatial pattern of development. We find that the effect of WUI development on suppression expenditures is highly dependent on spatial pattern. Although past research has confirmed that the presence of structures influences expenditures, our results indicate that the effect of development on fire suppression expenditures cannot be accurately assessed without considering the spatial pattern of development. A unit increase in the complexity of development pattern increases expenditures by approximately six percent. The difference in expenditures between fires with dispersed or clustered structures can be as much as $620,000. Our results indicate that policies that control the spatial pattern of WUI development can be nearly as effective as policies that completely restrict WUI development.

ORAL

MORPHOMETRIC FUNCTIONAL TRAIT ABUNDANCE OF BIOLOGICAL SOIL CRUSTS IN RESPONSE TO FIRE ACROSS THE NORTHERN GREAT BASIN. Lea A. Condon, Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis, OR 97331; David A. Pyke, U.S. Geological Survey, Forest & Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331; *Lea.Condon@science.oregonstate.edu*

The invasive annual grass, cheatgrass (*Bromus tectorum* L.), grows in the interspaces between native plants, resulting in a continuous fuel load. This continuous fuel load results in increased fire frequency and extent throughout the sagebrush steppe of the Great Basin region, also referred to as the cheatgrass-fire cycle. Fire may extirpate sagebrush and other native plant species from large parts of the region. I n undisturbed,

semi-arid systems, biological soil crusts, referring to lichens, mosses and cyanobacteria that grow on the soil surface, are common in the interspaces between native plants. Understanding how the sagebrush steppe recovers from fire is a matter of understanding how both vascular plants and biocrusts recover from fire. Given that biocrusts are a suite of organisms, it is not accurate to assume that all biocrust species will recover from fire in the same way. We tested the ability of biocrusts with different functional traits to recover from fire, specifically looking at life forms: short mosses, tall mosses, and lichens. We further examined biocrust recovery by examining functional traits based on their morphology such as nitrogen fixation (gelatinous), rapid growth (short mosses), and the ability to increase (moss) or reduce water infiltration (various morphogroups of lichens). Preliminary results indicated that short mosses were more prevalent in all burned sites, even in our oldest fire sites, twenty-three years after the fire. Lichens and tall mosses had not returned to pre-fire cover values on these same sites.

POSTER (COFSS)

TRAJECTORIES OF FIRE HAZARD AND PACIFIC MARTEN HABITAT FOLLOWING FUEL TREATMENT IN LASSEN NATIONAL FOREST. Kevin Credo, John Bailey, Oregon State University, Corvallis, Oregon 97331; *kevin.credo@oregonstate.edu*

Forest managers are challenged to restore resilience in forests with an elevated risk of stand-replacing fire by using mechanical treatments and prescribed fire. However, implementation of such treatments can be constrained by mandates to conserve sensitive wildlife species. On federal forestlands in the Sierra Nevada, the Pacific marten (*Martes caurina*) is a Management Indicator Species for late-seral, closed-canopy forests. The distribution of this forest carnivore is already fragmented due to management history and land use changes. Martens avoid simplified stands created by some management activities, but the long-term comparative risk to this species of increased wildfire versus fuel reduction treatments is not clear. This research will examine the trajectories of crown fire potential and Pacific marten habitat over a 30-year period following fuel treatment in Lassen National Forest. I will simulate the effects of treatments at two scales: on representative stands selected by vegetation type and management history, and on sub-watersheds randomly selected from those with documented marten occupancy. Four treatment scenarios will be implemented at each scale: no treatment; prescribed underburn only; light thin from below with underburn; and heavy thin from below with underburn. Additionally, at the sub-watershed level, 0 to 70% treatment of each unit will be simulated at 10% increments, and growth will be simulated with and without a large fire after 5 years. I hypothesize that enduring changes in crown fire potential will correspond to an extended period of marten exclusion. Light thinning from below may represent a balance between marten use and reduced fire hazard, but this effect will be short-lived. At the sub-watershed scale, I expect that 30% or more of the planning unit needs to be treated in order to significantly reduce fire behavior. In scenarios with fire after 5 years, this will translate into a long-term benefit for marten habitat.

ORAL

RAIN- VERSUS SNOW-DOMINATED WINTER PRECIPITATION AND RECHARGE OF THE PERCHED PUMICE AQUIFER, WALKER RIM STUDY AREA, FREMONT-WINEMA NATIONAL FOREST, OREGON. Michael L. Cummings, Jonathan M. Weatherford, David A. Eibert, Department of Geology, Portland State University, P. O. Box 751, Portland, OR 97207; *CummingsM@pdx.edu*

Plinian pumice fall (2.8 to 3.0 m thick) from Mount Mazama is an unconfined, perched aquifer over the Walker Rim study area. The pumice aquifer is a shallow groundwater source supporting biodiversity in the rain shadow of the Cascades. This once continuous blanket of pumice was disrupted by fluvial and lacustrine processes shortly after the eruption. Reworking continues at a lower rate. In the low relief study area pre-eruption topography and post-eruption disruption of the pumice layer produced a variety of hydrogeologic environments. Stream discharge (13 sites) and depth to water table (70 sites) in the Walker Rim study area (elevation 1592 – 1793 m) were monitored since July, 2010. Recharge of the perched aquifer takes place during snowmelt when release of melt water produces ephemeral stream flow and flooding of meadows and forest. By the end of the water year (WY) surface water is restricted to 6.5 km of Sellers Creek, 10.5 km of Jack Creek, and fens. In WY2015, winter precipitation fell primarily as rain. WY2015 (precipitation: 68.3 cm) was preceded by the drought of WY2014 (46.7 cm), third driest year at Chemult Alternate SNOTEL Site. End of water year depth to water table between WY2011 (82.6 cm) and WY2015 shows steady decline in aquifer storage. In several settings storage recovery during the freshet in WY2013, 2014, and 2015 was muted. Storage after the rain-dominated winter of WY2015 was similar or lower than after the freshet in droughty WY2014. It is inferred that frozen ground produced runoff and less aquifer recharge.

ORAL

INVENTORY AND CHARACTERIZATION OF MONTANE FENS ON USFS LANDS IN OREGON AND WASHINGTON. Rick Dewey, Deschutes National Forest, 63095 Deschutes Market Road, Bend, OR 97701; *rdewey@fs.fed.us*

Fieldwork on 10 Oregon and Washington National Forests largely during 2005-2015 has allowed the following observations. Fens, in their strongest expression, are groundwater-fed wetland ecosystems typically dominated by mosses and sedge-like plants occurring on soils that are saturated with water at or near the soil surface all or most of the growing season. Pre-field analysis is essential for a moderately efficient detection of fens in the field. Important data sources for this analysis include the USFWS National Wetlands Inventory, locations of selected fen indicator taxa as provided by the Consortium of PNW Herbaria, and aerial imagery. Recognition of fens in the field utilizes biophysical observations regarding local topography, evidence of frequency and extent of surface water vs. groundwater input, soil properties as assessed by soil probes, and presence, abundance and variety of fen indicator plant species. Fen ecosystems in Oregon and Washington are most notable for perhaps two primary reasons. First, these ecosystems

are locally either rare or uncommon, tending to be quite small in their individual areal extent, and are generally very sparsely distributed within the mountains of these two states. Second, in spite of being an extremely tiny spatial component of the regional landscape, fen ecosystems contribute very disproportionately to local levels of plant biodiversity, particularly with regard to rare and uncommon plant species. The vast majority of the Oregon and Washington landscape that includes fens is managed by the USFS. Even today, a primary threat to the health of these fens is lack of awareness of their existence.

ORAL

***STEREOCAULON* OF THREE ALASKAN NATIONAL PARKS — KATMAI, LAKE CLARK AND KENAI FJORDS. Elisa B. Di Meglio**, Bruce McCune, Department Botany and Plant Pathology, Oregon State University, 1098 Cordley Hall, Corvallis, OR 97331; *alphande@onid.orst.edu*

The lichen genus *Stereocaulon* is a diverse group that is widely distributed throughout the northern and southern hemispheres, occurring primarily in boreal, montane and arctic regions. As part of an inventory of lichens in national parks in the Southwest Alaska Network, we studied the lichen genus *Stereocaulon* in Katmai, Lake Clark, and Kenai Fjords National Parks and Preserves, sampling from sea level to alpine. Neither of the two most comprehensive treatments of Alaska lichens, Krog (1968) and Thomson (1984, 1997), contain much information on the base of the Alaskan Peninsula. Preliminarily, we found 22 species of *Stereocaulon* from these parks, including 2 crustose representatives. These parks represent a range of climates from cold oceanic to subcontinental, and include numerous floristic elements: Arctic, Boreal, Beringian, Cordillera, Northern Oceanic, Amphi-Atlantic and Pacific Northwest. Each *Stereocaulon* species present was assigned to a floristic element. We calculated occurrence of each element in the four climatic regions. Thus, we describe not only the biodiversity of *Stereocaulon* in this region, but how species and floristic elements depend on climate. Regional trends in the distribution and diversity of *Stereocaulon* species show a gradient from high representation of the Northern Oceanic element in the most oceanic climates, to high representation of the Boreal element in the most continental climates. Diversity of *Stereocaulon* was similar in the four climatic regions. Finally, we highlight several *Stereocaulon* species of interest found: *S. apocalypticum, S. arcticum, S. klondikense, S. leucophaeopsis, S. saviczii and S. tornense.*

POSTER

***ASPICILIA REPTANS*: MORPHOLOGICAL TRAITS SUPPORTING PHYLOGENETIC DATA. Joseph Di Meglio,** Bruce McCune, Oregon State University, Department of Botany and Plant Pathology, 2082 Cordley Hall, Corvallis, Oregon 97331; *dimeglij@onid.orst.edu*

Aspicilia reptans is a common, but often overlooked soil crust lichen with a wide distribution throughout North American grasslands. *Aspicilia reptans* has a wide range of morphological characters making this species complex difficult to distinguish in the

field from other cryptic soil lichens. With the recent additions of DNA sequences from near the type locality in Saskatchewan, our preliminary molecular data provides evidence for approximately seven clades that represent "*Aspicilia reptans"* or related taxa. The species concept is polyphyletic, with "*A. reptans*" appearing in numerous locations within *Aspicilia.* In addition, distinct macro and microscopic morphological features appear to correlate with some of the seven clades. These features possibly provide key traits to help differentiate between species without DNA sequencing. DNA extraction was performed with Sigma-Aldrich (REDExtract-N-Amp Plant PCR kits) and sequencing was performed by Eurofins. We used nuclear DNA sequence data of the (ITS) and (LSU) loci from freshly collected specimens originating from six western U.S. states and one central Canadian province. We used Staden package to assemble sequence data and PhyML in Geneious for phylogenetic tree assembly by maximum likelihood analysis. Morphological data were collected by examination under the dissecting and compound microscopes. Some clades appear to have distinctive cross sections, when comparing the arrangement of the algal layer in relation to the upper cortex. In conclusion, we present preliminary ITS and LSU phylogenetic trees to show genetic similarities and differences within the *A. reptans* complex as well as possible associated morphological traits.

POSTER

TEPHRA CHRONOLOGY OF THE TONNEMAKER – FRENCHMAN HILLS MAMMOTH SITE: SHEDDING LIGHT ON ITS GEOLOGIC HISTORY. Jessica Dodd, 52861 Sunquist Rd., Milton-Freewater, OR 97862; George Last, 1938 Harris Ave. Richland, WA 99354; Mark Amara, 4875 Bluff Dr NE, Moses Lake, WA 98837; Luke Tonnemaker, Kole Tonnemaker, 9098 Dodson Rd. S., Royal City, WA 99357**;** *j.dodd2014@yahoo.com*

Tephra deposits provide discrete marker beds, often correlated with known volcanic eruptions and age dates. This paper explores the tephra chronology and their implication on the geologic history of the Tonnemaker – Frenchman Hills Mammoth Site, located north of Royal City, Washington. Three separate tephra samples collected below the bone bed, within fine-grained Ice Age flood deposits, were submitted to Washington State University's GeoAnalytical Laboratory for electron microprobe analysis and tephra identification. Bulk compositions of the glasses together with stratigraphic position suggest that all three tephra deposits from the Tonnemaker site are most likely associated with the Swift Creek Stage of Mt. St. Helens eruptive history. This stage had two main eruptive phases producing Set "S" (13,600 to 12,500 C^{14} yrs BP) and Set "J" (10,740 C^{14} yrs BP) tephra. The lower two tephra layers are interpreted to be of Set "S". The upper most tephra contains glass similar to set "S" and set "J" suggesting this layer may be reworked and re-deposited, giving a maximum age of set "J" (10,740 C14 yrs BP). This is a relatively young age for a mammoth in this region.

ORAL

CONFLUENCE AND COLLABORATION: ART AND SCIENCE AT PLAYA (A RESIDENCY PROGRAM IN THE OREGON OUTBACK). Deborah Ford, 47531 Highway 31, Summer Lake, OR 97640; *deborahford@playasummerlake.org*

On the edge of the Great Basin, PLAYA offers creative individuals the space, the solitude and the community to reflect and to engage their work through its residency program. PLAYA supports innovative thinking through work in the arts, literature, natural sciences and other fields of creative inquiry and encourages dialogue between disciplines to bring positive change to the environment and the world. Through regular and thematic place-based art+science residencies, and opportunities for focused fieldwork, public presentations and interdisciplinary publications, PLAYA supports the confluence and collaboration of individuals from diverse disciplines. A residency provides the time and space to create significant work or to research and reflect upon one's creative or scientific processes. Away from the urgencies of daily life, residents can focus on their projects, immerse in a desert landscape of basin and rangeland, and find inspiration through self directed inquiry. We hope to foster broad approaches to creative investigation and expression while also offering residents the opportunity to be a part of a cohort group providing inspiration and catalyst for deeper inquiry. Works from recent residents attest to the success of the program and the influence of place.

ORAL

LINKING STABLE ISOTOPES AND GEOLOCATOR DATA TO INFER MIGRATORY CONNECTIVTY. Tesia Forstner, Audrey Taylor, Jeffrey Welker, Douglas Causey, University of Alaska Anchorage, Spirit Drive, Anchorage, AK 99501; Mary Anne Bishop, Anne Schaefer, Prince William Sound Science Center, 300 Breakwater Ave. Cordova, AK 99574; *tmforstner@alaska.edu*

Particularly for migratory birds, events happening in non-breeding habitats may impact survival and reproduction of the species; thus understanding the connectivity between specific breeding and non-breeding areas is critical for conservation planning. A recent decrease in the number of Black Turnstones (*Arenaria melanocephala;* BLTU*)* stopping in Prince William Sound, Alaska during spring migration could be related to an overall population decline or to a long-term shift in migration patterns as a result of herring decline following the Exxon Valdez oil spill. However, patterns of migratory connectivity for BLTU are currently unknown, and only one major study has investigated their population size or breeding ecology in Alaska. This project characterized the migratory routes and wintering locations of BLTU using a combination of stable isotopes found in body and flight feathers and location information derived from light-level geolocators. Stable isotope data were matched with geolocator data to refine both sources of data, and to calculate a transfer function relating isotope ratios in feathers to isotope ratios found in precipitation samples. Deuterium and oxygen isotope ratios were then mapped to corresponding continental-scale precipitation isoscapes to determine approximate non-breeding areas and migratory routes for untagged individuals. We

discuss the feasibility of linking geolocator and stable isotope migration maps for a wide-ranging shorebird, and of using existing freshwater isoscapes for a bird species that feeds in a marine environment.

ORAL

WATERSHED EROSION ESTIMATED FROM A HIGH-RESOLUTION SEDIMENT CORE REVEALS A NON-STATIONARY FREQUENCY-MAGNITUDE RELATIONSHIP. **Daniel G. Gavin**, Department of Geography, University of Oregon, Eugene, OR 97403; Daniele Colombaroli, Oeschger Centre for Climate Change Research & Institute of Plant Sciences, University of Bern, Switzerland; Ann E. Morey, College of Earth, Ocean and Atmospheric Sciences, Oregon State University, Corvallis, OR 97330; *dgavin@uoregon.edu*

The inclusion of paleo-flood events greatly affects estimates of peak magnitudes (e.g., Q_{100}) in flood-frequency analysis. Likewise, peak events also are associated with certain synoptic climatic patterns that vary on all time scales. Geologic records preserved in lake sediments have the potential to capture the non-stationarity in frequency-magnitude relationships, but few such records preserve a continuous history of event magnitudes. We present a 10-meter 2000-yr record from Upper Squaw Lake, Oregon, that contains finely laminated silt layers that reflect landscape erosion events from the 40 km^2 watershed. CT-scans of the core (<1 mm resolution) and a ^{14}C-dated chronology yielded a pseudo-annual time series of erosion magnitudes. The most recent 80 years of the record correlates strongly with annual peak stream discharge and road construction. We examined the frequency-magnitude relationship for the entire pre-road period and show that the seven largest events fall above a strongly linear relationship, suggesting a distinct process (e.g., severe fires or earthquakes) operating at low-frequency to generate large-magnitude events. Expressing the record as cumulative sediment accumulation anomalies showed the importance of the large events in "returning the system" to the long-term mean rate. Applying frequency-magnitude analysis in a moving window showed that the Q_{100} and Q_{10} of watershed erosion varied by 1.7 and 1.0 orders of magnitude, respectively. The variations in watershed erosion are weakly correlated with temperature and precipitation reconstructions at the decadal to centennial scale. This suggests that dynamics both internal (i.e., sediment production) and external (i.e., earthquakes) to the system, as well as more stochastic events (i.e., single severe wildfires) can at least partially over-ride external climate forcing of watershed erosion at decadal to centennial time scales.

ORAL

RETOOLING LICHENLAND: OUTREACH AND EDUCATION IN THE FIELD OF LICHENOLOGY. Abby L. Glauser, Bruce McCune. Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon, 97331; *glauseab@oregonstate.edu*

From a lichenologist's perspective, there is little questioning the importance of lichens within a landscape. Contributions to biodiversity, food webs, and nutrient cycles are all examples of why we value and strive to protect lichen habitats. However, these cryptic organisms are often overlooked by those who do not study them directly. Furthermore, those who do notice them often struggle as beginners to name and understand them. A need exists for resources to help educate students and the general public about the nature and significance of lichens. Over 20 years ago, the web site "LichenLand" (http://ocid.nacse.org/lichenland/) was developed by Sherry Pittam at Oregon State University as a tool for introducing lichens to a general audience. Although this site presents useful materials, it has become rather dated and experiences infrequent use. We plan to rebuild and modernize this site to reach a larger audience, and provide additional learning features, such as updated versions of lesson plans from the USFS Air Quality website. The enhancement of this site for public use will partially fulfill the broader impacts of an NSF funded project incorporating more than 150,000 Forest Service lichen specimens into the Oregon State University Herbarium (OSC). This presentation will offer a tour of LichenLand, and consider its strengths and weaknesses as a learning tool. We will propose to the audience several new directions, then lead a discussion in which our fellow lichen enthusiasts may offer critiques of the existing site, our proposed new directions, and ideas on how to improve our outreach.

ORAL

CONFLUENCE OF ARTS, HUMANITIES, AND ECOLOGY AT H.J ANDREWS EXPERIMENTAL FOREST. Charles Goodrich. Spring Creek Project, College of History, Philosophy, and Religion, Oregon State University, Corvallis, OR 97331; *charles.goodrich@oregonstate.edu*

The Long-Term Ecological Reflections program, now in its 13th year, hosts residencies at the H.J. Andrews Experimental Forest, and field symposia at the Andrews Forest, on Mount St. Helens and in other iconic Northwest landscapes. The program bring together scientists, creative writers, philosophers and others from the humanities, gathering the insights from multiple ways of knowing to tackle questions about humans' place in the natural world. This presentation will report on the methods, successes and products of the Reflections program, including a just-published book, Forest Under Story: Creative Inquiry in an Old-Growth Forest, a music composition project at the Andrews Forest, an art exhibit on the ecology of decomposition and other current projects.

ORAL

MODELING SPECIES DISTRIBUTION OF AN ECOSYSTEM ENGINEER, *CAREX NUDATA*, A DISTURBANCE-ADAPTED RIPARIAN SEDGE. **Matthew Goslin**, Department of Geography, 1251 University of Oregon, Eugene, OR, 97403; *goslin@uoregon.edu*

Carex nudata (torrent sedge) occurs in rivers throughout Oregon and California, and where prominent appears to function as an ecosystem engineer capable of altering river morphology. *C. nudata* appears to enhance channel complexity, a key goal of river restoration, and may indirectly facilitate the presence of other species, enhancing diversity. While the species appears to play a key role in river ecosystems, little is known about the drivers of its distribution. Using herbaria data and a species distribution model (SDM) designed for presence-only data (Maxent), I constructed a range-wide SDM that incorporated hydrological variables derived from the National Hydrographic Dataset Plus (NDHPlus) in addition to climate variables traditionally used in SDMs. The Maxent model revealed that hydrological variables dwarfed those of climate in explanatory power. Given the limitations inherit in using archival presence-only data, I used this initial predictive model to develop a systematic sampling scheme to facilitate development of a more robust model of *C. nudata* distribution. I conducted surveys of *C. nudata* and associated environmental factors within two Oregon river basins from headwaters to lower reaches. Preliminary results suggest that *C. nudata* distribution is patterned relative to factors that vary along headwater-to-mouth continuums. In particular, *C. nudata* appears to be associated with reaches high in stream power (high disturbance potential), but thresholds may exist at which stream power is too high for establishment. Canopy cover - driven by stream size, valley steepness and vegetation community - also appear to be a key drivers of *C. nudata* distribution.

ORAL

THE INTERSECTION OF ART AND ECOLOGY AT THE SITKA CENTER: AN UNCONTROLLED EXPERIMENT. **Sarah Greene**, Retired Forest Ecologist, Pacific Northwest Research Station, 7700 NW Ridgewood Dr., Corvallis, OR 97330; *seginor@gmail.com*

Art has been an integral and leading force at the Sitka Center for Art and Ecology since its founding in 1970. Art residencies, art workshops and the Sitka Art Invitational are mature, well-established programs at Sitka. Ecology on the other hand is a concept that has been "understood" but has never been formally articulated. Ecology as the concept of place at Sitka is central to its ethos; ecology-oriented workshops and science oriented residents have both been part of its programming, but only recently has Sitka adopted an articulated vision that seeks intentionally to integrate ecology/science with artistic expression. Through a series of visual and written examples, this talk will trace the evolution of Sitka's relationship with ecology/science and its intentions for the future.

POSTER

INTERPRETING ECOLOGY BY COMMUNICATING A CONSERVATION LAND ETHIC THROUGH STORYTELLING, CULTURE, AND ART. Robin Lee Gyorgyfalvy, Department of Landscape Architecture, Scenic Byways, and Interpretation, Deschutes National Forest, 63095 Deschutes Market Road, Bend, OR 97701; *rgyorgyfalvy@fs.fed.us*

As the Scenic Byways Program Leader and Landscape Architect for the Deschutes National Forest, my goal has been to introduce visitors to the natural, scenic, recreational, and cultural values found on public lands. Through a "Tour of Interpretive Sites" developed on the Cascade Lakes National Scenic Byway, visitors and families that are from the region and beyond have enjoyed learning about the ecological and scientific wonders of these treasured landscapes through storytelling, culture, and art. These have been in the form of Scenic Byway brochures and interpretive sign panels at viewpoints, interpretive trails, and visitor centers. Each of these creations have been designed to visually and intuitively integrate facts about the natural and scientific world with colorful and whimsical images and creative writing that communicates a conservation land ethic and interprets the ecological landscape. Storytelling often originates from generations of tradition that place a high value on the respect of land and culture. Art provides a way for individuals to better connect with and learn more about the special places they are experiencing. Haiku poetry is another cultural tradition that has found its way to the Cascade Lakes National Scenic Byway through an annual creative writing workshop called "Haiku Highway". This has culminated in the publication and production of a hand-made poetry book that reflects how a group of poets are experiencing and connecting to special places along a Scenic Byway.

ORAL

MIXED CONIFER AND PONDEROSA PINE FORESTS 90 YEARS AGO IN CENTRAL OREGON. R. Keala Hagmann, Applegate Forestry LLC, 28831 Tampico Road, Corvallis, OR 97330; Jerry F. Franklin, School of Environmental and Forest Sciences, University of Washington, Box 352100, Seattle, WA 98195; K. Norman Johnson, Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, OR 97331; Debora L. Johnson, Applegate Forestry LLC, 28831 Tampico Road, Corvallis, OR 97330; *hokulea@uw.edu*

Landscape-level inventories conducted 90 years ago describe the structure and composition of fire-prone forests. This record of a systematic 20% sample of more than 500,000 ha on two large landscapes in the eastern slopes and foothills of the Cascade Range indicates that the density of conifers larger than 15 cm dbh was predominantly low and dominated by large (≥ 53 cm dbh) fire- and drought-tolerant trees. Density and size distributions were similar on both landscapes despite differences in species composition. Large, treeless openings and stands composed solely of small-diameter trees, which might result from high-severity disturbance, were recorded only in lodgepole pine and in wetter, colder forests. We compared the conditions recorded in the 90-year-old timber

inventory to those described in two earlier historical records: 1899-1900 United States Geological Survey reports and, for a 24,000 ha subset, 1866-1909 General Land Office (GLO) survey notes. Pine (predominantly ponderosa with some sugar pine) was the most ubiquitous and abundant species group in all three historical records. Prevalence of large trees and substantial spatial heterogeneity in both density and composition were recorded in the two records that include tree size and spatial data: the timber inventory and the GLO survey. On both landscapes current conditions show increase in density, shift to dominance by shade-tolerant species, and loss of widespread dominance of large fire- and drought-tolerant trees. The variability described in this record of historical composition, density, and structure at multiple spatial scales is relevant to restoration and conservation of desired ecosystem functions.

ORAL

CALICIOID LICHENS AND FUNGI FROM GIFFORD PINCHOT AND OKANOGAN NATIONAL FORESTS: NEW RECORDS AND A SUMMARY OF FINDINGS. **Amanda Hardman,** Daphne Stone, Stone Ecosurveys, 30567 Le Bleu Rd., Eugene, OR 97405; Steven B. Selva, Department of Natural and Behavioral Sciences, University of Maine at Fort Kent, 23 University Drive, Fort Kent, ME 04743; *stoneecosurveys1@gmail.com*

Calicioids, often called "pin lichens", are a polyphyletic group of lichens and nonlichenized fungi with tiny, pin-like apothecia. In most species, minute stalks raise the spore-bearing capitulum above the boundary layer, thus promoting the dispersion of spores to new locations. We sampled calicioid lichens and fungi on Gifford Pinchot and Okanogan-Wenatchee National Forest lands in southwestern Washington. We sampled at 64 plots and made 930 collections consisting of 57 different species in 8 genera. Several new species records were made including *Chaenothecopsis nivea* and *Chaenothecopsis lecanactidis,* which are new to North America; *Chaenothecopsis norstictica* which is new to western North America; and *Chaenothecopsis vainioana* which is new to Washington State. There were an average of 15 species per plot and a maximum of 25 species per plot. The bark and wood of boles, branches, roots, and resin of 16 species of conifers, 4 species of hardwoods, and 2 species of shrubs served as substrate for calicioids on our plots. Most collections came from boles of live trees of all species (bark in particular). *Pseudotsuga menziesii* was the most common tree species host among the collections we made. Calicioids were also found on snags and logs of unknown tree species, rocks, polypore fungi, and lichens.

ORAL

ART INSPIRED BY THE SCIENCE OF ROT: THE AFTERLIFE OF TREES. **Mark E. Harmon**, Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR 97331; *mark.harmon@oregonstate.edu*

An art show entitled "Rot: The Afterlife of Trees" was developed in collaboration with the Corvallis Art Center and the Spring Creek Project as a way to engage a wide

community in thinking about a frequently overlooked ecological process: decomposition. Field trips were used to engage visual, performance, and musical artists in the science of decomposition, its relevance to ecosystem function and forest management. Works were submitted to a panel and those selected were displayed and highlighted in four community events which engaged the public, scientists, artists, and managers. Elementary students contributed to murals depicting the role of dead trees in forests and also visited the show to see their work and those of the other artists. Rather than depicting specific scientific results, this project allowed artists to provide their insights into the general process. This more general approach provoked a diverse set of conversations ranging across the relationships between art and science, themes related to decomposition including the meaning of permanence, mortality, recycling, and legacies, as well as the role of dead trees in the management of forests. It is therefore likely to have engaged a more diverse set of participants and more significantly influenced how the forest is considered than an artistic interpretation of a specific scientific result. Finally, this project reminds us that a science-humanities collaboration can be an essential tool in building a more complete understanding of natural resources and the processes that create them.

ORAL

PHENOLOGY OF PACIFIC NORTHWEST TREE SPECIES. Constance A. Harrington, Kevin R. Ford, USDA Forest Service, Pacific Northwest Research Station, 3625 93rd Ave SW, Olympia, WA 98512; *charrington@fs.fed.us*

This talk will review several research projects on the phenology of Pacific Northwest trees. Phenology is the study of the timing of recurring biological events. For foresters, the most commonly observed phenological events are budburst, flowering, seed shed, and leaf fall, but other harder-to-observe events such as the initiation of diameter growth are also of interest. Most events which occur in the spring are influenced by exposure to cool (chilling) temperatures as well as warm (forcing) temperatures. For Pacific Northwest tree species, chilling temperatures generally promote earlier height growth initiation, but species differ in their sensitivity to chilling and forcing and whether or not some minimum amount of chilling is required for budburst to occur at all. In contrast to height growth in many species, diameter growth may not require chilling, begins 6 to 8 weeks before the initiation of height growth, and on some sites plants may have completed 1/3 or more of their diameter growth prior to initiating height growth (bursting terminal bud). We have developed models of plant responses to temperature which allow us to predict of the timing of both past as well as possible future events and can be used to evaluate changes in phenology in conjunction with changes in the timing of frost events or the availability of favorable conditions (warm temperatures, high soil moisture) during the growing season.

ORAL

EFFECTS OF VARIABLE-RETENTION FOREST HARVESTING AND SOIL DISTURBANCE ON CHIPMUNK (*TAMIAS* SPP.) ABUNDANCE IN WESTERN WASHINGTON AND OREGON. Timothy B. Harrington, Randall J. Wilk; U.S. Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3625 93rd Avenue SW, Olympia, WA 98512-1101; *tharrington@fs.fed.us*

In the Demonstration of Ecosystem Management Options (DEMO) study, we evaluated two-year effects of variable-retention forest harvesting on chipmunk (*Tamias* spp.) abundance and habitat in western Washington and Oregon. In a randomized complete-block design, six treatments were applied to 13-ha units at three sites (blocks): four retention levels in an aggregated tree pattern (100, 75, 40, and 15% of initial basal area [BA]) and two retention levels in a dispersed tree pattern (15 and 40% BA). Log-yarding method (i.e., suspension cable, shovel-loader, or helicopter) differed at each site because of topography. Chipmunk abundance declined 50% as retention level decreased from 100 to 15% ($R^2 = 0.36$). Cover of herbs and low shrubs converged to values less than 20% with decreasing retention level ($R^2 = 0.90$), and the rate of decline varied by yarding method as cable > shovel-loader > helicopter. Disturbed soil cover varied inversely with retention level ($R^2 = 0.82$), and at 15% retention, predicted values differed among cable (16%), shovel-loader (10%), and helicopter (6%) yarding methods. As disturbed soil cover increased from 0 to 16%, chipmunk abundance declined 70% ($R^2 = 0.53$). The best predictor of chipmunk abundance was disturbed soil cover because it simultaneously accounted for forest harvesting impacts to cover, food supply, and mobility – critical elements of chipmunk habitat.

ORAL; POSTER (COFSS)

FUELS TREATMENTS OF PONDEROSA PINE (*PINUS PONDEROSA)* IN THE BLUE MOUNTAINS OF EASTERN OREGON: A MYCORRHIZAL PERSPECTIVE. Benjamin T. Hart, Department of Forest Ecosystems and Society, Oregon State University, 3100 SW Jefferson Way, Corvallis, OR 97330; Jane E. Smith, Pacific Northwest Research Station, USDA Forest Service, 3200 SW Jefferson Way, Corvallis, OR 97330; *ben.hart@oregonstate.edu*

Severe wildfires are an increasing risk as the western United States becomes hotter and drier for longer periods annually due to the changing climate. Reduction of historically uncharacteristic woody fuels that drive large, severe forest fires is an increasing priority for forest managers. Traditionally, fuel reduction has been achieved with mechanized thinning for removing over-crowded trees and low-intensity prescribed fire to reduce woody fuels near the forest floor. However, the long-term impact of these fuel reduction treatments is poorly understood with respect to ectomycorrhizal fungi (EMF). We quantified EMF biodiversity and abundance associated with ponderosa pine (*Pinus ponderosa*) in four randomly assigned replications of restoration treatments (thinned, burned, thinned and burned, and untreated), applied over a decade ago in the Blue Mountains of Oregon. The belowground community composition and structure of EMF

at the site were characterized using molecular methods. Preliminary results indicate that species richness and abundance were similar across treatment types, and that fire effects on community composition were smaller than anticipated. Our results provide evidence that a 10+ year interval allows EMF to disseminate and re-colonize areas from which they have been removed or reduced by disturbance treatments. Knowledge of the long-term impacts of forest restoration treatments on EMF will aid in understanding the outcomes of management designed to produce stands with large-tree retention and low fuel loads.

ORAL

EAST MEETS WEST IN ALBERTA'S GRASSLAND LICHEN COMMUNITIES.
Diane L. Haughland, Alberta Biodiversity Monitoring Institute at the Royal Alberta Museum, 12854 102 Avenue NW, Edmonton, AB T5N 0M6, Canada; *diane.haughland@gov.ab.ca*

Prior to the advent of the Alberta Biodiversity Monitoring Institute (ABMI) little was understood about Alberta's grassland lichen diversity, particularly east of the foothills fescue natural region. This deficit is slowly being remedied; from 2007 to 2014, ABMI completed macrolichen, bryophyte, and vascular plant surveys at 312 1-ha sites across all of the grasslands natural subregions. The results suggest that Alberta's grasslands host a fascinating macrolichen assemblage with a mix of species typically found further east (e.g., *Cladonia robbinsii, C. rei* and *Physcia millegrana*) as well as rarer species documented to the west of Alberta (e.g., *Xanthoparmelia camtschadalis* and *Cladonia imbricarica*). Macrolichens contribute 17-36% of the vegetative species at grassland sites, with an average species richness of 11 species and a maximum observed richness of 26 species. Those species also are disproportionately negatively impacted when anthropogenic disturbance intensifies. For example, macrolichen species richness at the most disturbed sites declined 58-82% vs. that found at undisturbed sites, while bryophyte and vascular plant richness declined 28-60%. I will use the species previously mentioned as case studies to explore the ABMI's ability to understand species' autecology, as well as discuss some of the taxonomic mysteries that remain within key genera such as *Cladonia* and *Xanthoparmelia*. These results are critical in contextualizing Alberta's lichen diversity within one of its most altered natural regions, at both the provincial scale (e.g., improving evidence behind conservation rankings and habitat associations) and in North America at large.

ORAL

APPLYING THE PRINCIPLES OF LANDSCAPE RESTORATION WITHIN THE EAST CASCADES, THE MANASTASH-TANEUM RESILIENT LANDSCAPE PROJECT. **Ryan Haugo,** The Nature Conservancy, Yakima, WA 98902; Bill Gaines, Washington Conservation Science Institute, Leavenworth, WA 98826; James Begley, Washington Conservation Science Institute, Leavenworth, WA 98826; Jamie Robertson, The Nature Conservancy, Seattle, WA 98121; Paul Hessburg, USDA Pacific Northwest Research Station, USDA Forest Service, Wenatchee, WA 98801; James D. Dickinson, USDA Pacific Northwest Research Station, USDA Forest Service, Wenatchee, WA 98801; *rhaugo@tnc.org*

Extensive efforts are being made across North America to restore the ecological patterns and processes of historically fire-dependent forested ecosystems. However, there is a growing recognition that a simple focus on stand-level forest management and uncoordinated terrestrial and aquatic restoration efforts will not lead to resilient ecosystems capable of continuing to provide critical habitat and ecosystem services in the face of a warming climate. The need for a landscape scale approach was recently crystalized in Hessburg et al.'s (2015) Restoring fire-prone landscapes: seven core principles. Here we describe the analytical foundation for applying these core principles within the Manatash-Taneum Large Landscape Restoration Project area. The project encompasses ~40,000 ha in the central Washington Cascades with a mix of federal, state, and private ownership, and is focused on 1) improving watershed conditions and processes, 2) restoring aquatic habitats to support recovery of listed fish, 3) restoring patterns of vegetation and habitat successional patches, and 4) restoring inherent fire/disturbance regimes. Following the core principles, we have produced comprehensive "landscape prescriptions" using historical and future climate change analogue reference conditions, which provide the basis for land managers to effectively work across ownership boundaries while respecting individual landowner objectives.

POSTER

***THAMNOPHIS* HEAD MORPHOLOGY: SIZE AND CONSTRAINTS AS A RESULT OF DIET.** **Alex Heimerdinger**, Randi Bowman, Michael Edgehouse, Lewis-Clark State College, 500 8th Ave., Lewiston, ID 83501; *mjedgehouse@lcsc.edu*

We measured and compared head morphology of two populations of Terrestrial Garter snake (*Thamnophis elegans*) with known diet differences. Snakes feeding primarily on aquatic prey (fish, amphibians, and leeches) were collected along the Grande Ronde River in southeastern Washington and compared to a population of snakes from the Santa Lucia Preserve (SLP) known to be terrestrial prey specialists. Head morphology was quantified by measuring head length, head height, head width, jaw length, jaw width, and inter-ocular distance. Using least-squares means and scaling snakes for snout-vent length, the Grande Ronde population had a significantly longer jaw, wider jaw, taller head, and greater inter-ocular distance ($p < .05$). Using principal components analysis, the terrestrial specialist snakes from SLP displayed a greater variation in head

morphology whereas the aquatic specialist snakes from Grande Ronde displayed less variation in head morphology. This data may provide evidence of constrained head morphology in snakes that exhibit an aquatic food preference.

ORAL

BREEDING ECOLOGY VARIATIONS IN ADULT AND SECOND-YEAR FEMALE TREE SWALLOWS (TACHYCINETA BICOLOR) AT OTTER LAKES, ANCHORAGE, ALASKA. Lindsay F. Hermanns, 3101 W Riverdell Drive, Wasilla, Alaska, 99654; Audrey R. Taylor, Department of Geography and Environmental Studies, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AK 99508; *lfhermanns@alaska.edu*

Current observations indicate that Tree Swallows are expanding their range in Alaska, however, little research has been done to determine the demographic composition of this expanding population and how this may impact reproductive success. Colonizing populations of birds are thought to be comprised of larger proportions of younger individuals, and which may breed later than older individuals. Later-breeding individuals may experience reduced nest success, thus the demographic composition of a colonizing population may impact its reproductive output. The goal of this project was to examine whether breeding parameters (incubation constancy and hatching success) varied between adult and second-year female Tree Swallows or between early- and late-nesting females in a newly established nest box colony at Otter Lake, near Anchorage, AK. During the summer of 2015, we monitored 150 nest boxes positioned around Otter Lake in 2013. Boxes were monitored every 3 days for swallow activity, and adult Tree Swallows attending boxes were captured and banded prior to chicks fledging. Chicks were also measured and weighed at 3, 6, and 10 days post-hatch to monitor growth. There was no significant association between female age and early vs. late initiated nests, although there were more early nests than late nests overall. The proportion of chicks hatched did not vary significantly between early vs. late nests or between second year vs. adult Tree Swallows. We are currently investigating whether incubation constancy varied between early vs. late nests or between second year vs. adult females even if proportion of chicks hatched did not.

ORAL

RESTORING FIRE-PRONE INLAND PACIFIC LANDSCAPES: SEVEN CORE PRINCIPLES. Paul Hessburg. USDA Pacific Northwest Research Station, Wenatchee, WA 98801; *phessburg@fs.fed.us.*

More than a century of forest and fire management of Inland Pacific landscapes has transformed their successional and disturbance dynamics. Regional connectivity of many terrestrial and aquatic habitats is fragmented, flows of some ecological and physical processes have been altered in space and time, and the frequency, size and intensity of many disturbances that configure these habitats have been altered. Current efforts to address these impacts yield a small footprint in comparison to wildfires and insect

outbreaks. Moreover, many current projects emphasize thinning and fuels reduction within individual forest stands, while overlooking large-scale habitat connectivity and disturbance flow issues. We provide a framework for landscape restoration, offering seven principles. We discuss their implication for management, and illustrate their application with examples. Historical forests were spatially heterogeneous at multiple scales. Heterogeneity was the result of variability and interactions among native ecological patterns and processes, including successional and disturbance processes regulated by climatic and topographic drivers. Native flora and fauna were adapted to these conditions, which conferred a measure of resilience to variability in climate and recurrent contagious disturbances. To restore key characteristics of this resilience to current landscapes, planning and management are needed at ecoregion, local landscape, successional patch, and tree neighborhood scales. Restoration that works effectively across ownerships and allocations will require active thinking about landscapes as socio-ecological systems that provide services to people within the finite capacities of ecosystems. We focus attention on landscape-level prescriptions as foundational to restoration planning and execution.

ORAL

TRACKING LATE DEVONIAN REACTIVATION OF THE TOOELE ARCH WITH DETRITAL ZIRCON PROVENANCE, GREAT BASIN. **Natalie A. Hollis**, Leif Tapanila, Paul K. Link, Department of Geosciences, Idaho State University, 921 S. 8th Ave, Pocatello, ID 83209-8072; *hollnat2@isu.edu*

Detrital zircons record two provenance signatures for Late Devonian sandstones along the western North American passive margin. In Idaho, Utah, and Nevada, sandstones interbedded with the carbonate platform display separate provenance north and south of the east-west trending Tooele Arch. Timing constraints on the activity of the Tooele Arch have dominantly described the arch as being an active structural feature to the end of the Silurian, however a distinct separation in provenance combined with isopach maps suggests the Tooele Arch was a structural high during the Late Devonian. The arch was expressed by the Stansbury Uplift, a localized eroded antiform located west of the Great Salt Lake, which began to uplift only in the Late Devonian. For this reason, it is difficult to discern whether the Tooele Arch was a positive topographic feature through the earlier epochs of the Devonian. A “northern” signature of central-southeastern Idaho consists of zircon grains >1.8 Ga and subordinate populations of Archean grains. Detrital zircon grains >1.8 Ga were proximally sourced from uplifted Ordovician Swan Peak Formation and Eureka Quartzite, and ultimately sourced from cratonic basement exposed by the Canadian Peace River Arch. The “southern” signature is identified by Grenville (1.3-1.0 Ga), and Yavapai-Mazatzal (1.8-1.6 Ga) zircon populations within the Guilmette sandstone of southern Nevada. “Mixed” signatures containing all mentioned zircon populations exist within northeastern Nevada and central Utah, most proximal to the location of the Tooele Arch.

POSTER (COFSS)

A 'LEOPOLDIAN' FIRE ETHIC TO INSPIRE ECOLOGICAL FIRE MANAGEMENT. Tim Ingalsbee, Firefighters United for Safety, Ethics, and Ecology, Eugene, OR 97403; *fire@efn.org*

Firefighters United for Safety, Ethics, and Ecology (FUSEE) is a national nonprofit organization promoting safe, ethical, ecological wildland fire management. FUSEE members include current, former, and retired wildland firefighters; fire managers, scientists, and educators; forest conservationists; and other concerned citizens who support FUSEE's vision and mission. FUSEE's primary mission is to provide public education and policy advocacy in support of the emerging paradigm that seeks to holistically manage wildland fire for social and ecological benefits instead of simply "fighting" it across the landscape. We seek to enable fire management workers to perform their duties with the highest professional, ethical, and environmental standards. Our long-term goal is the creation of fire-compatible communities of workers and citizens able to work safely and live sustainably with wildland fire. Inspired by Aldo Leopold's "Land Ethic," FUSEE advocates for a new "Fire Ethic" in fire management policies and practices: "A thing is right when it contributes to the safety of firefighters and the public, ethical use of public resources, environmental protection of fire-affected landscapes, and ecological restoration of fire-dependent ecosystems. It is wrong when it tends otherwise." This poster will display some of FUSEE's philosophy, research, education, and advocacy projects. Elaboration of some key FUSEE concepts will be featured, including: the FUSEE triad of safety, ethics and ecology; re-identifying firefighters as fire rangers; promoting community fire preparation; creating fire-compatible communities, restoring fire-permeable landscapes, and the fire ethic for ecological fire management.

ORAL

MONITORING RESTORATION TREATMENTS AT STAND AND LANDSCAPE SCALES. Sean M.A. Jeronimo, School of Environmental and Forest Sciences, College of the Environment, University of Washington, Seattle, WA 98195; Gunnar C. Carnwath, U.S. Forest Service, 1550 Dewey Avenue, Baker City, OR 97814; Derek J. Churchill, Van R. Kane, School of Environmental and Forest Sciences, College of the Environment, University of Washington, Seattle, WA 98195; *jeronimo@uw.edu*

We compared post-treatment structure to reference conditions for two Collaborative Forest Landscape Restoration (CFLR) project areas at two scales to assess efficacy of treatments in promoting resilient structure and pattern. First, we mapped residual forest structure in terms of individual trees, clumps, and openings on 5 treated units in the CFLR Area on the Malheur National Forest, OR (MNF). We compared these maps to reconstructed historical stand-level spatial pattern. Second, we used pre- and post-treatment LiDAR data to evaluate the change in conditions across a 3,340 acre CFLR project on the Sierra National Forest, CA (SNF), compared to a contemporary active-fire reference area in the Illilouette Valley, Yosemite National Park. On the MNF, treated

stands had more individual trees, more uniform spacing, and fewer large clumps and openings relative to reference stands. The treatments on the SNF reduced the amount of area in dense patches, decreased the average size of dense patches, and increased the average size of low-density patches. Compared to the reference area, the post-treatment landscape had fewer regeneration patches and more dense area with large tree cover. The reference condition datasets represent forests that have been demonstrably resilient in the face of fire and other disturbances. The multi-scale monitoring tools presented in this study help to evaluate the outcomes of restoration treatments in terms of measurable progress toward known resilient conditions.

ORAL

UNDERSTORY RESPONSE TO VARYING FIRE RETURN INTERVALS IN AN OLD-GROWTH PONDEROSA PINE FOREST. Elizabeth J. Johnson, Gregg M. Riegel, Sara C. Lovtang, U.S Forest Service Central and Southcentral Area Ecology Program, Deschutes National Forest, 63095 Deschutes Market Rd., Bend, OR 97701; Matt D. Busse, USFS Pacific Southwest Research Station.,1731 Research Park, Davis, CA 95618; *elizabethjohnson@fs.fed.us*

We studied the vegetation response to re-introduction of prescribed fire in the Metolius Research Natural Area, Deschutes National Forest, where fires burned historically every 2 to 47 years. Replicate plots were burned every 5, 10, or 20 years beginning in 1992, and understory vegetation measurements have been compared biannually to each other and to unburned-control plots. Several differences in herbaceous plant and shrub responses to fire frequency have been detected in 20+ years of treatment. Burning stimulated the dominance of the heavily rhizomatous bracken fern (*Pteridium aquilinum*), which now is found in all burn treatments but remains absent in the control. Higher graminoid cover and biomass, especially of fine leaved grasses such as Idaho fescue (*Festuca idahoensis*) and western fescue (*F. occidentalis*) has been consistently found on control plots, compared to higher forb cover and biomass on the burn treatments. Among the frequency-of-burn treatments, however, we do not see a clear difference in forb or graminoid response. The main difference in post-fire response has been a dramatic decrease in density and cover of bitterbrush (*Purshia tridentata*), a fire-sensitive shrub. Snowbrush (*Ceanothus velutinus*), a fire adapted shrub that establishes from seed and root crown sprouts, gradually increased in density and cover in the 10-year and 20-year burn treatments, with the highest levels found in the 10-year plots. Snowbrush presence in the 5-year and control treatments remains negligible. Different fire return intervals do not necessarily create maintenance of understory fuel conditions, but can create different successional trajectories. Our results can assist managers in better selecting prescribed fire re-entry intervals based on their particular management objectives.

ORAL

ENVIRONMENTAL HISTORY OF DISSOLVED OXYGEN, COOS BAY ESTUARY, OREGON COAST RANGE. **Geoffrey M. Johnson**, Daniel G. Gavin, Department of Geography, University of Oregon, Eugene, OR 97403; David R. Sutherland, Joshua Roering, Nathan Mathabane, Department of Geological Sciences, University of Oregon, Eugene, OR 97403; *gmj@uoregon.edu.*

Environmental history recorded in sediments is a lens through which landscape change can be understood. Additionally, sedimentary sequences can reconstruct past records of important estuarine water quality metrics, such as dissolved oxygen, through the use of geochemical and biological proxies. Sedimentary proxies may thus be important for contextualizing natural and anthropogenic ecological variability over time in complex estuarine settings. Furthermore, sedimentary proxies may aid in developing criteria for reference conditions in restoration and management. In April 2014, we collected four sediment cores from two locations in the Coos Bay Estuary spanning from early Euro-American settlement to the present. An age-depth model for each core was constructed using 210Pb and 14C. To address the historical record of water column oxygen in the estuary we measured a suite of geochemical proxies including organic matter and carbonate concentration, magnetic susceptibility, mineralogy and elemental composition. To characterize land-use cover change in the watershed we used the sedimentary pollen record. Dissolved oxygen has been measured extensively in the Coos Bay estuary for multiple decades allowing thorough calibration of proxies against a detailed record. We noted extensive covariation in some redox-sensitive metals as well as organic matter preservation, and significant differences in elemental compositions down core. By applying multi-proxy historical synthesis we reduced uncertainty in geochemical data surrounding the pollution history in the estuary and placed human impacts in the context of the environmental record. We present the history alongside geochemical analysis to track decadal and centennial variability in dissolved oxygen and development in this seasonal Pacific Northwest estuary.

ORAL

SUCCESSIONAL ACCRETION ALONG A PRODUCTIVITY GRADIENT FOLLOWING FIRE EXCLUSION IN THE SOUTHERN BLUE MOUNTAINS, OREGON. **James Johnston**, John Bailey, College of Forestry, Oregon State University, 140, Peavy Hall, 3100 SW Jefferson Way, Corvallis, OR 97333; *james.johnston@oregonstate.edu*

Numerous studies have documented significant change to conifer forests of the inland Pacific Northwest following the cessation of recurrent fire at the end of the 19th century. But the relative resilience of different forest types in the absence of fire disturbance and the mechanisms that influence successional pathways in different landscape settings are largely unexplored. This study reconstructs historical fire occurrence and forest structural and compositional change along a broad productivity gradient on the 688,000 ha Malheur National Forest in the southern Blue Mountains of eastern Oregon. Historical

fire return intervals were only marginally longer in productive mixed conifer sites than in less productive sites dominated by ponderosa pine. Analysis of structural and compositional change at thirty-year intervals over the last 150 years demonstrated that the greatest magnitude of change has occurred in mixed conifer plots and in ponderosa pine dominated plots that lack significant live old growth structure. Ponderosa pine dominated plots with significant live old growth structure have experienced relatively little change even after more than a century without fire. Historical stand structure/composition characteristics are predictors of successional accretion more than geophysical variables such as elevation, solar insolation, and vapor pressure deficit. Moister more productive mixed conifer sites were historically strongly coupled via frequent fire disturbance to the broader dry forest landscape pattern and should be a priority for restoration.

ORAL

PREDICATORS OF SOIL ORGANIC MATTER IN THE *ARTEMISIA TRIDENTATA/FESTUCA IDAHOENSIS* HABITAT TYPE, SOUTHWESTERN, MONTANA. Clayton B. Marlow, **Morgan Kauth,** Nate Haygood and Max Memalaar, Animal and Range Sciences Department, Montana State University, Bozeman, MT 59717-2900; *cmarlow@montana.edu*

Land managers use measures of plant cover and soil surface litter as surrogates for soil organic matter (SOM); the higher either measure the more likely that SOM levels will be sustained. However, there is relatively little information to support this 1:1 relationship. An ongoing field study to develop ecological site descriptions for the Gardiner Basin of southwestern Montana has provided an opportunity to investigate the expected relationship between soil cover and SOM. Twenty-one randomly located sites were sampled for plant community composition (% cover) in the *Artemisia tridentata/Festuca idahoensis* h.t. during the summer of 2015. Inventory site selection was embedded within polygons stratified by geology (unconsolidated or bedrock) and slope (0-4%, 4-15%, 15-35% and 35-60%). A soil sample was collected from each soil pit excavated in conjunction with the vegetation community inventory. Total SOM (loss on ignition) was determined for each collection. Regression analysis indicated that perennial grass cover was a significant ($p = 0.09$) indicator (adj. $r^2 = 0.95$) of soil organic matter on gently rolling landscapes. On moderately steep slopes (15 – 35%) both soil surface litter and perennial grass cover were significant ($P = 0.03$) predicators of soil organic matter (adj. $r^2 = 0.48$). However, perennial grass cover was the only factor that predicted soil organic matter ($p = 0.03$, adj. $r^2 = 0.79$) on slopes greater than 35%. Based on these results ecologists and managers can use perennial grass cover within the *Artemisia tridentata/Festuca idahoensis* h.t as a predicator of soil organic matter.

POSTER (COFSS)

HISTORICAL PATTERNS OF STAND DEVELOPMENT IN PONDEROSA FORESTS DURING NATURAL FIRE REGIMES. **Kayla Johnston**, Andrew Merschel, John Bailey, and Rob Pabst, Oregon State University, Corvallis, OR 97331; *kayla.johntson@oregonstate.edu*

There is strong interest in restoring the spatial pattern and development processes in ponderosa pine forests following a century of fire exclusion in central Oregon. Restoration of relatively fine-scale (10s of acres) stand structure requires an understanding of the controls on tree establishment and the process behind formation of clumps, gaps, and individuals. Our 4 ha study area in the Metolius Research Natural Area has already been stem mapped providing an opportunity to investigate the historical development of fine-scale structure in ponderosa pine forest. Specifically we examine 1) the relationship between historical tree establishment and fire and climate, 2) the temporal development over time of clumps, gaps, and individuals, 3) recruitment and longevity of snags and logs, and 4) patterns of establishment following fire exclusion. To date, all live and dead trees >10 cm have been precisely mapped, we have completed a preliminary reconstruction of fire frequency (MFI~12years), and have developed a multi-century ring-width chronology. Results can help guide prescriptions designed to reintroduce fire as a process and restore appropriate stand structure in similar ponderosa pine forests of Oregon.

POSTER

BRINE SHRIMP (*ARTEMIA SALINA*) CYTOXICITY SCREENING OF PACIFIC NORTHWEST FOREST PLANTS. Yvette M. Karchesy, Wood Science and Engineering, Oregon State University, Corvallis, OR; **Rick G. Kelsey** USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331; George Constantine, College of Pharmacy, Oregon State University, Corvallis, OR 97331; Joseph J. Karchesy Wood Science and Engineering, Oregon State University, Corvallis, OR 97331; *rkelsey@fs.fed.us*

A search for general cytotoxic activity was conducted with the brine shrimp (*Artemia salina*) bioassay for 211 methanol extracts from 127 Pacific Northwest plants collected predominately from Washington and Oregon forests. Four toxicity levels were recognized based on the extract concentration needed to cause 50% shrimp mortality (LC_{50} µg/ml): 1) strong (<100); 2) moderate (100-500); 3) weak (500-1,000); and 4) non-toxic (>1000). Strong toxicity was found for 17 extracts from 13 species, with highest activity observed for *Angelica arguta* roots at <10 µg/ml. Notably, tree heartwood extracts from four species of cedar and one of juniper in the Cupressaceae family dominated this group with LC_{50} ranging from 15-89 µg/ml. Moderate toxicity was found in 37 extracts from 24 species, while weak toxicity was detected for 18 extracts in 11 species. There were 139 extracts from 81 species that were non-toxic. The value of this bioassay for identifying new investigational leads was validated by our subsequent

studies of conifer heartwoods with strong activity resulting in the isolation and identification of compounds with insecticidal and fungicidal properties.

POSTER

ETHANOL'S KEY ROLE IN PRIMARY ATTRACTION OF *DENDROCTONUS VALENS* TO PONDEROSA PINE STEMS HEAT STRESSED BY FIRE. Rick G. Kelsey, Douglas J. Westlind**,** USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331; *rkelsey@fs.fed.us*

Ethanol concentrations were quantified by gas chromatography in heat stressed *Pinus ponderosa* tissues for two related, but independent experiments. One study site was located in a spring wildfire and the other in fall prescribed burn near Bend, Oregon. At the wildfire, cores with phloem and sapwood were collected from *D. valens* attacked trees above a gallery entrance hole, and on the bole's opposite, unattacked side. Adjacent unattacked trees of similar diameter and injury were sampled on the same aspect and height. Prescribed fire trees were selected in groups of three characterized by: 1) one or more *D. valens* attacks and 100% crown scorch; 2) no attack and 100% crown scorch; and 3) no attack and <100% crown scorch. Attacked trees were sampled above a beetle gallery, or equivalent positions on the other two tree boles. Ethanol concentrations at both fires were statistically higher in tissues above beetle gallery holes than in corresponding tissues from the unattacked sides of the same tree, or adjacent trees. Ethanol synthesis is induced quickly by heat stress and accumulates in stem tissues. Its release to the atmosphere in a mixture with tree monoterpenes serves as the initial attractant for pioneering beetles, while those arriving later selected previously attacked trees, suggesting a secondary pheromone attraction, possibly enhanced by host tree monoterpenes, and ethanol. We conclude that enhanced ethanol release from heat stressed tissues in burned trees is the critical physiological process that links them with initial host tree and bole position selection by pioneering *D. valens*.

ORAL

BURN SEASON AND INTERVAL EFFECTS ON UNDERSTORY VEGETATION IN AN EASTERN OREGON PONDEROSA PINE FOREST. Becky K. Kerns, Pacific Northwest Research Station, Forestry Sciences Lab, 3200 SW Jefferson Way, Corvallis, OR, 97331; Michelle A. Day, Oregon State Univeristy, Forestry Sceinces Lab, 3200 SW Jefferson Way, Corvallis, OR, 97331; *bkerns@fs.fed.us*

Repeat burning simulates natural fire regimes, but there is limited information regarding optimal burn intervals and seasonality in relation to desired vegetation conditions. We evaluated repeated seasonal (spring, fall) burning effects at two intervals (5- and 15-yr; hereinafter very frequent and frequent) and no burning on understory vegetation using five ponderosa pine stands located on the southern Malheur National Forest in Oregon. Stands were inititally burned in the fall of 1997 and spring of 1998. I n 2015, after four very frequent burns or two frequent burns, total cover was the lowest in spring frequently burned, and highest in the fall frequent treatment, although cover was similar to no

burning. Total cover was significantly higher in the fall frequent burn as compared to the spring frequent treatment. Frequent and very frequent fall burning almost doubled cover of open tufted bunchgrasses but did not impact densely tuffted bunchgrasses. Spring burning, regardless of interval, and very frequent fall burning increased rhizomatous grass cover. Very frequent fall burning decreased sedge cover as compared to frequent fall burning. Cheatgrass cover increased dramatically from 2002 to 2015, even in controls. Fall burning, irrespective of interval, and very frequent spring burning significantly increased cheatgrass cover as compared to no burning. The understory appears to be fairly resilient to spring burning, even if done very frequently. Very frequent fall burning increased some native grass understory groups, but this benefit may be outweighed by the associated decrease in sedge abundance and increase in cheatgrass.

ORAL

RARE MOSS AND LICHEN SURVEYS OF BLM VALE DISTRICT NORTH UMATILLA CO., OR. David Kofranek, 843 Snell Street, Eugene, OR, 97405; *davekofranek@gmail.com*

The rare mosses, *Aloina bifrons, Bryoerythrophyllum columbianum* and the rare lichen, *Texosporium sancti-jacobi* were searched for on 13 parcels in the Columbia Basin of Oregon managed by the Bureau of Land Management. Surveys using intuitive-controlled meander found *B. columbianum* on all parcels, *Aloina bifrons* on five parcels, and *Texosporium sancti-jacobi* on one parcel. Umatilla Butte has some of the best habitat for biological soil crusts because of patches of near pristine conditions and the presence of the late successional soil crust *Acarospora schleicheri*. Two moss species new to Oregon, *Tortula inermis* and *T. protobryoides*, were found in Juniper Canyon. The rare mosses *Didymodon norrisii* and *D. eckeliae* were found on three and five parcels respectively. Moss balls and a few other noteworthy lichen species that were found are addressed. Thin, fine-grain soil and rock support the best diversity of bryophytes and lichens, however the trampling of cattle and invasive cheatgrass, *Bromus tectorum*, significantly compromise most areas.

POSTER

SPECIES-SPECIFIC LITTERFALL INPUTS OF MERCURY TO A 2ND ORDER STREAM IN A SECOND- GROWTH TEMPERATE RAINFOREST. Kyle Krueger; Abir Biswas; Abby Watt; Andrew Buechel; Michael Galvan; Bobby Appleyard; Ian Senestraro; Carri LeRoy, Evergreen Biogeochemistry and Ecology Lab, The Evergreen State College, Olympia, WA 98505; *krukyl25@evergreen.edu*

Deposition of atmospheric mercury (Hg) to foliar surfaces and subsequent litterfall is a major pathway of Hg entering forest and stream ecosystems. While Hg deposition via litterfall has been incorporated into many studies, the role of individual species in scavenging Hg from the atmosphere has been understudied. Here we examine litter deposition of major species including *Alnus rubra*, *Acer macrophyllum*, *Thuja plicata*, *Pseudotsuga menziesii*, *Tsuga heterophylla*, and epiphytes in a temperate riparian forest in the Pacific Northwest (Olympia, WA) to quantify Hg loading to a 2nd order stream

system. Litter sampling and rates of Hg loading were quantified from Fall 2014 through Fall 2015, to include a period of the 2015 drought. During September – December 2014, over-stream litter traps averaged 19.35 g/m^2/day. Deciduous species *A. macrophyllum* and *A. rubra* accounted for 57.5% and 20.5%, respectively of the total dry leaf deposition to the riparian zone, while conifer species, *T. plicata* and *P. menziesii* contributed 17.7% and 2.5% of total deposition. In fall 2014, Hg concentrations in litterfall ranged from 27.49 (*A. rubra*) to 139.23 ng Hg g^{-1} (epiphytes), and overall averaged 68.93 ng Hg/g (±1 SD, 38.16). Preliminary analysis during peak litterfall (October through mid-November 2014) indicate *A. rubra, P. menziesii,* and *T. heterophylla* scavenge significantly different amounts of Hg from the atmosphere and contribute 24.71 (±1 SD, 2.46), 19.77 (±2.44), and 5.80 (±6.97) ng Hg/m^2/day, respectively, to underlying ecosystems. Epiphytes were effective in scavenging Hg but contributed minimally (~1%) to seasonal litterfall and contributed 12.57 (±5.38) ng Hg/m^2/day.

ORAL

STORY AS A WAY IN: RESPONSE TO CHANGE IN CLIMATE AND WATER.
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In 2014-15, as a Fulbright Visiting Research Chair at the University of Alberta, I studied response to climate change and mega-drought as seen in storytelling, geographic mapping, and indigenous transformation masks. The product of the research was to be a fictional account to help popularize information about water resources in the North American West. My methods included (1) literature review, (2) field trips to areas important to water supply, and (3) study of special collections. The literature review included scouring local, national, and international news outlets, Canadian and American prose and poetry, stream and lake water-quality and water-quantity data, drought monitoring information and maps, and sociological studies on the role of artists, musicians, poets, and writers in provoking cultural and policy change around climate. Field trips included visits to tar sands sites in Alberta and headwaters areas in Alberta and British Columbia. Study of special collections was conducted in museums and provincial archives in Ottawa, Edmonton, Victoria, and Vancouver, especially of First Nations icons conveying character transformation. Results indicate that (1) effective arid-lands narratives incorporate a handful of identifiable and essential storytelling techniques learned from oral tradition and (2) cultures do not embrace a national identity of aridity or respond to climate stress until the shared experience of adversity has been incorporated into art, story, and song.

ORAL

INFORMING FOREST RESTORATION: AN APPLICATION OF SPATIAL REFERENCE CONDTIONS OF THE COLVILLE NATIONAL FOREST, WASHINGTON. Miles LeFevre; Derek J. Churchill, School of Environmental and Forest Sciences, College of the Environment, University of Washington, Seattle, WA 98195; Andrew J. Larson, College of Forestry and Conservation, The University of Montana, Missoula, MT 59812; *milesle@uw.edu*

Forest restoration efforts increasingly aim to increase resilience in response to altered disturbance regimes. Stand level spatial patterns are recognized as being important to ecological function, influencing growth, mortality, regeneration, and disturbance patterns. Forest managers often seek to incorporate spatial heterogeneity into restoration treatments, yet lack explicit targets and monitoring techniques. A recently developed method of quantifying forest structure in terms of individual trees, clumps, and openings, termed ICO, provides managers with ecologically based, quantitative targets to guide restoration treatments. We present here a demonstration of these techniques as carried out on the Colville National Forest of eastern Washington. In the summer of 2014, we mapped and reconstructed pre-settlement conditions for 12 plots covering 4 plant association series within the study area. In addition, we installed multiple monitoring plots on 4 treatment units within the study area. Mean values for historical tree density ranged from 42 to 252 tph, and basal area ranged from 5.3 to 22.4 m^2 ha^{-1}. The proportion of historical trees occurring as widely spaced individuals (no neighbors within 6 m) ranged from 0.07 to 0.37. Eleven of the plots had large tree clumps (10-15 trees) and 8 had very large clumps (16+ trees). The proportion in these clumps ranging from 0.05 to 0.60. The range of conditions presented in this reference dataset provides managers flexible targets that can be used to guide restoration treatments and monitor the extent to which treated stands are within the ranges of size, density, composition, and pattern quantified in this study.

ORAL

STREAM COMMUNITY ASSEMBLY FOLLOWING THE CATASTROPHIC ERUPTION OF MOUNT ST. HELENS, WA. Carri J. LeRoy, Emily Wolfe, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505; Shannon Claeson, U.S. Forest Service, PNW Research Station, 1133 N. Western Ave, Wenatchee, WA 98801; Charlie Crisafulli, U.S. Forest Service, PNW Research Station, 42218 NE Yale Bridge Road, Amboy, WA 98601; *LeRoyC@evergreen.edu*

In 1980, the eruption of Mount St. Helens obliterated a vast area of forest and transformed many freshwater systems. Existing streams on the north flank were buried by over 100 m of new pumice. Following the eruption, mountain-side springs and snowmelt created four new channels flowing into Spirit Lake. Community recovery was predicted to take many decades to centuries, but stream surveys 35 years post-eruption have found significant periphyton and riparian community development and differences in a variety of physio-chemical variables. Reach-scale surveys (n=20) in the four

watersheds (June-Sept. 2015; 35 years post-eruption) revealed up to 10-fold differences in many variables across the four study streams: water temperature (3.7-25.5°C), discharge (0.0015-0.05 $m^3 s^{-1}$), bed shear stress (493-5859 $kg/m*s^2$), dissolved oxygen (36-97%), conductivity (60-861 µS cm^{-1}), alkalinity (6-60 mg L^{-1} CaCO3), canopy cover (0-98%), diatom cover (5-90%), and filamentous algal cover (0-80%). Although nutrient concentrations were uniformly low among streams (<0.01 mg L^{-1} NH_3-N, <0.07 mg L^{-1} NO_3-N, <0.06 mg L^{-1} PO_4-P), algal biomass (chl-a mg m^{-2}) was significantly positively correlated with nitrate and phosphate ($p<0.0004$, $p=0.0304$, respectively). Riparian plant communities differed significantly among streams ($A=0.07$, $p<0.0001$), and indicator species represented a mixture of both natives and exotics. Periphyton communities also differed significantly among streams ($p<0.0001$), and were primarily influenced by differences in slope, bankfull width, bed shear stress and vegetative cover. The more than 10-fold differences in many variables across the four study streams provide a unique opportunity to explore physical controls on in-stream community development.

ORAL

THE MYSTERY OF THE 700 YEAR-OLD TREES. Jan A. Henderson, U.S. Forest Service (retired), 21817 77th Place W., Edmonds, WA 98026; **Robin D. Lesher,** U.S. Forest Service (retired), 4602 226th St SW, Mountlake Terrace, WA 98043; David H. Peter, U.S. Forest Service PNW Research Station, 3625 93rd Ave. SW, Olympia, WA 98512; Chris Ringo, Dept. of Crop and Soil Science, 3017 Agricultural and Life Sciences Bldg., Oregon State University, Corvallis, OR, 97331; *janhenderson@msn.com*

Throughout the wetter areas of the North Cascades and Olympic Mountains in Washington State, there are numerous Douglas-fir trees that are 700 years of age or older. Many of these trees grow in areas that are too wet or too cold for Douglas-fir seeds to germinate and grow; *i.e*., the high precipitation areas in the upper parts of the Pacific Silver Fir Zone and even parts of the lower Mountain Hemlock Vegetation Zone. These areas are even inhospitable for planted two-year-old Douglas-fir seedlings to survive. These areas are particularly interesting because the environment there is so much wetter and colder than elsewhere where Douglas-fir trees grow today. The Potential Vegetation Zone model of Henderson et al. 2011 was used to estimate the difference between the climate of today and when these Douglas-firs got established.

ORAL

AMERICA'S RIVERS AS CREATIVE STIUMULI. **Dick Linford**, 1328 NW Constellation Drive, Bend, OR 97703; *dicklinford@echotrips.com*

"If the average American is less informed about his country than any other national, and cares less about its past and future… it is because the books prepared for his instruction were not written by artists." Constance Lindsay Skinner said this in 1937 when as an editor at the publishing company of Farrar Rinehart she launched a series of books about American rivers. The series became known as *The Rivers of America Series*. Skinner herself selected the authors to write about specific rivers. She didn't select scientists or

even historians. She chose novelists, memoirists and poets. She wanted books that spoke of rivers in language that would transcend normal expository writing. She wanted the books to sing. The goal was to publish a total of twenty-four books. When they stopped publishing the series in 1975 it boasted 65 titles. Rivers not only lend themselves to creative non-fiction. They also inspire creativity of all kinds. Running wild rivers has become a major outdoor activity because river trips are not only exciting; they also break down social barriers and stimulate a new way of seeing the world. My company ran river trips designed to bring disparate people together, and trips designed to get people to photograph, paint, write and make music. The trips were enormously successful.

ORAL

STABLE ISOTOPES AND DETERMINATION OF NITROGEN AVAILABILITY IN SAGEBRUSH STEPPE. Roger Long, Ken Aho, Bruce Finney, R. Terry Bowyer. Department of Biological Sciences, Idaho State University, 921 S 8th Avenue, Pocatello, ID 83209; *longrog2@isu.edu*

Sage grouse (*Centrocercus urophasianus*) and other sagebrush animals have been declining despite increased restrictions on hunting and development in the shrub-steppe. Causes of this decline may result from disruption of ecosystem processes by grazing. Many sagebrush-obligate animals are now most abundant near agricultural fields that border on shrub-steppe habitat. Inputs of nitrogen from agriculture to neighboring shrub-steppe environments may be the cause for this pattern. Quantifying soil N, however, does not necessarily quantify N available to plants. To determine nitrogen availability to plants we used a reliable method of stable isotope analysis of the plant tissues. We sampled for nitrogen isotopes at two representative sites: one that had not been grazed by livestock for 60 years and one that is currently grazed. We sampled 3 species of shrubs and two grasses adjacent to the borders of the agricultural fields and compared their nitrogen composition with plant samples taken at 100-meter intervals out to 2 km from agriculture. Our results indicate that the grazed site is more nitrogen limited than the ungrazed site, and plants occurring 2 km from agricultural fields were also more nitrogen limited. Plants are the focal point for this research because if plants are limited in nutritional quality or quantity by lack of available N, then animals, including sage grouse, pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) are limited in turn. The stable isotope data is supported by C:N data from plants.

POSTER

PHOTOGRAMMETRY, CT SCANS, DIGITAL FILE MANIPULATIONS, AND 3D PRINTED REPLICAS OF SUB-FOSSIL BONES FROM SOUTH CENTRAL WASHINGTON STATE. **Neil L. Mara**, Battelle, PNNL, Richland, WA 99352; King Detrick, MCBONES Foundation, Kennewick, WA 99338; Bax R. Barton, Burke Museum of Natural History and Culture, Seattle, WA. 98195; *neil.mara@pnnl.gov*.

Sub-fossils of late Quaternary ‘Ice Age’ mammals are the most common ‘fossil’ finds from geologic sediments in eastern Washington. Many are found in fragmentary and/or

fragile condition. For purposes of scientific study, museum display, loan and borrowing between institutions, and sharing in K12 classroom situations, it is often better to circulate precise casts of such fossils rather than risk handling the original fossils. Traditional mold making and casting techniques employed by museums are labor and time intensive, and are relatively inflexible in that they are limited to producing multiples of the same replica from a mold that degrades with production through time. Here we document our efforts at three late Quaternary sites in eastern Washington (Coyote Canyon mammoth site [CCMS], Coyote Canyon/South Hill camel site [CC/SH], and Tonnemaker Farm mammoth site [TFMS]) to use multiple scanning and digital data dependent techniques for the production of plastic replica bone copies or '3D prints'. At these sites we have used photogrammetry and CT scanners to produce easily manipulated digital files that are then printed to produce plastic replicas of the original fossil bones. These plastic replicas are then artistically rendered to complete the production of morphologically accurate and relatively quick and inexpensive fossil copies for display, teaching, and study. Printed plastic reproductions such as these add functional flexibility to traditional 'hands-off' paleontology collections by allowing visitors, adult or child, a 'hands-on' experience of light-weight morphologically accurate copies of irreplaceable fossils usually only experienced at a distance in protected display cases.

ORAL

IMPROVING LANDSAT ESTIMATION OF LIDAR DERIVED CHANGES IN CANOPY COVER USING PRE-FIRE BEETLE OUTBREAK AND TIMBER HARVEST ON THE POLE CREEK FIRE, OREGON. **T. Ryan McCarley**, Crystal A. Kolden, Arjan J.H. Meddens, Department of Geography, University of Idaho, Moscow, ID 83844; Nicole M. Vaillant, USDA Forest Service, Pacific Research Station, Western Wildland Threat Assessment Center, Prineville, OR, 97754; Brian M. Wing, UDSA Forest Service, Pacific Southwest Research Station, Redding, CA, 96002; Bryce Kellogg, The Nature Conservancy, Bend, OR, 97702; *mcca7981@vandals.uidaho.edu*

Across the western United States, bark beetles, timber harvest, and wildfire are three primary drivers of tree mortality and carbon balance at landscape scales. While these agents of forest change overlap spatially, uncertainty remains regarding their interacting impacts, particularly the influence of insect outbreaks and harvest on subsequent fire effects. Acquisition of pre- and post- fire Light Detection and Ranging (LiDAR) data on the 2012 Pole Creek Fire in central Oregon provided an opportunity to isolate quantitative fire effects from other agents of change across an entire wildfire. Our previous research found that the delta Normalized Burn Ratio (dNBR), the Relative dNBR (RdNBR), and a differenced simple ratio of shortwave infrared and near infrared Landsat bands (d7/5) were able to predict LiDAR-measured change in canopy cover. However, we observed spatial anomalies in the models for areas previously affected by mountain pine beetle (*Dendroctonus ponderosae*; MPB) and timber harvest. Here, we quantify the influence of pre-fire MPB and timber harvest on the ability for dNBR, RdNBR, and d7/5 to predict change in canopy cover. We found that the relationship between spectral index and change in canopy cover varied by agent, and that stratifying by agent improved model accuracy. Our results suggest that the dominant pre-fire agents

of change should guide spectral index selection when mapping fire-induced change in canopy cover.

ORAL

NITROPHILOUS LICHENS VARY IN FREQUENCY ALONG A PRECIPITATION GRADIENT IN ALASKA. **Bruce McCune**, Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis OR 97331; Tor Tønsberg, Museum of Botany, University of Bergen, Allégaten 41, N-5007 Bergen, Norway; Steven S. Perakis, U.S. Geological Survey, Forest and Range Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis OR 97331; *Bruce.McCune@science.oregonstate.edu*

The distribution and abundance of nitrophilous lichens depend on both climatic and anthropogenic nitrogen inputs. In most areas of the northern hemisphere, the dominant factors controlling nitrophilous lichens appear to be anthropogenic nitrogen sources, in particular from agriculture and vehicles. We found, however, a climatic gradient in nitrophilous lichen abundance in three national parks in clean-air areas in southwestern Alaska: Katmai, Lake Clark, and Kenai Fjords National Parks. We divided the three parks into four climatic regions, and in each region compiled lichen inventories by two collectors, totaling 630 to 1300 specimens per climatic region. We then calculated percentages of collections of the principal genera of nitrophilous lichens: *Caloplaca* s.l., Physcioid genera (*Phaeophyscia*, *Physcia*, *Physconia*), *Rinodina*, and *Xanthoria* s.l. Frequency of nitrophilous species had a negative linear relationship with log (mean annual precipitation) and a positive linear relationship with a measure of continentality. We hypothesize that even though total nitrogen inputs from precipitation increase with precipitation, high rainfall climates produce intense leaching and deplete nitrogen in plants, soils, and epiphytic lichens. While the precipitation effect may be masked by anthropogenic inputs in many areas of the world, it is likely to contribute to regional variation in nitrophile abundance and should probably be considered in models using nitrophilous lichens as indicators of air quality.

ORAL

THE ATLAS: A REGIONAL SYNTHESIS, TRANSLATION, AND BASELINE OF SCIENTIFIC DATA FOR THE PUBLIC AND RESOURCE MANAGERS. **James E. Meacham** and Alethea Y. Steingisser, InfoGraphics Lab, Department of Geography, University of Oregon. Eugene, OR 97403-1251; *jmeacham@uoregon.edu*

The atlas format provides a synthesis and baseline covering volumes of scientific data and other scholarly information of a region. The atlas takes a comprehensive look at topics geographically and communicates them through thematic maps, data-rich graphics and interpretative discussion, making subject matter accessible to a broad audience of stakeholders including the general public and resource managers. This paper weaves together themes and examples from two atlas projects to explore how atlases serve a function of a synthesis of regional baseline data and their role in revealing a deeper

understanding of places and landscapes. The first atlas covered is the "Atlas of Yellowstone". This 2012 publication provides a comprehensive look at the Greater Yellowstone Area and relies on contributions from scientists, historians, artists, managers and many other people that are dedicated to studying Yellowstone. The second project is part of the University of Wyoming's Wyoming Migration Initiative, and is titled the "Atlas of Wildlife Migration: Wyoming's Ungulates". Through the design of data maps, graphics and atlas pages, this effort visualizes the complexity of ungulate migration ecology and communicates the ungulate migration stories, with the expressed goal of advancing understanding and conservation of Wyoming's magnificent ungulate migrations and the preservation of their corridors and landscapes.

ORAL

HISTORICAL FIRE REGIMES ACROSS DRY TO MOIST FOREST ECOTONES IN CENTRAL OREGON, AND THE ROLE OF LANDSCAPE CONTEXT. **Andrew Merschel,** Oregon State University, Corvallis, Oregon 97331 and Tom Spies USDA Forest Service, Pacific Northwest Research Station, Corvallis, Oregon 97331; *andrew.merschel@oregonstate.edu*

Managers and the public have strong interest in restoration of structure and composition of mixed-conifer forests that is consistent with the historical fire regime of central Oregon. Generally, historical fire frequency is expected to decrease across the ecotonal transition from dry to moist forest, and moist forest environments are hypothesized to be less departed following fire exclusion. However, the magnitude of variation in fire regimes across mixed-conifer ecotones, and the controls on this variation are poorly understood. In particular the influence of surrounding topography and vegetation (landscape context), on dynamics at a local scale has not been effectively examined. We characterized historical fire regimes, stand dynamics, and current conditions across a 10,000 ha landscape that spans an annual precipitation gradient of 25-45 inches southwest of Bend, Oregon. Historically large spreading fires frequently burned across dry-moist forest ecotones (CFI25=12.5, NFR=19), and fire intervals varied slightly with stand precipitation and composition (15-20 years in dry vs. moist stands). The spread of fire was historically limited by landscape context as mixed-conifer stands on buttes isolated by flats dominated by lodgepole pine often did not record large spreading fires, and burned in small isolated fire events. Mixed-conifer stands with an isolated landscape context had longer maximum fire free intervals (>70 years) than non-isolated stands (<30 years). Our results demonstrate that dry and moist mixed-conifer forests had similar fire regimes except where landscape context limited the spread of frequent fires. Forest development following fire exclusion demonstrates that moist mixed-conifer forest with a frequent fire landscape context is most departed.

POSTER

CATERPILLARS AS INTERIOR DESIGNERS? USING LICHENS AS BUILDING MATERIALS FOR MOBILE HOUSES. **Ricardo Miranda-Gonzalez**, Andrew Moldenke, Bruce McCune, Department of Botany & Plant Pathology, Oregon State University, 2082 Cordley Hall, Corvallis, OR, 97331-2902; *mirandar_g@yahoo.com.mx*

During our studies of trophic interactions between lichens and invertebrates, we found a species of caterpillar that not only eats lichens but also uses them as camouflage. The caterpillar belongs to the family Psychidae, that is well known for living inside bags made of silk and decorated with pieces of bark or small twigs. Our study area is a tropical dry forest in the Pacific coast of Mexico that has considerable high levels of lichen biomass and diversity, with over 250 species. In order to understand the effect of these caterpillars in the lichen communities we analyzed the putative preference of particular lichen species in the construction of the caterpillars' houses. We collected 10 of these houses from the wild and separated every piece of lichen that appeared to be different (33 samples). Lichen DNA was extracted using the Sigma-Aldrich REDExtract-N-Amp Plant PCR Kit (St. Louis, Missouri), the whole ITS region was amplified with primers ITS1F and ITS4 and the product was cleaned with ExoSAP-IT® for PCR product cleanup (Affymetrix, Santa Clara, CA). We found a high level of specificity in the selection of lichens, with only 5 species across all the houses. All caterpillars used at least one species of *Dirinaria* as the main component of the house. The 5 species of lichens contain secondary metabolites which are probably related to the selection process. The pieces of lichens, even though very small, seemed healthy and able to grow again, which suggest a positive dispersion effect.

POSTER (COFSS)

FUEL TREATMENT LONGEVITY IN THE BLUE MOUNTAINS OF OREGON. **Kat Morici**, John Bailey, Oregon State University, Corvallis, Oregon 97331; *kat.morici@oregonstate.edu*

Fuel treatments are designed to reduce extreme fire behavior, promote resilient forest structure, and facilitate fire control efforts. Repeated treatments are needed to maintain desired conditions, and longevity is likely to vary with forest type and treatment approach. The Blue Mountains Fire and Fire Surrogate study site in northeastern Oregon was a prime candidate for re-measurement of existing fuel treatments in ponderosa pine and dry mixed conifer forest. In 1998, sixteen units were assigned to four treatment groups: mechanical thin, prescribed burn, both thin and burn, and control. Thinning took place in 1998, and prescribed burning in 2000. The primary research question is: How does fuel loading and understory vegetation composition vary between fuel treatments, measured 15-17 years post-treatment, in the Blue Mountains of northeastern Oregon? Treatment longevity can be examined by comparing pre- and post-treatment fuel loading and understory vegetation. My hypotheses are: 1) fuel reduction effects persist, but fuel loading is higher now than directly after treatment; 2) prescribed fire increases cover of

grass and forbs; 3) shrubs are more prevalent in untreated units; and 4) invasive plant species cover is correlated with treatment intensity. Quantifying persistent changes in fuel loading and understory vegetation aids in the planning of future fuels treatments, along with scheduling maintenance of existing treated areas.

ORAL

EMERGENCE OF ART AS A RESEARCH METHOD IN A SCIENCE LAB.
Jay Stratton Noller, Department of Crop and Soil Science, 107 Crop Science Building, Oregon State University, Corvallis, OR, 97331 and Soilscape Studio LLC, PO Box 199, Corvallis, OR 97339; *jay.noller@oregonstate.edu*

I confess that over the past 15 years my lab evolved from strictly scientific pedological assays to dominantly artwork creation as a means of answering the same research questions. My students and I created art about soil with or without soil. As a research strategy it was artfully very successful, but not so successful as viewed from science.

ORAL

THE TALE OF TWO RIVERS - SAVING THE "WILD" IN WILD AND SCENIC.
Maret Pajutee, U.S. Forest Service, Sisters Ranger District, PO Box 249, Sisters, OR 97759; *mpajutee@fs.fed.us*

Bend and Sisters face rapid population growth over the next several decades with many people moving here for the coveted outdoor lifestyle. Yet land managers struggle with development pressure on public lands and with their capacity to protect wild places and people's experiences. Where do recreation developments and ecosystem conservation collide and what can we do to keep wild places in our future?

ORAL

HEAT TOLERANCE OF PRAIRIE ASSOCIATED NATIVE AND EXOTIC DORMANT SEEDS FROM WESTERN WASHINGTON.
David H. Peter, Timothy B. Harrington, U.S. Forest Service, Pacific Northwest Research Station, 3625 93rd Ave. SW, Olympia, WA, 98512-1101; *dpeter@fs.fed.us*

Fire affects vegetation in many ways, however, the mechanisms favoring some species over others are often not understood. One possible mechanism—dormant seed heat tolerance—was examined in 38 native and exotic prairie or woodland species from western Washington. In a laboratory experiment, dormant seed was heated for 1, 2, 5 or 10 minutes at 8 temperatures ranging from 40°C to 200°C. An untreated control was also included. Following treatment, the seed was imbibed and germinated in petri plates in a germinator with a 9 hour dark (10°C)/15 hour light (20°C) diurnal regime. Pre-stratification for 120 days in a dark, 0.5°C cooler was used where literature suggested a benefit. Germinants were counted weekly. Three heat tolerance species groups were identified: 1) low (12 native and 11 exotic species), 2) medium (8 native and 1 exotic

species), 3) high (5 exotic and 1 native species). Low tolerance seed died at 125°C for 1 minute, but 67% of control levels survived at 100°C for 1 minute. Medium tolerance seed died with 1 minute at 150°C, but 22% of control levels survived 125°C for 1 minute. Most high tolerance seed survived 1 minute at 125°C, and 7% of control levels survived 1 minute at 150°C. Mortality increased in 10 minute compared to 1 minute 100°C treatments by 18% in the low, 34% in the medium, but only 2.5% in the high tolerance groups. Heat tolerance differences in seed survival suggest one mechanism by which some species could be favored over others by fire.

ORAL

TWO HOLOCENE SAGEBRUSH STEPPE FIRE RECORDS AT THE WILDLAND-URBAN INTERFACE, EASTERN CASCADES, WA. Dusty Pilkington, Megan Walsh, Department of Geography, Central Washington University, 400 E. University Way, Ellensburg, WA 98926; *pilkingtod@cwu.edu*

Washington's wildland-urban interface (WUI) of the eastern Cascades has begun experiencing larger, more damaging wildfire events. This reality became apparent when the Carlton Complex and Okanogan Complex fires burned during the summers of 2014 and 2015, respectively. As the largest fire events recorded in Washington state history, the fires burned over 240,000 hectares, consumed 300 homes, and caused infrastructure damage. To put recent large fires in the eastern Cascades into perspective, long-term fire histories showing variability in fire activity during the past ~14,000 years are needed. The goal of this study is to evaluate climatic and human influences on Holocene fire frequency, with emphasis on effects of the past ~100 years of fire suppression. During the summers of 2012 and 2015, lake sediments cores spanning ~14,000 years were recovered from Green and Campbell lakes, two sites in the recently burned sagebrush steppe environments of Okanogan County, WA, near the towns of Omak and Twisp, respectively. To complete this study, macroscopic charcoal analysis is underway to reconstruct fire history by quantifying input rates of charcoal fragments in each lake's sediments at 1 cm intervals. Preliminary Green Lake results suggest high fire frequency from ~12,000-8,000 calendar years before present (cal yr BP), with a decline from ~8,000-4,000 cal yr BP. After 4,000 cal yr BP, fire frequency increased overall, but declined in the early 20th century with fire suppression. These records will inform fire management in the WUI, while expanding knowledge of long term fire regimes into sagebrush steppe environments.

POSTER

WILDFIRE AND WILDFIRE-DEPOSITED CHARCOAL IN RAIN-SHADOW FOREST SOILS OF THE OLYMPIC PENINSULA. Melissa R.A. Pingree, Thomas H. DeLuca, School of Environmental and Forest Sciences, University of Washington, Box 352100, Seattle, WA 98195; *mpingree@uw.edu*

We measured surface mineral soil and organic horizon carbon (C), nitrogen (N), and throughfall in nine forest stands on the Olympic Peninsula, Washington, to improve our

understanding of soil biogeochemistry in forest ecosystems that are expected to experience more severe fire disturbances with future climatic conditions. The stands were last exposed to wildfire 3 – 115 years prior (total of 9 sites) where ten replicate plots were established. Adsorption capacity of charcoal collected at each site was compared to laboratory charcoal using adsorption batch experiments with phenol as a sorbate. Thermogravimetric analysis was used to quantify the organic C composition of reference and field-collected charcoal along the fire chronosequence. Results do not support the generalization of decreased adsorption capacity with time since fire, perhaps because the mixed-severity fire regime of the rain-shadow Olympic Peninsula forests adds an additional layer of spatial and temporal complexity. Carbon content in surface organic horizons were weakly correlated with time since fire (Unadjusted $r^2 = 0.15$; *p*-value < 0.001) and inorganic NO_3^- -N concentrations were significantly different between plots, but with no relationship to the chronosequence. Total C, N, throughfall dissolved organic C, and phenolic C did not show any trends along the chronosequence. Preliminary charcoal mass in organic horizons showed a high variation within sites and higher charcoal mass per unit area at recent fire history plots, decreasing with time. Future studies will compare paired burned and unburned plots in a direct comparison of net N transformations.

ORAL

FROM NATIVE AMERICAN ORAL HISTORIES TO STUDYING PAST GEOLOGIC EVENTS AND CLIMATE HISTORY—USE OF TREE-RING-DATA, RESEARCH, AND CURRICULUM MODULES IN UNDERGRADUATE SCIENCE LABS AND RESEARCH PROJECTS. **Patrick T. Pringle**, Science Dept., Centralia College, 600 Centralia College Blvd, Centralia, WA 98531; *ppringle@centralia.edu*

Field and lab inquiries involving tree-ring studies and (or) radiocarbon dating can be used to study the history and usefulness of these techniques as well as to investigate past climate, human, and geologic history and serve as an educational tool via curriculum modules (e.g. Pringle, 2009, 2013; Davi et al, 2012; 2015). Based on their involvement in field investigations as well as subsequent library research, lab work, and data analysis, Centralia College students and recent graduates have coauthored posters at meetings of the Northwest Scientific Association, Geological Society of America, Washington Hydrogeology Symposium, Pacific Northwest Anthropological Conference, and American Geophysical Union, as well as at the Centralia College Capstone Project Poster Sessions (2013–2015) and at regional meetings that feature undergraduate research. I will present examples of student research that show the types of projects they are taking on and the challenges they have faced as well as examples of curriculum modules I am developing as part of an NSF–TUES grant collaboration with instructors from William Paterson University, West Point Military Academy, and Passaic Community College. The Centralia College Foundation has recognized the value of undergraduate research and the quality of student work presented at the Capstone sessions and scientific meetings and is now offering small student research grants for approved student proposals in support. More information about the Centralia College Tree-Ring Lab (CCTRL), student

dendrochronology research, and the NSF-TUES collaboration can be found at http://www.centralia.edu/academics/earthscience/index.html.

POSTER

WHITE STURGEON (*ACIPENSER TRANSMONTANUS*) LARVAE FEEDING ECOLOGY AND PREY AVAILABILITY IN THE UPPER COLUMBIA RIVER, USA. **Ryan W. Reihart**, Camille McNeely, Department of Biology, Eastern Washington University, 275 Science Building, Cheney, WA 99004; Andrew Miller, Spokane Tribe of Indians, 6195 Ford-Wellpinit Road, Wellpinit, WA 99040; *Reihartr1@gmail.com*

White Sturgeon (*Acipenser transmontanus*) in the Upper Columbia River has been in decline for over 60 years and is listed as critically endangered by the IUCN. Annual spawning produces dispersing larvae; however, recruitment into the juvenile age class does not occur. One hypothesis is that larvae may not find adequate prey. Little is known about diet and prey availability for white sturgeon larvae, especially in Lake Roosevelt. The Spokane Tribe of Indians collected littoral and mid-channel benthic drift samples annually at 9 locations in Lake Roosevelt from 2007 to 2010. The most abundant invertebrates were small crustaceans (Cladocera and Copopoda); however, in 2009 Chironomidae and Hydridae dominated drift samples. Invertebrate density was significantly influenced by year ($P < 0.001$), and significantly higher in the littoral zone ($P < 0.001$). To determine the diet, 591 larvae measuring between 14.7 and 21.8 mm were collected in July 2015. A total of 14 prey items were found in 9 stomachs, mainly Dipteran larvae and copepods. These data suggest that prey scarcity could be limiting white sturgeon recruitment in Lake Roosevelt.

ORAL

EFFECTS OF SOILS ON TASTE OF PINOT NOIR WINES FROM THE WILLAMETTE VALLEY, OREGON. **Gregory J. Retallack**, Department of Geological Sciences, University of Oregon, Eugene, OR 97403; Scott F. Burns, Department of Geology, Portland State University, Portland, OR 97207; *gregr@uoregon.edu*

Conventional wisdom of vintners is that alkaline cations and flavor compounds, and thus less sour and more rounded taste, are enhanced in wine and grapes challenged by low nutrient soils. A common thread here is pH, an objectively measurable variable, which is both a part of wine taste and a proxy for soil fertility. The role of low pH soils is supported by metadata on Oregon wines from different soils in the Willamette Valley of Oregon, which show significant inverse correlations between minimum pH of the soil and pH of finished Pinot Noir wine. There is also a direct correlation between depth of clayey horizons and pH of the finished wine. Minimum pH of these soils is near the base of the clayey (Bw or Bt) horizon, and minimum pH of these soils is inversely correlated with depth of the clayey horizon. Low soil pH is found in thick middle Pleistocene soils of bedrock (Jory, Willakenzie, Laurelwood, and Bellpine soil series) and high soil pH in

thin soils on late Pleistocene and Holocene Missoula flood deposits and loess (Hazelair, Woodburn, and Chehulpum soil series). Similar relationships are found between soil pH or depth and pH of grapes at harvest, which is lower and more varied than pH in finished wine. These relationships are especially notable in years of good harvest, but obscured by winemaking techniques in years of poor harvest. Good harvest years are not necessarily vintages esteemed by wine connoisseurs, which are more strongly correlated with low October precipitation.

ORAL

AN APPROACH TO MODELING SOIL MOISTURE DROUGHT POTENTIAL AT REGIONAL SCALES IN THE PACIFIC NORTHWEST. **Chris Ringo**, Jay Noller, Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331; Karen A. Bennett, USDA Forest Service, Portland, OR 97204; David Moore, USDA Forest Service, Prescott AZ 86303; Duo Jiang, Department of Statistics, Oregon State University, Corvallis, OR 97331; *Chris.Ringo@oregonstate.edu*

Natural resource managers need better estimates of water storage and supply in forested landscapes, both in planning for management activities aimed at maintaining and enhancing forest health, and in preparing for a changing climate. In particular, low soil moisture in combination with high evaporative demands can induce significant stresses on forests, increasing vulnerability to attacks of insect and disease, as well as increasing wildfire risk. Although high-resolution soils data exist for much of the region, regional-scale datasets do not exist that identify forested areas on the landscape most vulnerable to soil moisture-related drought. In this study we used readily-available spatial datasets depicting available water supply, soil depth, and evapotranspiration to model the likelihood that soils experience prolonged summer drying. To calibrate the model we examined soil profile descriptions, lab data, and soil moisture curves for 25 SNOTEL stations throughout the Pacific Northwest and estimated the average annual number of days that soil moisture drops to levels at or below permanent wilting point, the theoretical lower limit of plant-available water. Using this approach we found statistically significant relationships between the independent variables and broad classes of soil moisture levels representing the highest and lowest levels of plant-available moisture. We expect that this approach can be further developed to include additional SNOTEL data outside Washington and Oregon and other explanatory variables such as topographic position. The current dataset can aid in identifying vulnerable landscapes in the context of managing for increased forest resiliency.

POSTER

AVAILABLE SOIL RESOURCE INFORMATION ON FOREST LANDS IN THE PACIFIC NORTHWEST REGION - RETRIEVAL OF LEGACY FOREST SERVICE SOIL RESOURCE INVENTORY DATA. **Chris Ringo**, Jay Noller, Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331; Karen A. Bennett, USDA Forest Service, Portland, OR 97204; *Chris.Ringo@oregonstate.edu*

Quantifying the potential impacts of a changing climate on Northwest forests requires reliable datasets representing a variety of environmental variables. Of primary importance in evaluating the response of forests to potential changes in drought stress is the availability of good soils data, particularly texture, depth, coarse fragments, and organic content for estimating water holding capacity. NRCS soil surveys (SSURGO) do not exist for most Pacific Northwest National Forests however, so researchers have had to fall back on the NRCS General Soils Map (STATSGO) for these areas. These data were compiled at a considerably smaller scale than SSURGO data (1:250,000 versus 1:24,000), and generally do not have the detail needed by many users. During the 1970s and 1980s however, all Pacific Northwest National Forests conducted Soil Resource Inventories (SRI) at a mapping scale of 1:63,360 to provide some basic soil, bedrock, and landtype information for use in resource management. Most Forests did not subsequently convert these datasets to digital form, however. This poster outlines our efforts in bringing these legacy spatial and tabular data into the digital world, focusing particularly on the development of soil moisture metrics such as Available Water Storage (AWS) for integration with SSURGO data, and the use of these data in a regional droughty soils analysis. Development of these legacy data will prove useful in filling the gaps in regional soils information, and provide researchers and resource managers with valuable information for assessing the potential impacts of climate change on forested ecosystems in our region.

ORAL

PEATLAND TYPES OF WASHINGTON: THEIR CLASSIFICATION AND CONSERVATION VALUES. **Joe Rocchio**, Washington Dept. of Natural Resources, Natural Heritage Program. 1111 Washington Street SE, MS: 47014, Olympia, WA 98504-7014; *joe.rocchio@drn.wa.gov*

Peatlands are wetlands with a substrate comprised of relatively undecomposed organic material which accumulates due to saturated and/or anoxic soil conditions. Peat origin ranges from peat mosses (*Sphagnum* spp.), brown mosses (Amblystegiaceae family), sedges (Cyperaceae family), or woody species. Peatlands are formed over hundreds to thousands of years. Ecological variation associated with water chemistry, floristics, hydrology, and topography result in a wide variety of peatland types occurring within Washington's landscapes. Understanding this variation is necessary to account for the full suite of ecological services and biodiversity supported by peatlands. Using the U.S. National Vegetation Classification as a framework, an expert-based, supervised classification of Washington peatlands was developed. A total of 18 different peatland

types (i.e. “Subgroups”) were identified. From 2011 to 2015, vegetation data was collected from 363 plots. Electrical conductivity and pH were collected from 97 plots. Exploratory analysis of these variables determined that peatland types on the extreme margins of the pH gradient showed clear differences in species composition, pH, and electrical conductivity. Peatland types with slightly acidic to circumneutral pH showed floristic overlap with other peatland types such as poor fens as well as large internal variability. The analysis also demonstrated that elevation was a significant factor not considered in the classification for some western Washington types. These results are informing ongoing revisions to the classification. The final classification will provide a framework for communicating biodiversity values, threats, and distribution patterns for each peatland type.

ORAL

UNDERSTORY RESPONSES TO DRY FOREST RESTORATION DIFFER IN THE SHORT AND LONG TERM. Allison K. Rossman, Jonathan D. Bakker, and Charles B. Halpern, School of Environmental and Forest Sciences, College of the Environment, Box 352100, University of Washington, Seattle, WA 98195-2100; *akrossman@gmail.com*

Managers increasingly use mechanical thinning and controlled burning to restore dry, mixed-conifer forests in the inland Northwest that have suffered from a century of fire suppression. Despite extensive use of these treatments, our understanding of their ecological outcomes is limited by the short time-frames of most studies (2-5 years). We examined the role of time since disturbance in the responses of forest understory communities to thinning and burning in a fuels-reduction experiment in central Washington. We based our analyses on species richness and compositional data from 7 experimental units sampled with 41 plots before treatment and 2 and 9-12 years after treatment (short- and long-term, respectively). We quantified responses to thinning, burning, and thinning plus burning as changes in richness and composition relative to pre-treatment conditions. Species richness increased with time but differed among treatments only in the long-term, when it was greater with thinning plus burning than with thinning alone. Species composition also changed with time, and it differed among treatments not in the average, but in the variability of compositional change: burning increased the variability among sample plots. Long-term sampling can offer insights into the effectiveness of restoration treatments that are not evident in the short term.

POSTER

SOIL TEXTURAL ANALYSIS USING THE HYDROMETER METHOD VS. ONLINE SOIL SURVEY DATABASE FOR RESEARCH AND MANAGEMENT PURPOSES. **Tiffany D. Salveson**, Department of Animal and Range Sciences. Montana State University, Bozeman, MT 59717; *tiffany.salveson2011@gmail.com*

Soil textural analysis is an important factor in determining soil quality attributes which is used in a number of practices including agriculture, scientific research, housing developments, and construction. There are various methods to texture soils, all of which

have advantages and disadvantages. The level of accuracy and precision of soil textural analysis is dependent upon which management practice a person is interested in. For example, engineers and building contractors may be more interested in small scale differences in texture than forest and range managers who work across large landscapes. To evaluate the utility of the online soil database, SoilWeb, for addressing this broad set of needs, I assisted a graduate student at Montana State University in a research project using both particle-size analysis (PSA) and the online soil survey database, SoilWeb. The online database proved to be an unreliable source for determining local differences in soil textures when compared to PSA results. According to a probability test, the likelihood of selecting one soil mapping unit from SoilWeb that matches the PSA results ranges from 24-64% (95% confidence interval). Additional investigation should be undertaken in the Pacific Northwest to learn if this disparity occurs outside Montana.

POSTER (COFSS)

INNOVATIONS AND LESSONS LEARNED IN POST FIRE FUELS TREATMENT EFFECTIVENESS ASSESSMENTS, MALHEUR NATIONAL FOREST, CANYON CREEK COMPLEX. Dana Skelly, E. Clark, T. Boyce, K. Rappelyea, J. Offutt, K. Percy, USDA Forest Service, Malheur National Forest, John Day, OR 97845; *dskelly@fs.fed.us*

The 2015 Canyon Creek Complex burned over 110,000 acres in the heart of Grant County, Oregon. Most of this fire occurred on the Malheur National Forest. While more than half of the forest acres burned were designated as wilderness, the remaining 41,000 acres were in the Wildland Urban Interface and tested over 11,000 treated acres. Most of these treatments represented the earliest projects collaborated on by the Malheur and Blue Mountain Forest Partners (BMFP). Thorough assessments of the treatments were critical for adaptive management as well as to honor these early collaborative efforts. To complete this work, combined with extensive Burned Area Emergency Response (BAER) work and the existing "Green Tree" program, new efficiencies were developed both in terms of technological application, integration across disciplines, and transparent dialogues. We also learned valuable lessons in terms of data reporting that will inform future projects. In this presentation we give an overview of these innovations.

ORAL

TWENTY-FIVE YEARS OF CLIMATE INDICATION IN LICHEN COMMUNITIES FROM ALASKA TO CALIFORNIA. Robert J. Smith and Bruce McCune, Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis, Oregon 97331-2902; Sarah Jovan, USDA Forest Service, Portland Forestry Sciences Lab, 620 SW Main, Suite 400, Portland, OR 97205; *smithr2@oregonstate.edu*

Variation in epiphytic lichen communities can reveal how forests may respond to global changes because lichen responses integrate climate, air quality and forest disturbances. Here we explore lichen communities as climate indicators at 1118 sites in the U.S. Pacific

states of Alaska, Washington, Oregon and California, summarized in two analyses. *Analysis 1*, from USFS Forest Inventory and Analysis (FIA) measurements, yielded a super-regional lichen–climate gradient model spanning thirty degrees of latitude. Site scores ("climate scores") revealed associations between contemporary climate and the composition of epiphytic lichen communities. Changes in climate scores at sites resurveyed in the future could indicate climatic shifts. Select lichen indicator species were faithful and specific to climate zones (sites of similar temperature, moisture, seasonality, etc.), which suggests possible monitoring targets. *Analysis 2* was a survey of historical data from 50 regional plots remeasured over 25 years in coastal southeast Alaska. For this subset of lichen communities, we detected no signal of climate change response over the period 1989–2014. Species richness, climate scores, community composition and indicator species did not change more than random expectations, possibly due to climatic buffering by the adjacent Pacific Ocean. As environmental monitoring in the western U.S. continues, stakeholders can benefit from existing data as well as continued monitoring of epiphytic lichens to examine how climate will shape forest communities of the Pacific coast.

ORAL

ROOSTING HABITAT USE AND SELECTION BY NORTHERN SPOTTED OWLS DURING NATAL DISPERSAL. **Stan G. Sovern**, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; Eric D. Forsman, USDA Forest Service, Corvallis Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331; Katie M. Dugger, U.S. Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; Margaret Taylor, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; *ssovern@fs.fed.us*

We studied habitat selection by northern spotted owls (*Strix occidentalis caurina*) during natal dispersal in Washington State, at both the roost site and landscape scales. We used logistic regression to obtain parameters for an exponential resource selection function based on vegetation attributes in roost and random plots in 76 forest stands that were used for roosting. We used a similar analysis to evaluate selection of landscape habitat attributes based on 301 radio-telemetry relocations and random points within our study area. We found no evidence of within-stand selection for any of the variables examined, but 78% of roosts were in stands with at least some large (>50 cm dbh) trees. At the landscape scale, owls selected for stands with high canopy cover (>70%). Dispersing owls selected vegetation types that were more similar to habitat selected by adult owls than habitat that would result from following guidelines previously proposed to maintain dispersal habitat. Our analysis indicates that juvenile owls select stands for roosting that have greater canopy cover than is recommended in current agency guidelines. Managing a landscape to facilitate northern spotted owl dispersal in the long term may prove a challenge in fire-prone eastside forests.

ORAL

FORESTS - EXPLORING ALTERNATIVE FUTURES FOR FIRE-PRONE FOREST LANDSCAPES OF THE EASTERN CASCADES. Tom Spies, USDA Forest Service Pacific Northwest Research Station, Corvallis, OR 97331; *tspies@fs.fed.us*

Fire-prone landscapes present many challenges for both managers and policy makers developing adaptive behaviors and institutions. We used a coupled-human and natural systems framework and an agent-based landscape model to examine how alternative management scenarios affect fire and metrics of ecosystem services in the eastern Cascades of Oregon. Our model incorporated existing models of vegetation succession and fire ignition and spread, and was based on original empirical studies of landowner decision making. Our findings indicate that alternative management strategies can have variable effects on landscape outcomes over 50 years for fire, socio-economic and biodiversity metrics. For example, scenarios with federal restoration treatments had less high-severity fire than a scenario without treatment; exposure of homes in the wildland-urban interface to fire was also slightly less with treatment than without. Treatments appeared to be more effective at reducing high-severity fire in years with more fire than in years with less fire. Under the current scenario, timber production could be maintained for at least 50 years on federal lands. Under an accelerated restoration scenario, timber production fell due to shortage of areas meeting current stand structure treatment targets. Tradeoffs between restoration outcomes (e.g. open forests with large fire-resistant trees) and habitat for species that require dense older forests were evident. For example, percent area of nesting habitat for northern spotted owls was somewhat less after 50 years under the restoration scenarios than under no management. However, the amount of resilient older forest structure and habitat for white-headed woodpeckers was higher after 50 years under active management. More carbon was stored on this landscape without management than with management, despite the occurrence of high-severity wildfire. We plan to use the model in collaborative settings to facilitate discussion and development of policies and practices for fire-prone landscapes.

POSTER (COFSS)

OREGON'S PRESCRIBED FIRE COUNCIL: WORKING IN THE FUTURE WITH PRESCRIBED BURNING AND MANAGED WILDFIRE. Amanda Stamper, The Nature Conservancy, Eugene, OR 97403, and John Bailey, Oregon State University, Corvallis, Oregon 97331; *amanda.stamper@tnc.org*

As a member of the national network of prescribed fire councils, our focus in Oregon is first and foremost on the use of management-ignited fires that meet pre-planned landowner objectives. There is broad agreement within both the management and scientific communities on the effectiveness and unique benefits of prescribed burning across a wide range of Pacific Northwest ecosystems. These ecological benefits cannot be fully achieved through other, non-fire-based management approaches; restoration of cultural burning practices and fire regimes is included within this scope. We also acknowledge the very real and growing challenges facing fire and fuels managers in

Oregon, particularly on federal lands, where fire seasons are increasingly long and resultant wildfires are increasingly severe, with little reprieve or optimism in sight relative to wildfire risks, budgets and personnel. Annual treatments to reduce wildfire hazard/risk account for only a small percentage of the area that needs attention and do not even compensate for continued growth of biomass/fuel. We therefore conclude that it is not feasible to fully address wildfire hazard in many areas outside of the wildland-urban interface or to significantly reduce wildfire risk across landscapes with mechanical treatments and/or manager-ignited prescribed fires. Many areas are too steep or remote for mechanical treatments, in designated wilderness or other reserved lands (where fire is the only tool for maintaining ecological health), or economically unfeasible to treat given current fiber markets and infrastructure. Similarly, air quality management constraints, liability and personnel requirements frequently limit manager-ignited prescribed burning. Consequently, we recognize the need to define and market "beneficial fire" more broadly, and to regard both prescribed fire and managed wildfire as important tools for bringing fire-adapted and fire-dependent ecosystems in Oregon into a more resilient condition. This redefined relationship with fire and resultant resilient landscapes will further serve to reduce the stress on fire management systems and our larger society over time relative to current realities.

ORAL

OBSERVATIONS ON RARITY AND IDENTIFICATION OF SOME SOIL CRUST LICHENS. Daphne F. Stone. NW Lichenologists, 30567 Le Bleu Rd., Eugene, OR 97405; *daphstone@gmail.com*

We surveyed soil crust species in central Washington and southeastern Oregon over the past 5 years. Taken together with the work of Anne DeBolt (2008) in southeastern Oregon, Jeanne Ponzetti (2007) in south-central Washington and Heather Root in central Oregon, we are now getting a more complete picture of where some less common lichen species are found. We present information about 13 species that were considered rare or uncommon by Root et al. (2011). *Circinaria rogeri, Heteroplacidium congestum,* and *Heppia lutosa* still appear to be rare in the Pacific Northwest. *Cladonia imbricarica* was considered rare but we consider it to be locally common in Washington. *Acarospora schleicheri, Endocarpon loscosii, Ochrolechia turneri, Psora decipiens, Texosporium sancti-jacobi, Trapeliopsis bisorediata,* and *T. steppica* were considered uncommon and we now know more about distribution. *Acarospora terricola* is present in central Washington and a new species of *Acarospora* was found. *Diploschistes muscorum* and *Rhizocarpon diploschistidina* were considered common but our work suggests they become less prevalent in southern Oregon. Photographs of all of these species may facilitate further finds, adding to our knowledge of their ranges.

ORAL

RESTORING A SLOUGH FLOODPLAIN OF THE DESCHUTES RIVER. Peter Sussmann, USDA Forest Service, Deschutes National Forest, 63095 Deschutes Market, Bend, OR 97701; *prsussmann@fs.fed.us*

Historic and current water use in the Deschutes Basin has modified flows of the Upper Deschutes River for nearly 100 years. Dams built to store water for irrigation uses have altered the natural hydrograph of the river, and constructed barriers along the channel have isolated floodplains like the Ryan Ranch slough basin. The Forest Service is currently working to reconnect the floodplain and restore eroding riverbanks at the Ryan Ranch site. Multiple factors have combined to create a compelling story of scientific investigation and wetland intrigue, including concerns from local irrigation districts regarding potential water loss and water rights, a federally listed aquatic species (Oregon Spotted Frog), concerned citizens, multiple State and Federal Agencies, a long retired Bureau of Reclamation hydrologist and a lawsuit from Waterwatch and the Center for Biological Diversity. Opposition to this project has allowed the Forest Service to spend multiple years studying the geomorphic and geohydrologic characteristics of a significant slough floodplain at Ryan Ranch. Results of these investigations reveal a complex interaction of water resources and social concerns in the Deschutes River basin.

ORAL

CONFLUENCE OF ARTS, HUMANITIES, AND ECOLOGY AT SITES OF LONG-TERM ECOLOGICAL INQUIRY. Frederick J. Swanson, U.S. Forest Service, Pacific Northwest Research Station, 3200 Jefferson Way, Corvallis, OR 97333; *fred.swanson@oregonstate.edu*

After many decades of profound separation, ecology, the arts, and humanities seem to be reuniting in many ways and with fascinating potential. Sites of long-term ecological research, such as the National Science Foundation's Long-Term Ecological Research (LTER) sites, Forest Service Experimental Forests, and biological field stations, are increasingly engaging arts and humanities in their programs; and sites more deeply rooted in the arts and humanities are reaching out to scientists. The objectives of these programs vary widely – from basic inquiry to education to mission-oriented efforts, such as drawing public attention to climate change issues. Forms of expression, including creative writing, visual arts, philosophical analysis, theater, dance, and music, are represented by examples from the Bonanza Creek (AK), North Temperate Lakes (WI), Harvard Forest (MA), and Andrews Forest (OR) LTER sites. In the long run there is intention to have these programs be highly interdisciplinary; attentive to the land; take the long view; collect, archive, and share the works; and interpret findings and consequences of this work at the network scale. However, these ambitious goals are not yet fully realized. The Pacific Northwest has a leading role in these efforts.

ORAL

MORPHOLOGY AND SPATIAL CHARACTER OF THE MIMA MOUNDS, THURSTON COUNTY, WASHINGTON. **Ken Tabbutt**, The Evergreen State College, 2700 Evergreen Parkway, Olympia, WA 98505; *tabbuttk@evergreen.edu*

The genesis of the Mima mounds, which occur on specific Pleistocene outwash terraces, has been the subject of considerable debate and conjecture. A morphologic analysis of the Mima mounds in five prairies in Thurston County, Washington was conducted using GIS and LIDAR data. The classified mounds have a wide variation in height, area and volume locally. Regionally, the prairies to the north have, on average, much larger mounds. Aspect data indicate that the mounds exhibit an elongation and orientation in the direction of the outwash terrace gradient. The morphology and spatial character of the Mima mounds do not indicate a definitive process of formation but the elongation and orientation, which differs between prairies, support a mechanism that involves down-gradient flow.

ORAL

NOW YOU SEE ME, NOW YOU DON'T: SHIFTS IN BLACK TURNSTONE MIGRATION PATTERNS IN PRINCE WILLIAM SOUND, AK. **Audrey R. Taylor**, Department of Geography & Environmental Studies, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AK 99508; Mary Anne Bishop, Anne Schaefer, Prince William Sound Science Center, PO Box 705, Cordova, AK 99574; Ron Porter, Delaware Bay Shorebird Project, Ambler, PA 19002; and Kristine Sowl, Yukon Delta National Wildlife Refuge, PO Box 346, Bethel, AK 99559; *artaylor@uaa.alaska.edu.*

Black Turnstone is a rocky coast shorebird species that breeds in western Alaska and winters from southcentral Alaska south to the coast of Mexico. Counts of Black Turnstones stopping at Prince William Sound's Montague Island during spring migration have declined dramatically in the last 20 years, despite this area being designated as an Important Bird Area for the species. The overall goal of this project was to document current Black Turnstone migration patterns and connectivity, and to examine evidence for shifts from previously observed routes that included Prince William Sound. In 2013 we captured and equipped with geolocators 30 Black Turnstones breeding on the Yukon Delta (YD) in western Alaska and 5 turnstones breeding at Cape Krusenstern (CK) in northwestern Alaska. In 2014 and 2015 we recaptured and recovered 18 geolocators at YD and 2 geolocators at CK. We also analyzed three recovered geolocators from a pilot study conducted at Oak Harbor, WA, in 2011/2012. Wintering locations of these turnstones occurred only within the northern half of the known wintering range, from southcentral Alaska to the southern Oregon coast. Migration routes were similar in spring and fall, and we documented several high-use regions for migration stopovers during both north- and southbound migration. None of the 23 geolocator-tagged individuals stopped over at Montague Island itself and few were recorded in Prince

William Sound, indicating that migration patterns may have changed and turnstones are no longer using this area as a major spring stopover site.

ORAL

SOCIAL ORGANIZATION AND SEXUAL SEGREGATION IN AMERICAN BISON. Johanna C. Thalmann, R. Terry Bowyer, John G. Kie, Ken A. Aho, Department of Biological Sciences, Idaho State University, 921 S. 8th Ave. Stop 8007, Pocatello, ID 83209; Jericho C. Whiting, Department of Biology, Brigham Young University- Idaho, 525 South Center St., Rexburg, ID 83460; *thaljoha@isu.edu*

Sexual segregations occur commonly in sexually dimorphic ruminants. Factors underpinning this phenomenon, however, continue to be debated. We conducted research on spatial and social organization of American bison (*Bison bison*) on Antelope Island State Park, Utah, to provide further insights into causes of sexual segregation. We focused our analyses on the two leading hypotheses associated with ecological segregation —the gastrocentric and predation hypotheses— but we also examined aspects of the social factors and activity budget hypotheses. Results from MRPP (multi-response permutation procedure) and overlap analyses illustrated significant spatial and elevational separation between male and female groups throughout the year, which increased substantially during parturition (a period of sexual segregation), and decreased during the mating season (sexual aggregation). Male-only groups commonly used habitat on the northern end of the island, which is at lower elevation and received heavy human activity. Females, especially nursing mothers, used areas low in tourist activity and high in elevation, where vegetation was likely in an earlier phenology, and females would have an unobstructed view of potential predators. Those outcomes provide evidence for both the predation and the gastrocentric hypothesis. Our results did not support the social segregation hypotheses because spatial separation and social organization occurred simultaneously, providing further evidence against social factors driving ecological segregation of the sexes. This research can aid management of and habitat restoration for bison and other wild ruminants by providing new insights into spatial use and social organization during two critical periods—parturition and rut (mating season).

ORAL

DIVERSITY AND ABUNDANCE OF THE BIRDS AND THE BEES UNDER INTENSIFYING AGRICULTURE. Michelle Toshack, Elizabeth Elle, Department of Biological Sciences, Simon Fraser University, 8888 University Dr, Burnaby, BC V5A 1S6 Canada; *mtoshack@sfu.ca*

Land use intensification can negatively impact the abundance and diversity of wildlife that use these landscapes, which in turn provide essential ecosystem services such as crop pollination and pest control. While agriculture is known to impact native communities, little is known of how abundance and diversity of wildlife, and their food, differs between organic and conventional blueberry agriculture. Therefore, we studied birds and wild pollinators on organic and conventional blueberry farms, as well as natural areas in the

Lower Mainland of British Columbia. First, we examined the abundance and diversity of birds, wild pollinators, and their flowering resources across different farming landscapes. Second, we identified the different pollen types that bumble bees collected in farming landscapes and natural areas, and compared them with the resources available to them. We found no difference in abundance or diversity of bird, wild pollinator, and floral resources between farm types. In natural areas, bird and floral resource diversity was higher than in farms, but overall abundance of floral resources was lower. Although previous studies have shown an average increase in biodiversity on organic farms, our results suggest this might not be the case in blueberry farms, possibly due to site differences unrelated to farming method. Furthermore, bumble bees collected pollen from outside of the farm, suggesting they may be supplementing their diet with off-farm resources. These findings emphasize the importance of resource heterogeneity, either on-site or in the surrounding landscape, for the conservation of biodiversity in agricultural systems.

POSTER

HIGH-TECH TREE HUGGERS: WHAT THE ELECTRONIC DENDROMETERS' EMBRACES HAVE REVEALED ABOUT TREE GROWTH.

Teresa M. Vail, Kevin R. Ford, Constance A. Harrington, Leslie C. Brodie, USDA Forest Service Pacific Northwest Research Station – Olympia Forestry Sciences Laboratory, 3625 93rd Avenue SW, Olympia, WA 98512-1101; *tmvail@fs.fed.us*

Conventional dendrometer bands don't automatically record data in real time, which is problematic when researchers need to collect high frequency data on tree responses to rapidly changing environmental factors. One such tool that allows researchers to gather these measurements is the electronic dendrometer. These are sensitive, yet rugged, clamp-like devices that are lightly fastened to a tree stem and electronically record the pressure exerted on it by the stem. As the tree grows in diameter, it exerts more pressure on the dendrometer, thus creating a record of tree growth. We have deployed over 100 electronic dendrometers (by Dynamax) to measure tree diameters every fifteen to thirty minutes in two major ongoing studies, the Douglas-fir Seed Source Movement Trial and the Pacific Northwest Mixed Species Dormancy Trial, in the field and greenhouse, respectively. We have accumulated several years of real-time measurements and graphed the data over annual time periods using the calibrations of each dendrometer and the open-source R software. The graphs were subsequently edited to remove erroneous readings and account for adjustments we made to the dendrometers. The dendrometer data have led to new, intriguing findings. We now know that diameter growth can begin one to two months prior to budburst; that the onset of shoot growth appears to temporarily inhibit diameter growth; and that cool temperatures can promote earlier diameter-growth initiation. Thus, these high-tech tree huggers are a valuable tool in the study of tree biology.

ORAL

BIG MARSH RESTORATION: AN ONGOING SUCCESS STORY. Christina Veverka. Crescent Ranger District, Deschutes National Forest, P.O. Box 208, Crescent, OR 97733; *cveverka@fs.fed.us*

Big Marsh comprises a 2,250 acre high elevation (4,730 ft) meadow, marsh, and wetland complex located in the southern portion of the Deschutes National Forest. It is home to the largest breeding population of Oregon spotted frogs in the state of Oregon, as well as other sensitive flora and fauna species such as the Pacific rail, the lesser bladderwort, and swaying bulrush. The hydrology of Big Marsh was altered in the 1940's with the creation of two canals on the east and west sides of the marsh used to drain the area and make it more suitable for livestock grazing. In the 1980's the Forest Service purchased Big Marsh and began a series of restoration projects to return the natural hydrology to the marsh. This included installation of a head gate and check dams to revert water flow from the canals back into the marsh. Additional restoration work included creation of pond habitats for spotted frog, introduction of prescribed fire, and manual removal of invasive reed canarygrass. The ecosystem benefits from the restoration work has included increased hydrologic flow across the marsh, reductions in lodgepole pine encroachment, and increases in spotted frog egg masses.

ORAL

CONSERVATION STATUS OF THE KIT FOX (*VULPES MACROTIS*) IN OREGON. David G. Vesely, Oregon Wildlife Institute, PO Box 1061, Corvallis, OR 97339; *dave@oregonwildlife.org*

The kit fox is one of the most elusive mammals in Oregon. Between 1931 and 2012, there were only 25 recorded observations of kit foxes in the state. The last efforts to study kit foxes in Oregon were during the early 1990's. By 2012, it was not certain whether the species was still present in the state. However a remote camera survey conducted in southeastern Oregon from 2012 to 2015 by the Oregon Wildlife Institute and Oregon Department of Fish and Wildlife detected kit foxes at 10 locations within their known geographic range. To better understand the conservation status of the Oregon kit fox population, I synthesized existing scientific literature on the species, as well as information about environmental conditions and land uses at kit fox sites in southeastern Oregon. My review leads me to conclude that the Oregon kit fox population is presently secure from development and land use practices that threaten the species in other states. However, an increasingly severe wildfire regime, projected to be exacerbated by climate change in southeastern Oregon, poses a significant risk to kit foxes and other desert wildlife in the region.

ORAL

A TEST OF SURVEY METHODS FOR AN OLD-GROWTH TREE CANOPY LICHEN. Jesse E. D. Miller, Department of Zoology University of Wisconsin, Madison WI 53706; **John Villella**, Greg Carey, Siskiyou Biosurvey, 265 Ball Road, Eagle Point, OR 97524; Tom Carlberg, California Academy of Sciences, 55 Music Concourse Drive, San Francisco, CA 94118; Heather Root, Botany Department, Weber State University, 2504 University Circle, Ogden UT 84408; *jvillella@siskiyoubiosurvey.com*

Forest managers in many parts of the world are charged with protecting rare lichen species, including species growing near their range limits. These lichens may be particularly vulnerable to effects of climate change, and conserving populations necessitates understanding factors that limit their distributions. Developing effective survey protocols is one key to monitoring rare lichen species, but the effectiveness of commonly used survey methods is rarely tested. In this study, we quantified the canopy distribution of an epiphytic old-growth forest cyanolichen near the edge of its range and tested whether ground surveys reliably detected canopy populations. We found that *Lobaria oregana* is most abundant in two distinct habitats: on tree branches of old, large trees at mid-canopy heights, and on the boles of small trees near ground level. Targeted ground-based detection using litterfall (e.g., the intuitive survey method usually employed in surveys on federal lands) detected the species when it was abundant in the canopy. However, litterfall surveys did not reliably detect the lichen when it occurred in very low abundance. These results suggest that ground surveys are useful for characterizing abundant lichen species, but that canopy surveys can more reliably detect species that occur at a very low abundance.

POSTER

SMALL DIFFERENCES IN ELEVATION MAKE A BIG DIFFERENCE FOR PHYSIOLOGICAL RESPONSES OF UNDERSTORY PLANTS TO DROUGHT CONDITIONS. **Abby J. Watt**, Dylan G. Fisher, Field Ecology Laboratory, The Evergreen State College, Olympia, WA 98505; Joseph A. Antos, Department of Biology, University of Victoria, Victoria, BC V8W 3N5 Canada; Donald B. Zobel, Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331; *abbyjeanwatt@gmail.com*

The extent to which forest species are able to acclimate to climate stressors like drought depends on their physiological responses to the abiotic environment. To investigate how differences in species and microenvironments may affect such physiological responses, we examined water relations and gas exchange rates of dominant understory species in a Pacific Northwest montane forest during a historic drought year (2015) representative of future climate projections for the Northwest. We examined two species of conifers in the shrub layer (*Abies amabilis* and *Tsuga heterophylla*) and two species of mature huckleberry shrubs (*Vaccinium membranaceum* and *Vacciniumn ovalifolium*), taking their measurements in old-growth and adjacent clear-cut sites at two different elevations. Interestingly, we found increased water stress and decreased gas exchange rates at the

higher-elevation sites as compared with the lower elevation sites, but no significant differences between old-growth and clear-cut sites. No significant differences in water stress were detected among the four species, but the two huckleberry species maintained higher gas exchange rates than the two conifer species. These results suggest that small differences in elevation can have a strong influence on understory species' physiological responses to drought stress—even more so than dramatic microclimatic differences between old-growth and clear-cut forests. Additionally, our results help constrain estimates of physiological differences among understory species in montane forests and suggest how species may respond to future climate change.

POSTER

MODELS WITH PRESENCE/ABSENCE OF RED TURPENTINE BEETLE AND WESTERN PINE BEETLE IMPROVE PREDICTIONS OF PONDEROSA PINE POST-FIRE MORTALITY IN THE PACIFIC NORTHWEST. Douglas J. Westlind, Rick G. Kelsey, Walter G. Thies, USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331; *dwestlind@fs.fed.us*

Managers need to accurately predict individual tree mortality with easily observed characteristics to plan post-fire recovery activities following low to moderate intensity fires. We modeled post-fire mortality using fire injury variables of crown scorch proportion (CSP), bud kill proportion (BKP), and bole scorch proportion (BSP) along with the presence/absence of post-fire attack by red turpentine beetle (RTB; *Dendroctonus valens)* and western pine beetle (WPB; *Dendroctonus brevicomis)* on 8,303 ponderosa pine in 19 prescribed and wild fires from east of the Cascade Range crest in Washington, Oregon, and northern California. Due to differences in mortality processes and beetle tree size preferences, separate models were developed for trees greater, and those less, than 53.3 cm diameter at breast height. For small diameter trees, inclusion of RTB and WPB presence improved prediction accuracy for models based on BSP and CSP. After accounting for BSP and CSP, small trees were 1.7 and 6.3 times more likely to die if attacked by RTB or WPB, respectively. For large diameter trees, presence of RTB improved prediction accuracy for models based on BKP and CSP. After accounting for CSP and BKP, large pines were 5.2 times more likely to die when RTB were present. RTB are generally not primary mortality agents for ponderosa pine. Our related studies demonstrate they are responding to heat stress induced ethanol, an indicator of underlying tissue damage, when released to the atmosphere mixed with host volatiles. Western pine beetle presence was not a significant predictor of large pine mortality.

POSTER

REPEATED SPRING AND FALL PRESCRIBED BURNING MAY NOT ACHIEVE DESIRED FUEL STRUCTURES FOR PONDEROSA PINE FORESTS IN THE BLUE MOUNTAINS OF OREGON. **Douglas J. Westlind**, Becky K. Kerns, Walter G. Thies, USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, Oregon 97331; *dwestlind@fs.fed.us*

Decades of fire suppression in western U.S. dry forest types historically frequented by wildfire has allowed them to develop beyond past norms for species composition, tree density and fuel loads putting them at risk to severe wildfire, disease, and insect attack. Repeat burning simulates natural fire regimes, but there is limited information regarding optimal burn intervals and seasonality in relation to achieving desired fuel conditions. We evaluated repeated seasonal (spring and fall) burning effects at two intervals (5- and 15-yr) on fuel structure, including ground fuels (litter and duff), surface fuels (1 to 1000 hour lag-time fuel), understory conifer density (regeneration) and height to live crown (HLC) at six stands in the Blue Mountains. Initial burns followed with either three re-burns at 5-yr, or one at 15-yr intervals all reduced ground fuel, but not surface fuels compared to controls. Five-year fall re-burning resulted in the highest total surface fuel load primarily owing to higher mortality and subsequent tree fall after the initial burns. Fall burns at both intervals were effective at limiting regeneration, but spring burning was not. No treatment effectively raised HLC, but prior thinning of all treatments may have obfuscated those results. Initial spring or fall prescribed burns will reduce some ground fuels and help limit larger tree mortality from subsequent fire, but to achieve sustainable low fuel loads it may be necessary to re-burn during drier, warmer periods in June and July when wildfire ignitions by lightning historically occurred.

ORAL

PEOPLE—HUMAN SYSTEMS IN COMPLEX FIRE-PRONE LANDSCAPES. **Eric White**, USDA Forest Service Pacific Northwest Research Station, Olympia, WA 98512; Jeff Kline, USDA Forest Service Pacific Northwest Research Station, Corvallis, OR 97331; A. Paige Fischer, University of Michigan, Ann Arbor, MI 48109; Susan Charnley, USDA Forest Service Pacific Northwest Research Station, Portland, OR 97208; Christine Olsen, Oregon State University, Corvallis, OR 97331; *Eric.White@oregonstate.edu*

Many fire-prone landscapes around the world are coupled human-natural systems (CHANS) where landscape outcomes are determined jointly from processes and events within linked human and natural subsystems that exist in those landscapes. The fire-prone landscape of central and southern Oregon is a CHANS, where the human subsystem includes private forest landowners and managers, homeowners, and policy makers. Actors within the human subsystem make decisions about forest management and homesites that affect natural resource conditions and wildfire behavior. Using results from social science research in the Forests, People, Fire project, we describe processes

and decision-making within that human subsystem in the context of several complexities that are hallmarks of CHANS: spatial connections across places within the landscape, delayed responses in the natural system from human actions, and infrequent signals to individual actors about disturbance and conditions in the natural system. We describe the motivations of managers and landowners in central and southern Oregon, how those actors organize themselves into social networks that influence management in the fire-prone landscape, the factors that influence private landowner management decision making, and private forest landscape outcomes. We identify opportunities for managers and policy makers to better connect to, and coordinate with, landowner actors within this fire-prone landscape.

ORAL

FUNGAL ENDOPHYTE-INFECTED *ACER MACROPHYLLUM* LEAF LITTER NEGATIVELY INFLUENCES AQUATIC FUNGAL SPORULATION. **Emily R. Wolfe**, Carri J. LeRoy, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, WA 98505; *wolemi06@evergreen.edu*

Microbial decomposers mediate the decomposition of organic substrates. During the early stages of in-stream decomposition, aquatic fungi (hyphomycetes) dominate the colonizer community, and secrete extracellular enzymes to degrade plant litter. However, initial fungal colonization is affected by leaf chemistry, which may be altered by many factors, including endophyte presence. The fungal endophyte *Rhytisma punctatum* infects the leaves of bigleaf maple (*Acer macrophyllum*), and has been shown to slow in-stream decomposition. Using three treatment groups involving *R. punctatum* infection status in leaf tissue (infected, aborted, uninfected), leaf litter punches were submerged in a second-order temperate stream using mesh litter bags and harvested periodically over eight weeks to determine treatment effects on microbial community colonization and decomposition rates. Significantly more fungal conidia were produced on uninfected tissue than tissue containing either successful (t-test, $t(23)=2.37$, $p=0.0267$) or aborted *Rhytisma* infections (t-test, $t(23)=2.40$, $p=0.0250$). Infection status also had a significant effect on decomposition rate (ANCOVA, $F_{5,40}=49.0265$, $p<0.0001$). Interestingly, tissue containing aborted infections decomposed slower than either uninfected or infected tissue (t-test, $t(40)=2.02$, $p<0.0001$), while uninfected and infected tissue decomposed at insignificantly different rates. Although endophytes occur ubiquitously in plants, their influence on aquatic decomposer communities is poorly understood, especially with regard to decomposition and nutrient cycling; consequently, further research is needed to better understand these greater ecosystem effects.

POSTER

DETERMINING THE EFFECTS OF BROOK STICKLEBACK (*CULAEA INCONSTANS*) PRESENCE ON THE TURNBULL NATIONAL WILDLIFE REFUGE, CHENEY, WA. **Jenae Yri**; Chantilly Higbee; Jariel Dewitt; Chelsea Brown; Liam Johnston; Whitney Stevens; Emily Dunn; Krisztian Magori; Joanna Joyner-Matos; Department of Biology, Eastern Washington University, Cheney, WA 99004; *jyri@eagles.ewu.edu*

The introduction of non-native fishes can cause trophic cascades in freshwater habitats; these effects may be amplified in ephemeral habitats. Non-native brook stickleback fishes (*Culaea inconstans*) were first documented on Turnbull National Wildlife Refuge (WA) in 1999 and are now present in many portions of the refuge. The consequences of their presence on the refuge's perennial and ephemeral habitats are poorly understood. From April – September 2015, I compared the abundance of macroinvertebrates, number of invertebrate taxa, dried macrophyte biomass and number of plant species in twelve lentic systems at the refuge. Four systems have brook stickleback and are ephemeral (dry during the 2014 season; "fish/ephemeral"); four have brook stickleback and are perennial (wet during the 2014 season; "fish/perennial"). Three perennial systems are completely free of fish ("fish-free/perennial"); one fish-free, ephemeral system, was not included in these preliminary analyses. The fish-free/perennial lentic systems had the highest macroinvertebrate abundance ($p<0.0001$) relative to the fish systems, and had more macroinvertebrate taxa than did the fish/ephemeral ($p=0.01$) and fish/perennial ($p<0.001$) lentic systems. The fish/ephemeral lentic systems had more macroinvertebrate taxa than did the fish/perennial systems ($p<0.001$). Macrophyte biomass and number of taxa were higher in the fish-free/perennial lentic systems than in the fish/ephemeral (biomass, $p<0.0001$; taxa, $p<0.001$) and fish/perennial (biomass, $p=0.002$; taxa, $p<0.004$) systems. These results suggest that the presence of brook stickleback is associated with lower macroinvertebrate and macrophyte abundance, particularly in ephemeral habitats. This is of particular concern for the refuge because these changes, if they persist, will impact waterfowl nesting success.

ORAL

ENVIRONMENTAL RELATIONSHIPS IN FORESTS OF EARLY 20TH CENTURY COOS COUNTY, OREGON, BASED ON TIMBER CRUISE DATA. **Donald B. Zobel,** Botany and Plant Pathology, Oregon State University, 2082 Cordley Hall, Corvallis OR 97331; *zobeld@science.oregonstate.edu*

Measurements of timber volume (timber cruises) from early 20th century Coos County, Oregon, were used to assess the degree to which tree species distribution and timber volume varied with edaphic and climatic factors. Coos County has diverse geology in a moderate maritime climate, and represents an area of forest transition between the Coast Range and the Klamath Mountains. Burning and cutting had occurred over substantial parts of the area before the cruise. Data for distribution came from 629 sections; those for volume, from 192 sections with old-growth forest. Most forests were dominated by

Douglas-fir (*Pseudotsuga menziesii*); Sitka spruce (*Picea sitchensis*), although least frequent, had the second-most timber volume. All six commercial conifer species showed patterns of distribution in relation to geography and to environment that differed significantly from other species. Douglas-fir distribution varied significantly with geologic and soil type, temperature and summer precipitation; western hemlock (*Tsuga heterophylla*) and Port-Orford-cedar (*Chamaecyparis lawsoniana*), with geology, soils and precipitation (with opposite sign); Sitka spruce, with soils and temperature; grand fir (*Abies grandis*), with soils and geology; and western redcedar (*Thuja plicata*), only with geology. In old-growth forest, volume of spruce varied significantly with geology, soils, and temperature; grand fir, with geology and soils; Douglas-fir, with temperature and precipitation; hemlock and Port-Orford-cedar with precipitation (with opposite sign), and redcedar with no factor. Cruise data can be used to specify which geologic and soil units should make good and poor habitat for future planting of the species.