CELEBRATING 15 YEARS!

Urban Ecology & Conservation Symposium

15th Annual | February 6, 2017

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Peregrine falcon in flight–Mike Houck, Urban Greenspaces Institute
OakQuest– Lori Hennings, Metro Parks & Nature
Oregon iris at Cooper Mountain Nature Park– Lori Hennings, Metro Parks & Nature
Western screech owl at Oaks Bottom Refuge– Scott Carpenter
Conducting survey at Fernhill Wetland– Candace Larson
Peregrine falcon– Mike Houck, Urban Greenspaces Institute
Certificate of Appreciation awards–Mike Skuja, Tualatin Riverkeepers
Green heron– Ray Hennings
Boy smelling flower– Brooke Porter, Vancouver's Water Resource Education Center
Beaver eating himalayan blackberry–Mike Houck, Urban Greenspaces Institute
Bee and sunflower– Mike Houck, Urban Greenspaces Institute

15TH ANNUAL

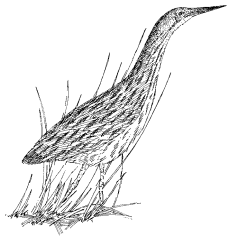
URBAN ECOLOGY & CONSERVATION SYMPOSIUM

Held at
Smith Memorial Center Ballroom
Portland State University
Portland, Oregon, USA
February 6, 2017

Organized by the
Urban Ecosystem Research Consortium (UERC)

Sponsored by

TABLE OF CONTENTS



Urban Ecosystem Research Consortium (UERC)
Portland, Ore. - Vancouver, Wash. Metropolitan Region

What is the UERC?
The UERC is a consortium of people from various universities and colleges, state and federal agencies, local governments, non-profit organizations and independent professionals interested in supporting urban ecosystem research and creating an information-sharing network of people that collect and use ecological data in the Portland/Vancouver area. Participants come from a variety of fields, including:

air quality	*education*	*hydrology*	*stormwater management*
climate change	*environmental design*	*land management*	*sustainable development*
conservation biology	*fisheries*	*land use planning*	*transportation*
ecology	*geology*	*social sciences*	*water quality*
economics	*habitat restoration*	*soil science*	*wildlife biology*

Mission Statement - To advance the state of the science of urban ecosystems and improve our understanding of them, with a focus on the Portland/Vancouver metropolitan region, by fostering communication and collaboration among researchers, managers and citizens at academic institutions, public agencies, local governments, non-profit organizations, and other interested groups.

Goals and Objectives
- Provide direction and support for urban ecosystem research
- Create an information-sharing network within the research community
- Track and house available information
- Promote greater understanding of urban ecosystems and their importance

Organizers - The principal organizers span academic institutions, government agencies (city, regional, state and federal), private firms and non-profit organizations. Individuals from the institutions listed below have served on the steering committee. The diverse backgrounds and affiliations of those involved have allowed the UERC to bring together many important sectors of the natural resources community.

Audubon Society of Portland
City of Portland
City of Vancouver
Earthworks
Herrera Environmental Consultants
Kingfisher Ecological Services
Lewis & Clark College
Metro
Oregon Department of Fish and Wildlife
Oregon State University
Portland State University
Reed College
The Intertwine Alliance
Tualatin Hills Parks & Recreation District
U.S. Fish and Wildlife Service
Urban Greenspaces Institute

Web Site – The UERC web site can be found at **http://www.uercportland.org/**. There, you will find background and contact information, a link to sign up on the listserv, announcements about upcoming events, and full details about annual UERC symposia, including downloadable proceedings.

Listserv - Oregon State University hosts a listserv designed for members to share information and facilitate communication among those interested in urban ecology. Anyone can join by going to the UERC web site and following the link "Join Our Listserv."

Advocacy Statement - The role of the UERC is not to provide a political or advocacy platform, but rather to foster communication and collaboration by offering a forum for professionals to exchange and discuss information regarding urban ecology and its application to relevant fields.

2017 URBAN ECOLOGY & CONSERVATION SYMPOSIUM ACKNOWLEDEMENTS

ORGANIZING COMMITTEE

Amy Chomowicz
City of Portland, Bureau of Environmental Services
amy.chomowicz@portlandoregon.gov; (503) 823-5323

David Cohen
The Intertwine Alliance
david@theintertwine.org; (503) 445-0991

Julie Fry
Reed College, Chemistry and Environmental Studies
fry@reed.edu; (503) 517-7951

Sean Gordon
Inst. for Sustainable Solutions, Portland State Univ.
sean.gordon@pdx.edu; (503) 808-2698

Lori Hennings
Metro, Parks and Nature
lori.hennings@oregonmetro.gov; (503) 797-1940

Mike Houck
Urban Greenspaces Institute
mikehouck@urbangreenspaces.org; (503) 319-7155

Ted Labbe
Kingfisher Ecological Services
ted.labbe@gmail.com; (503) 758-9562

Joe Liebezeit
Audubon Society of Portland
jliebezeit@audubonportland.org; (971) 222-6121

Noelwah Netusil
Reed College, Department of Economics
netusil@reed.edu; (503) 517-7306

Bob Sallinger
Audubon Society of Portland
bsallinger@audubonportland.org; (503) 292-6855 x110

Cory Samia
City of Vancouver, Water Resources Education Center
cory.samia@cityofvancouver.us; (360) 487-7112

Olyssa Starry
Urban Honors, Portland State University
ostarry@pdx.edu; (503) 725-2335

Jennifer Thompson
U.S. Fish and Wildlife Service, Oregon State Office
jennifer_thompson@fws.gov; (503) 231-6179

FINANCIAL SPONSORS

Audubon Society of Portland
Metro
Portland Environmental Services
Portland State University, Institute for Sustainable Solutions
Urban Greenspaces Institute

EVENT SUPPORT

We also wish to thank **Cornelia Coleman**, PSU, University Honors College, **Christy Carovillano**, Metro Natural Areas Program and **Brooke Porter**, City of Vancouver, Water Resources Education Center, for their assistance and support for this event.

2017 Urban Ecology & Conservation Symposium
AGENDA

8:00 **REGISTRATION**

9:00 **WELCOME AND INTRODUCTION: Mike Houck**, Executive Director, Urban Greenspaces Institute, with opening remarks from **Robert Liberty**, Director, Institute for Sustainable Solutions, Portland State University

9:10 **OPENING KEYNOTE ADDRESS: Dr. Kathleen Wolf**
Research Social Scientist, University of Washington, College of the Environment
Holding nature accountable: The economics of nature and human health

GREEN INFRASTRUCTURE ELEMENTS & FUNCTIONS *Moderator: Amy Chomowicz, City of Portland*

9:50	Katie Holzer	City of Gresham	Monitoring the effectiveness of green stormwater infrastructure
10:00	Angie DiSalvo	City of Portland, Urban Forestry, Parks & Recreation	How Portland engaged volunteers to help inventory 220,000 street trees
10:10	Jason Aloisio	Wildlife Conservation Society	Spatially-dependent biotic and abiotic factors drive survivorship and physical structure of green roof vegetation
10:20	Adam Nayak	Cleveland High School Student/ Johnson Creek Watershed Council Intern	Modeling the effects of land use change on flooding in Northwest streams
10:30	Q&A		

10:40 **BREAK** *Raffle at 10:55*

THE URBAN HABITAT *Moderator: Jennifer Thompson, U.S. Fish and Wildlife Service*

11:00	Marion Dresner	Portland State University	Do urban yards contribute to biodiversity?
11:10	Bill Hall	Parametrix	Beaver management practices within urban drainage districts
11:20	Bill Gerth	Oregon State University, Department of Fisheries & Wildlife	Developing environmental DNA methods to promote conservation of Portland Metro's own freshwater crustacean species
11:30	Adam Baz	Portland State University/Portland Environmental Services & Parks	Habitat associations of woodpeckers in Portland's urban parks
11:40	Lori Hennings	Metro	Impacts of recreation on wildlife
11:50	Q&A		

12:00 **LUNCH** *Raffle at 12:55*
You are invited to participate in a facilitated discussion or walking tour during the lunch break. Descriptions of the lunchtime offerings can be found on page 7.

1:00 **AFTERNOON KEYNOTE ADDRESS: Dr. Lynn D. Dierking**
Sea Grant Professor, Free-Choice STEM Learning, Oregon State University, College of Education
Meaningfully engaging families and communities in nature: A lifelong learning approach

CULTURE, CITIZEN SCIENCE & SCIENTISTS *Moderator: Joe Liebezeit, Audubon Society of Portland*

1:40	Jenny de la Hoz	U.S. Fish & Wildlife Service/Oregon State University	The environmental identity of Latinas/os in the Pacific Northwest
1:50	Mike Skuja & Carlos Gonzalez	Tualatin Riverkeepers & Centro Cultural	Growing Green: Training diverse leaders for tomorrow's jobs
2:00	Kris Freitag	Portland State University	Citizen's Rare Plant Watch
2:10	David Lowenstein	Oregon State University, Department of Horticulture	Public engagement as a tool to monitor the distribution of Brown Marmorated Stink Bug and a newly introduced biocontrol agent
2:20	Meenakshi Rao	Portland State University	iSmell: An app for reporting and mapping environmental odors and enabling citizen science
2:30	Q&A		

2:40 **BREAK** *Raffle at 2:55*

HABITAT RESTORATION & MANAGEMENT *Moderator: Cory Samia, City of Vancouver*

3:00	Kaitlin Lovell	City of Portland Bureau of Environmental Services	Strategic prioritization of restoration projects in an urban stream under climate change
3:10	Lucius Caldwell	Cramer Fish Sciences	Thermal benefits of restoration: An overlooked component
3:20	Robert Lascheck	Portland State University	The effects of long-term managed flooding on *Phalaris arundinacea* and native vegetation in a large palustrine wetlands ecosystem
3:30	Andrea Hanson	Oregon Department of Fish and Wildlife	Introducing OregonConservationStrategy.org: A Blueprint for Conservation in Oregon
3:40	Q&A		

3:50 **CLOSING REMARKS:** Lori Hennings, Metro

4:00 – 6:00 **POSTER SESSION AND SOCIAL**
with Student Poster Award presented at 5:30

POSTER PRESENTATIONS

Coordinator: Ted Labbe

AUTHOR(S)	TITLE
Aaron Anderson,* Michael Nelson, and Gail Langellotto (Oregon State University)	An analysis of bee Communities from home and community gardens
Leslie Bliss-Ketchum,* Catherine Werner (City of St. Louis), Peter Brastow (City of San Francisco), Lori Hennings (Metro), Rebecca Kiernan (City of Pittsburgh), and Joan Blaustein (City of Philadelphia)	The Urban Biodiversity Inventory Framework
Nancy Broshot,* Hayden Cooksy, Tatiana Taylor (Linfield College), and Wes Hanson (University of Maryland)	A comparison of urban soil to rural soil
Lauren A. Burns* and Kevan B. Moffett (Washington State University)	Managing street tree canopy and composition to reduce urban air and runoff temperatures in Portland, Oregon
Noah Enelow,* Brody Abbott, Mike Mertens (Ecotrust), Chris Schildt, Kalima Rose, Victor Rubin (PolicyLink), Alan Hipolito, Ricardo Moreno, and Carolina Iraheta (Verde)	Jobs and equity in the urban forest
Leilani Ganser (Reed College)	Urban avifaunal diversity: An indicator of anthropogenic pressures in northwestern metropolitan Atlanta
Charles George* and Lucca DiGioia (Mount Hood Community College)	Mt. Hood Community College Salmon Safe Program
Jim Gersbach* and Angie DiSalvo (City of Portland Parks & Recreation)	How diverse are Portland's street trees? Discoveries from the Tree Inventory Project
Dave Helzer,* Adam Baz (City of Portland), Joe Liebezeit, Mary Coolidge, and Candace Larson (Audubon Society of Portland)	Winter bird monitoring at Mt. Tabor Park
Christine Johnson,* Jenna Tilt, Paul Ries, and Bruce Shindler (Oregon State University)	Continuing professional education in green infrastructure: A constructivist approach to interdisciplinary trainings
Ted Labbe* (Kingfisher Ecological Services), David Hedburg (Portland State University History Department), Angie DiSalvo and Jim Gersbach (City of Portland Parks and Recreation)	Changing composition of Portland's changing urban forest, 1938-present
Vanya North (Clark Public Utilities)	Eradication Nation: Controlling knotweed in the Salmon Creek Watershed
Zuriel Rasmussen (Portland State University)	Why did the coyote cross the road? Analyzing coyote sighting reports from the Portland metropolitan area

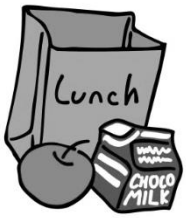
AUTHOR(S)	TITLE
Natalie Rogers,* Leslie Bliss-Ketchum, Martin Lafrenz, and Catherine de Rivera (Portland State University)	Urban connections: Assessing greenspace wildlife connectivity in Portland, Oregon
Celeste Searles Mazzacano* and Janel Hull (Johnson Creek Watershed Council)	Community-based dragonfly & damselfly monitoring in Johnson Creek Watershed
Lauren Senkyr,* Jill Ory (NOAA Restoration Center & ERT), and Jennifer Thompson (U.S. Fish and Wildlife Service)	Habitat restoration update for the Portland Harbor Superfund Site
Kristin Smith* (Tualatin Hills Park & Recreation District)	Nature revealed: Incorporating public art in natural areas
Michelle Talal* and Mary Santelmann (Oregon State University)	Vegetation biodiversity patterns and ecosystem functioning relationships within various types of green infrastructure of Portland, Oregon
Ashlyn Teather,* Jesse Seals and Kimberly Koller (City of Gresham)	Johnson Creek beaver survey results in Gresham
Ruth "Anna" Thurston	Insights from green roof failure

**Primary author*

Lunchtime Offerings

Bring your lunch and learn about some exciting ideas in the world of urban ecology. Be inspired by new ways of thinking and the experiences of your peers. Four conversations for those who need more intellectual stimulation and two tours for those who want to move their bodies. Come be part of the conversation.

1) **Green Infrastructure Perspectives – Room 328**



Come join a discussion to share varied experiences with green infrastructure in the Pacific Northwest. In what way can green infrastructure be used to enhance biodiversity and ecosystem function? What do you envision to be the future of green infrastructure within our region?

- Conversation Lead: Michelle Talal, Oregon State University

2) **Equity and Inclusion– Room 329**

Research has shown that quality urban green spaces can reduce stress and improve quality of life for urban residents. But not all urban spaces are equal. What can be done to ensure that all urban residents have access to quality green spaces?
Jenny will share a research study conducted by Matthew White on Urban Green Spaces (http://www.bbc.com/news/science-environment-25682368) and compare it to research done by the U.S. Forest Service regarding Latinos and fear (https://www.fs.fed.us/research/highlights/highlights_display.php?in_high_id=203) to help spur interactive conversation on this topic.

- Conversation Co-Leads: Jenny de la Hoz, U.S. Fish and Wildlife Service and David Cohen, The Intertwine Alliance

3) **Impacts of Revegetation Projects: Costs of the Unplanned – Room 333**

Do we fully understand and consider the short and long term impacts of our revegetation projects? Join a conversation about questions you've never thought of that could make your projects more successful. The facilitator will offer some project examples and pose questions, but attendees will carry the conversation.

- Conversation Lead: Jason Dumont, Mosaic Ecology LLC

4) **Where Conservation and Climate Change Meet – Room 327**

Share your activities and interests related to climate change and discuss how we might make progress on the actions recommended in the Regional Conservation Strategy (Intertwine 2012)

- Conversation Co-leads: Robert Liberty, PSU Institute for Sustainable Solutions and Kaitlin Lovell, Portland Bureau of Environmental Services

5) **PSU Sustainable Features Tour (including cultural and ecological features) –** meet your PSU guide at the stage. Tours will depart promptly at 12:15 and return by 12:55pm.

6) **Self-guided PSU Sustainable Features Tour**
Stop by the registration desk to pick up a map of places to explore.

MORNING KEYNOTE ADDRESS

Kathleen Wolf, Ph.D.
Research Social Scientist
University of Washington, College of the Environment
School of Environmental and Forest Sciences
Seattle, Washington

Holding nature accountable: The economics of nature and human health

Assessment of environmental services (e.g. carbon and stormwater management) including economic valuation has generated agency and community support for planning and management of urban natural resources. Decades of research also confirms human health benefits (e.g. Green Cities: Good Health website). Benefits occur within a wide range of urban greening situations (e.g. trees, parks, school yards, streetscapes), resulting in a range of positive human health responses (e.g. work performance, cardiovascular disease, stress and immune function). The health evidence is the basis of recent peer-reviewed articles about economic benefit and valuation. This presentation will highlight analysis results, showing economic value for the nation and communities. It will present values within several stories or scenarios, based on metro nature settings, social situations and demographics. Finally, it will propose methods, for discussion, about how local communities can demonstrate how investments in the urban ecosystems and metro nature result in economic returns.

Biography

Dr. Kathleen Wolf is a Research Social Scientist with the College of the Environment, University of Washington, and is a research associate with the U.S. Forest Service Pacific NW Research Station on a research program about Urban Forestry and Civic Stewardship. Since receiving her Ph.D. from the University of Michigan, Dr. Wolf has done research to better understand the human dimensions of urban forestry and urban ecosystems. She has also worked professionally as a landscape architect and as an environmental planner. Kathy's studies are based on the principles of environmental psychology; her professional mission is to discover, understand and communicate human behavior and benefits, as people experience nature in cities and towns. Moreover, Kathy is interested in how scientific information can be integrated into local government policy and planning. She is a member of or has served with national organizations that promote nature in cities: the Environmental Design Research Association, the International Society of Arboriculture, Society of American Foresters, the Transportation Research Board national committee on Landscape and Environment, the Washington State Community Forestry Council, as well as a technical contributor on human well-being to the Sustainable Sites Initiative, and Research Advisor to the TKF Foundation's NatureSacred program. Dr Wolf has presented her research throughout the United States, in Canada, Europe, Australia and Japan. An overview of Dr. Wolf's research programs can be found at www.naturewithin.info and a review of nature-based health benefits is available at Green Cities: Good Health: www.greenhealth.washington.edu.

AFTERNOON KEYNOTE ADDRESS

Lynn D. Dierking, Ph.D.
Sea Grant Professor, Free-Choice STEM Learning
Oregon State University, College of Education
Corvallis, Oregon

Meaningfully engaging families and communities in nature: A lifelong learning approach

In order to meaningfully engage families and communities in nature, one needs to step back and understand families, communities and learning in the 21st century, in particular, free-choice learning. Most of what people learn, they learn through free-choice learning, learning guided by the needs and interests that arise as they go about the daily activities of their lives. Dr. Dierking has spent almost 40 years working with and studying youth and families in diverse communities. Her research has been conducted in museums and science centers, zoos and aquariums, libraries, national and local parks, nature centers, prisons and individuals' homes. Through this research she has gained insights into learning, observing directly its continuous nature throughout people's lifetimes, and also appreciating that learning is reinforced in and across multiple settings. Most importantly, to connect with people around any topic such as nature, it is critical to respect that families themselves are learning communities, the first and foremost learning institution to which a person belongs, playing a vital role in facilitating children's (and adult members') joy for learning and understanding that learning is a process, something that all children *and* adults can do all of their lives. It is also in the family where people often learn about the joy of connecting to, and protecting nature. Currently Dr. Dierking is Principal Investigator and Project Director for a National Science Foundation (NSF) Research in Service to Practice project, SYNERGIES, based in the Parkrose neighborhood of Portland. This 7-year research-practice partnership is designed to collaboratively create a community-wide STEM learning ecosystem that supports the needs and interests of middle-school-age Parkrose youth and their families.

Biography

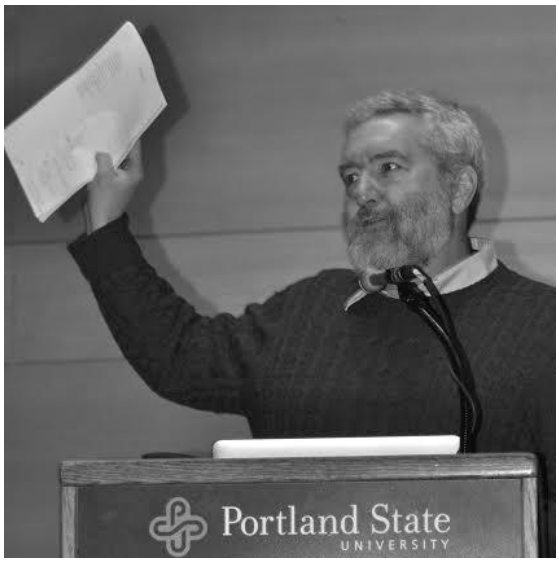
Dr. Lynn D. Dierking is a Professor in Free-Choice STEM (*S*cience, *T*echnology, *E*ngineering, & *M*athematics) Learning at Oregon State University. She is nationally/internationally recognized for her free-choice learning research with diverse youth and families. In addition to the NSF SYNERGIES project, she recently completed three other NSF-funded studies, *Cascading Influences*, long-term impacts of girls-only programming; *Pathways to Brighter Futures through Green Careers*, with incarcerated Hispanic youth in New Mexico; and a Denver Museum of Nature & Science project studying youth STEM literacy. Dr. Dierking publishes extensively, is on three national editorial boards and has been acknowledged for her critical role and influence in the recognition that free-choice/informal learning matters. She received the 2010 American Alliance of Museums' John Cotton Dana Award for Leadership, a 2016 Distinguished Contributions to Science Education through Research award from NARST, an international organization supporting research on teaching and learning, and served as a speaker in NSF's 2013 Distinguished Lecture Series.

The Fifteenth Annual Urban Ecology and Conservation Symposium is Dedicated to:

Alan Yeakley and Jennifer Thompson

In 2001 several colleagues gathered to form a regional Urban Ecosystem Research Consortium, and two years later the Consortium hosted its first Urban Ecology and Conservation Symposium.* Over the next sixteen years organizers came and went, but these two people remained throughout and their ongoing leadership has in large part been responsible for both the UERC's and Symposium's success.

Alan Yeakley: Alan, who left his position as Director of PSU's School of the Environment in 2016 to take the position of Chair of Geography and Environmental Systems at the University of Maryland, insisted that UERC remain above the political fray and focus instead on maintaining objective, science-based research and information for local and regional policy makers, citizens, and nonprofit organizations. An inspiring leader, Alan guided many graduate students who engaged in ecological research in the Portland metropolitan region. His tireless efforts ensured that PSU continued to host the annual UERC symposium. He dealt with myriad campus logistics to ensure the symposium ran smoothly, year in and year out.



Jennifer Thompson: Jennifer, in addition to shepherding the UERC and Symposium from day one, has contributed to urban conservation in many venues including serving as the USFWS lead on the Metropolitan Greenspaces Program, advising Metro's regional fish and wildlife habitat program and working on a wide variety of urban conservation efforts with many local partners. Jennifer has been a tireless advocate, both internally and externally, to elevate urban conservation and access to nature in the city. She leaves her position at the Oregon Field Office early in 2017 to return home to Falls Church, VA to assume her new position with USFWS.

Alan and Jennifer will be missed for their leadership, technical expertise, camaraderie, and for mentoring those new members of the UERC family. We wish them the best in their new endeavors.

*Original founding members: Jennifer Budhabhatti, Lori Hennings, Mike Houck, Kelli Larson, Joe Poracsky, Bob Sallinger, Mary Santelmann, Jennifer Thompson, Alan Yeakley
First symposium organizing committee: Jennifer Budhabhatti, Lori Hennings, Mike Houck, Kelli Larson, Holly Michael, Lauri Shainsky, Jennifer Thompson, Alan Yeakley
Photo credits: Mike Houck

ABSTRACTS SUBMITTED

Jason Aloisio[1], Matthew I. Palmer[2], Mario A. Giampieri[3], Amy R. Tuininga[4], James D. Lewis[5]

[1]Wildlife Conservation Society, Phone: (631) 806-8376, Email: jaloisio@wcs.org
[2]Columbia University, Email: mp2434@columbia.edu
[3]Massachusetts Institute of Technology, Email: mariogiampieri@gmail.com
[4]Montclair State University, Email: tuiningaa@mail.montclair.edu
[5]Fordham University, Email: jdlewis@fordham.edu

Spatially-dependent biotic and abiotic factors drive survivorship and physical structure of green roof vegetation

Plant survivorship depends on biotic and abiotic factors that vary at local and regional scales. This survivorship, in turn, has cascading effects on community composition and the physical structure of vegetation. We evaluated the effects of biotic and abiotic factors on survivorship, composition and physical structure of two native perennial species assemblages, one characterized by a mixture of C4 grasses and forbs (Hempstead Plains: HP) and one characterized by a mixture of C3 grasses and forbs (Rocky Summit: RS), that were initially sown at equal ratios of growth forms (5:1:4; grass, N-fixing forb and non-N-fixing forb) in replicate 2-m^2 plots planted on 10 roofs. Of 24,000 installed plants, 40% survived 23 months after planting. Within-roof factors explained 71% of variation in survivorship, with biotic (species identity and assemblage) factors accounting for 54% of the overall variation, and abiotic (growing medium depth and plot location) factors explaining 17% of the variation. Among-roof factors explained 29% of variation in survivorship and increased solar radiation correlated with decreased survivorship. While growing medium properties (pH, nutrients, metals) differed among roofs there was no correlation with survivorship. Percent cover and sward height increased with increasing survivorship. At low survivorship, cover of the HP assemblage was greater compared to the RS assemblage. Sward height of the HP assemblage was about two times greater compared to the RS assemblage. These results highlight the effects of local biotic and regional abiotic drivers on community composition and physical structure of green roof vegetation.

Keywords: Conservation biology, Plant ecology, Sustainable development

Aaron Anderson[1], Michael Nelson[2], Gail Langellotto[3]

[1]Oregon State University, Phone: (503) 860-9286, Email: andeaaro@oregonstate.edu
[2]Oregon State University, Email: nelsonm8@oregonstate.edu
[3]Oregon State University, Email: gail.langellotto@oregonstate.edu

An analysis of bee communities from home and community gardens

Urban green-space has gained notice as a source of quantifiable ecosystem services. Gardens are unique examples of urban green space, as they tend to be small, fragmented, florally rich and individually managed parcels that can support an abundant and diverse assemblage of urban bees. The value of gardens as urban habitat for these species is particularly significant due the negative impact of urbanization on overall biodiversity. Through a comprehensive literature review of published bee surveys in the United States, this study sought to understand the ecological characteristics of bee communities in urban gardens, and bee community composition across eco-regions. Despite the hypothesized homogenization of floral resources in gardens, a cluster analysis of presence/absence data show that bee composition is distinct east or west of the Rocky Mountains. Further, ground-nesting species richness was found to be significantly depressed in home gardens compared to other systems, while cavity nesting species were greater represented in the urban environment.This analysis suggests several avenues through which home gardeners can affect bee diversity in their locality, such as focusing on early-season floral resources and providing a variety of ground cover options for nesting bees.

Keywords: Animal ecology, Conservation biology

Adam Baz

Portland State University, Bureau of Environmental Services, Portland Parks and Recreation, Phone: (845) 532-5401, Email: adambaz@pdx.edu

Habitat associations of woodpeckers in Portland's urban parks

Urbanization is a driving force in the loss of biodiversity and forest cover. In this context urban parks are essential to the maintenance of biodiversity by providing patches of remnant forest that may benefit forest specialists such as woodpeckers. Woodpeckers perform a critical ecosystem function by creating tree cavities that are used by a suite of other forest organisms, yet little information exists on urban woodpecker ecology. My master's research aimed to answer the following questions: what habitat, landscape, and anthropogenic variables drive changes in woodpecker abundance in urban parks? And, what natural resources should park managers conserve for the benefit of woodpeckers? In 2015-16 I surveyed woodpeckers in 30 urban parks throughout Portland, Oregon using point counts and audio broadcast surveys. I investigated 11 explanatory variables as possible predictors of woodpecker abundance, including patch area, tree and snag density, length of downed logs, shrub density, canopy cover, habitat connectivity, and human development. The relationships between these variables and woodpecker abundance were analyzed using linear regression models. Pileated and Hairy woodpeckers exhibited similar distributions, and their abundance increased with patch area and forested conditions. Conversely, downy woodpeckers and northern flickers were more abundant in smaller, less forested parks. Pileated and hairy woodpeckers may be useful indicator species of forested urban parks, and I recommend that park managers protect large, contiguous forest patches. Larger forested stands appear to benefit these woodpeckers and the many species associated with woodpecker occurrence.

Keywords: Animal ecology, Land use planning, Wildlife biology

Leslie Bliss-Ketchum[1], Catherine Werner[2], Peter Brastow[3], Lori Hennings[4], Rebecca Kiernan[5], Joan Blaustein[6]

[1]Samara Group LLC, Phone: (503) 481-6753, Email: leslie@samarapdx.com
[2]City of St. Louis Mayor's Office, Email: WernerC@stlouis-mo.gov
[3]San Francisco Department of Environment, Email: peter.brastow@sfgov.org
[4]Parks and Nature Department, Metro, Email: lori.hennings@oregonmetro.gov
[5]Office of Sustainability, City of Pittsburgh, Email: rebecca.kiernan@pittsburghpa.gov
[6]Philadelphia Parks & Recreation, Email: joan.blaustein@phila.gov

The Urban Biodiversity Inventory Framework

In recognition of the need to accurately assess biodiversity in urban areas five partner cities (St. Louis MO, San Francisco CA, Portland OR, Pittsburgh PA and Philadelphia PA), active in the Urban Sustainability Directors Network, selected Samara Group LLC to develop the Urban Biodiversity Inventory Framework (UBIF). In conjunction with partner cities Samara group identified three data collection tracks that vary in the resources required to accomplish them, however all methods can be utilized simultaneously. Track 1 involves compiling local stakeholder/partner data on species detections within the city providing documentation of species detections throughout the city. Track 2 and 3 rely on a city-specific suite of surrogate species selected to represent habitats of interest in the region. These species are then monitored at paired sites, one within the city, and a second at a reference site. Monitoring paired sites allows for detection of larger trends, such as those due to climate change that may be difficult to detect with city sites alone. Track 2 involves presence/absence monitoring of surrogate species while Track 3 involves estimating subpopulations. These data will be entered and stored in a central web interface location. The primary goal of the UBIF is to create a new national norm by identifying which urban biodiversity information should be collected and to standardize the methods used for data collection and storage. Ultimately the UBIF will provide cities the ability to track changes over time, develop urban biodiversity enhancement strategies and prioritize areas in need of restoration or other resources.

Keywords: Conservation biology

Nancy Broshot[1], Hayden Cooksy[2], Tatiana Taylor[3], Wes Hanson[4]

[1]Linfield College, Phone: (503) 883-2753, Email: nbrosho@linfield.edu
[2]Linfield College, Email: hcooksy@linfield.edu
[3]Linfield College, Email: ttaylor1@linfield.edu
[4]University of Maryland, Email: whanson@umd.edu

A comparison of urban soil to rural soil

Previous studies have shown significantly more seedlings and saplings at control sites above Estacada, Oregon than in Forest Park. In an attempt to determine possible reasons for the lack of young trees in the urban forest, we measured the depth of the O horizon, as well as soil Carbon, Nitrogen, and CO_2 (as a measure of respiration rate) in soil at multiple sites. We found significantly deeper O horizons at the control sites relative to the sites in any section of Forest Park. We also found significantly higher levels of C and a higher C/N ratio at the control sites. We did not find significant differences among the level of soil respiration, but did see a tendency for higher levels at the control sites. We will discuss these findings at the conference.

Keywords: Habitat assessment, Plant ecology, Soil science

Lauren Burns[1], Kevan B. Moffett[2]

[1]School of the Environment, Washington State University, Vancouver, WA, Phone: (937) 212-9242, Email: lauren.burns@wsu.edu
[2]Washington State University, Email: kevan.moffett@wsu.edu

Managing street tree canopy and composition to reduce urban air and runoff temperatures in Portland, Oregon

Warm stormwater runoff from streets has the potential to increase urban stream temperatures and degrade sensitive and threatened downstream cold-water aquatic habitats. Under predicted climate scenarios of lower streamflows and rising in-stream water temperatures, urban stormwater runoff may further imperil these species. To aid cities in adapting to changing climate while protecting local species of concern, we propose looking towards managing urban street tree canopy as one strategy to help cool cities, manage runoff, and reduce runoff temperatures. While urban forestry benefits have been widely researched, little data exist on the interrelationship between urban forests and runoff temperatures. To test the importance of the amount and type of street tree cover in determining runoff temperature, we measured temperature, water, and weather variables (air, pavement, and runoff temperatures, runoff volumes, precipitation, solar radiation), in addition to tree metrics (type, height, canopy cover fraction) for 12 residential street blocks in inner Portland, Oregon. The sites spanned low vs. high street tree canopy cover for both deciduous and evergreen tree types (3 streets for each of the 4 combinations). Preliminary results indicate statistically significant differences in summer and early fall runoff temperatures related to both the amount and type of street tree canopy cover and quantifiable, significant differences in pavement, air, and runoff temperatures in full sun vs. under street tree shade. Continued study will fit the field data into a numerical model suitable for predicting benefits of different street tree planting decisions for mitigating high-temperature urban runoff.

Keywords: Climate change, Fisheries, Hydrology

Lucius Caldwell[1], Raymond Timm[2], Paul Anders[3], Philip Roni[4]

[1]Cramer Fish Sciences, Phone: (503) 491 9577, Email: lucius.caldwell@fishsciences.net
[2]Cramer Fish Sciences, Email: ray.timm@fishsciences.net
[3]Cramer Fish Sciences, Email: anders@fishsciences.net
[4]Cramer Fish Sciences, Email: phil.roni@fishsciences.net

Thermal benefits of restoration: An overlooked component

In the Pacific West, summer water temperatures in 99% of streams have increased by ≈0.1°C/decade since the mid-1960s. Global climate change models agree that stream temperatures will continue to increase in the foreseeable future. Much of the Pacific West now exhibits thermal impairment of waterbodies, and temperature-sensitive taxa such as Pacific salmonids already encounter thermal barriers that impede migrations, forcing range contractions. These impacts are not limited to salmonids, but rather extend to include additional important fishes such as herring and lamprey. Currently, temperature mitigation efforts focus on maintaining or restoring riparian buffers to augment stream shading and reduce accretion of additional thermal load. While effective at buffering streams from warming effects of solar radiation, shading does little to cool water that is already warm. Roads, urban development, and agricultural uses can logistically limit practical riparian buffer widths and function. Moreover, imperiled fish stocks may not be able to wait the decades necessary for the functional benefits of riparian plantings to be realized. As a result, there is a compelling need for techniques that effectively promote in-stream cooling. One mechanism proposed to cool stream water is forcing the water to infiltrate the channel bed and interact with hyporheic substrate. During summer months, ground temperatures underneath the stream bed are substantially cooler than stream water temperatures. When warm stream water is forced into interstitial spaces between stream bed substrate, this water interacts with particles that are cooler than the water itself. Rate of water cooling depends on the temperature differential between the water and hyporheic substrate, as well as the spatiotemporal dynamics of this water-substrate interaction. Spatially longer hyporheic path lengths and temporally longer residence times are generally associated with cooler upwelling zones. When they promote deep downwelling, habitat structures show demonstrable temperature-moderating effects. If accomplished on a sufficiently large spatial scale, techniques making use of such structures have the capacity to lower in-stream water temperatures downstream of the placement. We hypothesize that thermal impairments can be addressed by local increases in exchange between surface and subsurface waters. Consequently, we analyzed series of temperature data associated with different types of restoration projects, and undertook a synoptic review of published data to determine differences in temperature above, below, and through reaches that received restoration treatments. Findings from this study could inform management of temperature problems in salmonid streams in places where competing interests such as agricultural land uses, and physical constraints like roads might preclude conventional responses to temperature issues.

Keywords: Climate change, Fisheries, Habitat restoration

Jenny de la Hoz[1]

[1]U.S. Fish and Wildlife Service / Oregon State University, Phone: (831) 915-5164, Email: jennydelahoz@gmail.com

The environmental identity of Latinas/os in the Pacific Northwest

The construct of environmental identity, or the sense of "how we orient ourselves to the natural world," is changing the way environmental education field connect people, especially urban populations, to the environment. Instruments such as the Environmental Identity Scale (EID) help us ascertain the strength of an individual's environmental identity. In the United States, these scales have been administered historically to college students, most of whom are from a Caucasian population. This study focuses on Latinas/os, an underrepresented audience in the environmental movement, who predominantly live in the Pacific Northwest and who possess a broad range of literacy skills. Overall, the study sample (N = 149) demonstrated a strong environmental identity, with significant differences according to age, gender, and place of birth. Study implications position the lack of Latina/o activism back on the environmental movement and its inability to activate the Latina/o environmental identity.

Keywords: Environmental education, Environmental policy, Environmental social sciences

Angie DiSalvo

Urban Forestry, Parks & Recreation, City of Portland, Phone: (503) 823-4484, Email: angie.disalvo@portlandoregon.gov

How Portland engaged volunteers to help inventory 220,000 street trees

Portland Parks & Recreation Urban Forestry recently completed one of the largest and most comprehensive inventories of urban street trees in the nation. From 2010 to 2016, seven standardized data points were collected on almost 220,000 trees in all 96 of the city's neighborhoods. This presentation will describe Urban Forestry's shared stewardship model for caring for the urban forest. It will also explain how Urban Forestry staff recruited, trained, and directed 1,300 volunteers to help do field collection and GIS data entry totaling more than 17,000 hours. In addition, the presentation will detail how the city has provided urban forestry education and training of Neighborhood Tree Stewards, who form the backbone of neighborhood-based Tree Teams. It will also cover how Inventory results are being shared with these teams to empower them to take evidence-based action to improve the urban forest in their area and meet goals set forth in Portland's Urban Forestry Management Plan and Urban Forest Action Plan.

Keywords: GIS / modeling, Land/watershed management, Plant ecology

Marion Dresner[1], Andrew Gibbs[2], Andrew Moldenke[3]

[1]Portland State University, Phone: (503) 725-5961, Email: dresnem@pdx.edu
[2]Portland State University, Email: andrew.gibbs@pdx.edu
[3]Oregon State University, Email: moldenka@science.oregonstate.edu

Do urban yards contribute to biodiversity?

Our central research question investigated the role shrubs might play in provisioning urban birds with arthropod food. We compared yards in two different Portland neighborhoods, one with a high total tree cover, one with a high percent impervious surface, and both having an array of yards with similar proximity to a large greenspace. We compared yards having similar relative mixtures of native and ornamental plants. Shrub diversity was measured using line transects placed along the side of the yard. We collected arthropods from shrubs using branch beating and using a passive set up of Malaise traps. Arthropods were subsequently identified in the lab. We collected bird diversity data using point counts from 50 m radius areas in yards over two spring seasons. A total of 12 yards and two natural areas were sampled. Overall tree cover was an important factor influencing the abundance of arthropods and diversity of birds. Particular species of shrubs hosted considerably more arthropods; Snowberry (*Symphoricarpos*), Indian plum (*Oemlaria*), Rhododendron, Ribes and Cherry laurel (*Prunus*). Hillsdale, a neighborhood having the highest conifer tree cover had higher bird species diversity (30 species) when compared with Laurelhurst (16 species), a neighborhood with lower and primarily deciduous tree cover. Arthropods collected in Hillsdale from the nearby greenspace, Keller Woods, were five times more numerous than the arthropod abundance from the highest yielding yard, and 14 times more than the next highest yielding yard. Citizen scientists contributed data about bird diversity and abundance.

Keywords: Conservation biology, Plant ecology, Wildlife biology

Jason Dumont

Mosaic Ecology LLC, Phone: (503) 961-2423, Email: jason@mosaicecology.net

Commonly forgotten questions

With hundreds of revegetation projects being undertaken each year at an increasing scale and intensity, a revegetation contractor asks everyone to step back and reflect on some questions about projects that may still be unanswered. Beginning with project selection and ending with sustainability, we'll ask some often overlooked questions, and provide almost no answers. But the questions just might make your project stronger. Here's a quick quiz: How long will it take for your site to be as rich in diversity as it was before you started your project? When was the last time you visited a reference site for your project? How many stems per acre do you expect your project to have when it is mature? When was the last time you asked for an outside opinion of your project? If you didn't immediately have an answer to one of these questions, you're not alone. Let's all ask more questions.

Keywords: Habitat assessment, Habitat restoration, Land/watershed management

Noah Enelow[1], Brody Abbott[2], Chris Schildt[3], Kalima Rose[4], Victor Rubin[5], Mike Mertens[6], Alan Hipolito[7], Ricardo Moreno[8], Carolina Iraheta[9]

[1]Ecotrust, Phone: (503) 467-0752, Email: nenelow@ecotrust.org
[2]Ecotrust, Email: babbott@ecotrust.org
[3]PolicyLink, Email: cschildt@policylink.org
[4]PolicyLink, Email: kalima@policylink.org
[5]PolicyLink, Email: victor@policylink.org
[6]Ecotrust, Email: mmertens@ecotrust.org
[7]Verde, Email: alan@verdenw.org
[8]Verde, Email: ricardomoreno@verdenw.org
[9]Verde, Email: CarolinaIraheta@verdenw.org

Jobs and equity in the urban forest

How can investments in the urban forest be designed to maximize positive impacts on underserved communities, including low-income and communities of color? This study examines the economic, ecological, and social impacts of existing community-based urban forestry investments, focusing on the greater Portland metropolitan area combined with a scan of policies and programs from around the county. Urban forestry, including neighborhood tree planting, open space restoration, and natural methods of stormwater management, can benefit communities in multiple ways, including improvements in air and water quality, physical and mental health, social cohesion and public safety. Though most existing urban forest policies to date have not prioritized targeting of investments in the urban forest to underserved communities, a number of recently established policies, programs, and investments to create jobs and build social equity in the urban forest have met with demonstrable success. These investments are creating economic and social opportunities for underserved communities, including living wage jobs, skill-building and advancement, and increased involvement in planning processes. Our results reveal growing opportunities for connecting communities of color and low income to investments in urban forestry and urban landscape restoration. We offer recommendations to policymakers, investors, and philanthropists to build on existing efforts to craft urban revitalization strategies centered on restoration of both urban landscapes and underserved communities.

Keywords: Economics, Environmental policy, Sustainable development

Kris Freitag[1], Ed Guerrant[2]

[1]Portland State University, Phone: (503) 725-2468, Email: kfreitag@pdx.edu
[2]Rae Selling Berry Seed Bank & Plant Con. Program, Portland State University, Email: ed.guerrant@pdx.edu

Citizen's Rare Plant Watch

The Rae Selling Berry Seed Bank & Plant Conservation Program (RSBSB) is the successor to the Berry Botanic Garden Seed Bank for Rare and Endangered Plants of the Pacific Northwest. Its mission is to "Conserve the genetic resources of Oregon's native plants for current and future generations." RSBSB is currently part of Portland State University. The focus of this presentation is a project called Citizen' s Rare Plant Watch (CRPW). Begun four years ago by dedicated and capable volunteers with the Native Plant Society of Oregon, CRPW has yielded important data about little-visited rare plant populations in Oregon. Its mode of operation is to deploy volunteers to known plant populations to collect data on their current health and extent. Within this past year, CRPW became part of RSBSB, and in spring and summer of 2016 we engaged the services of 30 volunteers, or "citizen scientists," and collected data on 15 rare plant species.

Keywords: Conservation biology, Educational outreach

Leilani Ganser

Reed College, Phone: (305) 606-1309, Email: leiganser@reed.edu

Urban avifaunal diversity: An indicator of anthropogenic pressures in northwestern metropolitan Atlanta

The study of biodiversity is integral to understanding the health of an ecosystem. In order to assess the health of the Kennesaw Mountain National Battlefield Park bird population, a correlative study was devised which monitored historic indices of avifaunal diversity at the park and compared the data to metrics of urbanization in the Atlanta Metropolitan Area including measures of impermeable surfaces and motor vehicle registration. The key populations studied were the birds of Kennesaw Mountain National Battlefield Park and the citizens of the Atlanta Metropolitan Area. The research question could not be answered due to issues in prior data collection, but the biodiversity index performed suggested that the park's bird population was unhealthy, scoring a 0.446 out of 1 while a healthy forest will typically score within the 0.7-0.8 range. The data also support the rapid urbanization of the Atlanta Metropolitan Area given that centerline miles, impermeable surfaces, increased by 1.02% while the number of registered motor vehicles increased by 3.02%. It is recommended that further studies continue to assess the health of the bird population as well as any correlation between the avifaunal biodiversity and urbanization. Given the results of the experiment, it is recommended that the Atlanta city planners implement sustainable growth models including but not limited to transit oriented development.

Keywords: Habitat assessment, Land use planning, Sustainable development

Charles George[1], Lucca DiGioia[2]

[1]MHCC Facilities Director, Phone: (503) 491-6997, Email: charles.george@mhcc.edu
[2]MHCC Natural Resources / Facilities Work Study program, Email: lucca.digioia11@gmail.com

Mt. Hood Community College Salmon Safe Program

Mt. Hood Community College (MHCC), located in Multnomah County, opened in 1966, and was built near the confluence of Beaver and Kelly Creeks. Due to 1960's development practices, impactful methods were employed during the construction. The expansion resulted in a dam and spillway that crosses over the middle of the property, with storm water exiting through outfalls into the creeks with no filtration. However, 50 years later, the current MHCC team is highly focused on sustainability and habitat protection. We joined the Beaver Creek Partnership in 2015, to improve current water conditions on campus, along with an operational review phase by the Facilities Director. It was realized that many programs were already in place. This included an Integrated Pest Management (IPM), water and energy conservation, and minimized chemical usage. With these existing practices, and a solid plan for the future, MHCC was qualified to apply for a Salmon Safe certification. Salmon Safe is a 501(c)(3) nonprofit, founded in Portland, with a goal to help the Pacific Salmon population flourish, through land management renovations. In June of 2016, in concert with the Beaver Creek Partnership, MHCC applied for the certification and in October of 2016, our campus officially became the first US community college certified Salmon Safe! This required a commitment to continue improvement practices over the 5-year certification period and beyond. Our next step is to use the $1.3 million grant to make storm water and environmental improvements on campus, and complete the selected 5 year requirements.

Keywords: Land/watershed management, Sustainable development, Water quality

Jim Gersbach[1], Angie DiSalvo[2]

[1]Urban Forestry, Portland Parks & Recreation, City of Portland, Phone: (503) 349-0571, Email: james.gersbach@portlandoregon.gov
[2]Urban Forestry, Portland Parks & Recreation, Email: angie.disalvo@portlandoregon.gov

How diverse are Portland's street trees? Discoveries from the Tree Inventory Project

This presentation will share an analysis of the diversity found in Portland street trees using data collected by Portland Parks & Recreation Urban Forestry staff and trained volunteers. From 2010 to 2016, almost 220,000 street trees across all 96 Portland neighborhoods were identified as to genus and sometimes species, with the family identified for each. Every tree's condition was also rated, its diameter at breast height (DBH) measured, and its location fixed in a computerized mapping database. DBH was used to classify trees as established or recently planted to help discern trends in which tree types are being planted in Portland. Further comparisons were also made with an earlier 1976 street tree inventory. Inventory results reveal that Portland can grow a wide variety of trees as street trees, with 145 genera in 55 families having been identified. This potential diversity, however, is not reflected in most of the city's street trees. Just seven genera in five families account for more than half of Portland's street tree population. Results in neighborhood after neighborhood show that Portland has become overly reliant on just two genera – *Acer* and *Prunus*. This has caused a lopsided dependence on deciduous broadleaf trees at the expense of evergreen conifers, whose share of the population has fallen by almost half from the 1970s to today. This presentation will also briefly explore the vulnerability to pests and diseases such over-reliance creates in Portland's urban forest.

Keywords: GIS / modeling, Land/watershed management, Plant ecology

Bill Gerth[1], Alan Herlihy[2], Taal Levi[3]

[1]Oregon State University, Dept. of Fisheries & Wildlife, Phone: (541) 971-3326, Email: william.gerth@oregonstate.edu
[2]Oregon State University, Dept. of Fisheries & Wildlife, Email: alan.herlihy@oregonstate.edu
[3]Oregon State University, Dept. of Fisheries & Wildlife, Email: taal.levi@oregonstate.edu

Developing environmental DNA methods to promote conservation of Portland metro's own freshwater crustacean species

Ramellogammarus similimanus is a unique, native, freshwater crustacean that is only known from springs and streams in the Portland Oregon metro area. Because this species has a limited geographic distribution within an urban area, and urban development is commonly associated with aquatic habitat alteration and decreased water quality, this species may be at risk and in need of conservation planning. Currently, we are developing and testing methods for using environmental DNA (eDNA) from streamwater to detect *R. similimanus* populations. The use of eDNA would be preferable to current methods (collecting and killing specimens for microscopic examination) since it would allow the detection of populations without handling or harming individuals. After investigating the reliability of this method, we will also sample a number of streams throughout the Portland metro area to add to the little that is known about the geographic distribution of this species. We hope to make this information and sampling methodology available to groups and management agencies interested in developing conservation plans and in monitoring the persistence or loss of *R. similimanus* populations into the future.

Keywords: Conservation biology

Bill Hall[1], Sunny Simpkins[2], David Helzer[3], Cyrus Bullock[4]

[1]Parametrix, Phone: (503) 233-2400, Email: whall@parametrix.com
[2]Multnomah County Drainage District, Email: ssimpkins@mcdd.org
[3]City of Portland Bureau of Environmental Services, Email: David.Helzer@portlandoregon.gov
[4]Parametrix, Email: cbullock@parametrix.com

Beaver management practices within urban drainage districts

The American beaver (*Castor canadensis*) provides very important watershed health and ecological benefits, but can be a concern within an urban setting because of the damage their activity can inflict on infrastructure. The Multnomah County Drainage District (MCDD) and the City of Portland Bureau of Environmental Services (BES) have developed best management practices (BMPs) to assist with beaver management within the MCDD districts, BES properties, and associated facilities in the northern metropolitan region. The BMP document identifies applicable regulations related to beaver management, areas of recurring beaver activity, and locations of areas that benefit from beaver activity as well as critical infrastructure that could be damaged by beaver. The purpose of developing these BMPs is to: 1) establish standards for when, where, and what methods of beaver deterrence or encouragement should be used; 2) identify when, where, and by whom beaver may be relocated or removed (including lethal as a last resort); and 3) provide a process for monitoring and evaluating the success of beaver deterrence or relocation efforts. While the BMPs are effective at some problem sites, they have limitations, and sometimes indirect effects or unacceptable costs. The BMPs are intended to provide the information necessary to determine which technique, if any, is the best option for any particular situation. The BMPs will be continually reviewed, evaluated, and updated by MCDD and BES as needed, and expanded to other others areas in the City if appropriate.

Keywords: Animal ecology, Environmental policy, Land/watershed management

Ted Hart[1], J. Alan Yeakley[2], Joshua S. Caplan[3]

[1]Portland State University, Phone: (541)760-9389, Email: hartt@pdx.edu
[2]UMBC, Email: yeakley@umbc.edu
[3]Bryn Mawr College, Email: jscaplan@brynmawr.edu

Root characteristics and infiltration among stormwater bioretention facilities with different vegetation assemblages

Within stormwater bioretention facilities (SBFs), vegetation selection can play an important role. Studies show variation in root morphology and distribution, root biomass seasonal peaks, and roots enhancing infiltration rate. However, no researchers have shown how different root characteristics may vary from different plant types/species, how these differences can occur at various depths, and how root characteristics may effect infiltration rate within currently functioning SBFs. I hypothesized that: 1) larger-root SBFs exhibit greater infiltration during January to February (J-F) and March to June (M-J) periods compared to the smaller-root facilities, and 2) the increase in root characteristics and infiltration rate from J-F to M-J is greater in the larger-root SBFs compared to the smaller-root SBFs. Five larger-root (*Juncus* sp. dominant + tree) and five smaller-root (*Carex* species dominant) SBFs were selected within inner Southeast Portland. Infiltration rates were recorded using water depth data loggers from January 2014 to February 2015. Three root cores per facility were collected to a depth of 1 m during J-F 2014 and M-J 2014. Root depth sections of approximately 8 cm were analyzed using WinRHIZO for six root characteristics. *Juncus* showed greater infiltration rate and root characteristics values compared to *Carex* SBFs during J-F and M-J 2014. Four *Juncus* root characteristics and one *Carex* root characteristics showed a positive relationship with infiltration rate M-J 2014. This work demonstrates vegetation with larger-root characteristics can increase infiltration more than vegetation with smaller-root characteristic within fully functional SBFs.

Keywords: Hydrology, Land/watershed management, Water quality

Dave Helzer[1], Adam Baz[2], Joe Liebezeit[3], Mary Coolidge[4], Candace Larson[5]

[1]City of Portland Environmental Services, Phone: (503) 823-2761, Email: david.helzer@portlandoregon.gov
[2]City of Portland Environmental Services, Email: adambaz@pdx.edu
[3]Audubon Society of Portland, Email: jliebezeit@audubonportland.org
[4]Audubon Society of Portland, Email: mcoolidge@audubonportland.org
[5]Audubon Society of Portland, Email: clarson@audubonportland.org

Winter bird monitoring at Mt. Tabor Park

Mt. Tabor Park is a popular recreational area and important greenspace providing urban wildlife habitat. In 2009 the Bureau of Environmental Services (BES) launched a large-scale vegetation management program for the park focused on invasive plant removal. Concerns raised by the neighborhood about potential adverse impacts on birds prompted BES and Audubon Society of Portland (Audubon) to partner on a citizen science powered 6-year bird study, which included winter surveys. Audubon volunteers performed avian area searches during 6 consecutive winters using established methodologies. Objectives were to: 1) Monitor changes in bird assemblage during the vegetation management operation, and 2) Establish a baseline bird inventory of the winter bird community at Mt. Tabor. We documented 36 species within the study area. Golden-crowned kinglets were the most numerous accounting for 32% of all detections. The best-supported multivariate regression model suggested that number of surveyors (2 in years 1-3; 1 in years 4-6) was the most important variable explaining a decrease in bird abundance detected in years 4-6. There was little support for vegetation manipulations and environmental variables affecting bird abundance. However the lack of quantitative habitat data collected limited our ability draw strong inferences. This study provides baseline information at an important urban greenspace and contributes to a larger database of bird surveys for Portland.

Keywords: Animal ecology, Habitat restoration

Lori Hennings[1], Jonathan Soll[2]

[1]Metro, Phone: (503) 797-1940, Email: lori.hennings@oregonmetro.gov
[2]Metro, Email: jonathan.soll@oregonmetro.gov

Impacts of recreation on wildlife

It is crucial to understand the potential impacts of different types of recreation on both trails and wildlife to develop appropriate natural area site designs and management practices. We surveyed the scientific literature pertaining to the impacts of three recreational "visitor groups" – hikers, mountain bikers and equestrians – on trails, habitat and wildlife to help inform the work of Metro's trail planners and land managers. When information was available, we compared the relative impacts of different visitor groups. We summarized information on Flight Initiation Distances and Alert Distances and used that information to develop a set of best management practices (BMPs) to avoid or minimize impacts on wildlife, as well as simple GIS methods to estimate potential impacts on wildlife under different trail alignment scenarios. It was interesting to note that visitor group impacts on and near trails were generally least for hikers and mountain bikers, and clearly strongest for horses. In contrast, visitor group impacts on wildlife were typically least for horse riders, followed by mountain bikers then hikers. Heavier trail use created more impacts, and gestating mammals or those with young, as well as many migratory bird species, were more vulnerable to disturbance impacts. All trails and trail users cause impacts, but the review's resulting BMPs can help guide trail design to reduce harm to habitat and wildlife.

Keywords: GIS / modeling, Land/watershed management, Wildlife biology

Katie Holzer[1], Karen Bromley[2], Keri Handaly[3], Torrey Lindbo[4]

[1]City of Gresham, Phone: (503) 618-2377, Email: katie.holzer@greshamoregon.gov
[2]City of Gresham, Email: Karen.bromley@greshamoregon.gov;
[3]Keri Handaly, City of Gresham, Email: Keri.Handaly@greshamoregon.gov;
[4]Torrey Lindbo, City of Gresham, Email: torrey.lindbo@greshamoregon.gov

Monitoring the effectiveness of green stormwater infrastructure

Urbanization of rural areas has the potential to greatly alter local stream ecosystems. In anticipation of Urban Growth Boundary expansion into the Pleasant Valley and Springwater areas near Gresham and Portland, the cities, counties and Metro developed concept plans aiming to 1) develop land use zonings to provide housing, jobs and services, 2) protect and enhance buffers around stream and wetland resources, and 3) manage stormwater to mimic natural hydrology. The current approach in these areas requires green stormwater infrastructure for managing stormwater at three scales (lot, street, and neighborhood) prior to discharging to local streams. This type of infrastructure is not one-size fits all, and each site has its own unique challenges, including the steep slopes and clay soils in these areas. The City of Gresham is conducting studies to test the effectiveness of various green stormwater facilities in new subdivisions and has set up long term monitoring sites to evaluate the effect of the land use change on the streams. Studies include continuous water level monitoring, water quality sampling, and storm simulations using fire hydrants. Our results suggest that green stormwater infrastructure has the potential to effectively reduce peak flows and improve water quality in water discharging from new urban areas, even when they are on steep slopes with clay soils. Our findings continue to lead to refinements in designs and construction to improve effectiveness. Our long-term studies will allow us to evaluate if we meet our goals of protecting and enhancing local streams.

Keywords: Land use planning, Sustainable development, Water quality

Rhianna Hruska[1], Stacy Philpott[2]

[1]The Evergreen State College, Phone: (714) 350-1670, Email: hruskar@evergreen.edu
[2]University of California, Santa Cruz, Email: sphilpot@ucsc.edu

Native and invasive ants in California and the Urban Garden Project

This study analyzes the factors that both native and invasive species prefer in an urban garden setting. Nineteen urban garden locations were selected, ranging from Santa Clara, CA to Carmel, CA. Six pitfall traps were placed at each location and set five meters apart. The traps were set from May to September 2013. Sixty factors were measured total and were divided by three categories: local, regional, and distance. For species abundance, we documented more ants in areas with no ornamental species, in > 0.25% rock cover within 1 meter, and in areas with > 38% canopy cover. For species richness, preference was found in areas with >7% mulch cover, >86% urban area, < 24% building cover, < 18% weedy cover, and > 13% concrete cover. *Tetramorium caespitum* (also known as the pavement ant) was only found in locations with >87% urban area within 1 kilometer. They preferred areas with non-woody vegetation cover. *Hypoponera opacior* (native to CA) was only found in areas with >66% tall vegetation. They preferred areas with >13% mulch cover, over 175 white flowers within 1 meter, and areas with >23% canopy cover. *Linepithema humile* (also known as the Argentine ant) was often found in areas with >18% weedy cover within 100 meters (with the exception of one outlier). They preferred areas with < 20% non-woody vegetation cover, < 4% lawn cover, and 9 violet flowers within 1 meter.

Keywords: Conservation biology

Janel Hull[1], Katie Songer[2], Alexis Barton[3]

[1]Johnson Creek Watershed Council, Phone: (503) 652-7477 Ext. 107, Email: janel@jcwc.org
[2]Johnson Creek Watershed Council, Email: katie@jcwc.org
[3]Johnson Creek Watershed Council, Email: alexis@jcwc.org

Community science: Producing novel scientific data that informs habitat restoration

Over the past year, Johnson Creek Watershed Council (JCWC) has launched a community science program that engages local volunteers in: salmon surveys, steelhead/lamprey surveys, beaver activity surveys, dragonfly surveys, and a one-day Eco-Blitz event. Each of these innovative community science projects has generated novel wildlife data that will inform habitat restoration for years to come. Six years of volunteer salmon surveys have allowed JCWC to identify the distribution of spawning salmon activity throughout the watershed and the location of the highest priority fish passage barriers. These surveys also helped the watershed council to attain funding to remove a critical barrier in Badger Creek. The Powell Butte Eco-Blitz generated data on 7 bird species never before documented on Powell Butte. Volunteers also discovered the first ever Oregon Slender Salamander recorded in the city of Portland. This Eco-Blitz allowed Portland Parks & Recreation to update their bird list and begin developing engineered ponds to increase habitat for this listed salamander species. Not only is community science a valuable tool for engaging volunteers, but it also generates novel scientific data that allows land managers to design scientifically sound restoration projects.

Keywords: Habitat restoration, Land/watershed management, Wildlife biology

Christine Johnson[1], Jenna Tilt[2], Paul Ries[3], Bruce Shindler[4]

[1]Oregon State University, Phone: (330) 472-0722, Email: christine.johnson@oregonstate.edu
[2]Oregon State University, Email: tiltj@oregonstate.edu
[3]Oregon State University, Email: paul.ries@oregonstate.edu
[4]Oregon State University, Email: bruce.shindler@oregonstate.edu

Continuing professional education in green infrastructure: A Constructivist approach to interdisciplinary trainings

The practice of green infrastructure is synonymous with collaborative partnerships. Expertise from engineers, landscape architects, and natural resource consultants are often required for successful implementation. Traditionally, these professionals perform their responsibilities in their disciplinary "silos," but this evolving area of sustainable development is creating a demand for continuing professional education (CPE) trainings that address the challenges and opportunities associated with collaboration. Yet an interdisciplinary audience with mixed motivations, backgrounds, and experiences creates a challenging balancing act between professional development skills and technical training. Herein lies the dilemma – how to deliver curricula valuable to all practitioners of green infrastructure? This study aims to answer that question by using a qualitative approach to gain insight into the motivations, instructional design processes, and evaluation mechanisms utilized for interdisciplinary CPE trainings. A variety of green infrastructure CPE providers in OR and WA participated in the study, offering perspectives from agencies, non-profits, consulting firms, and educators. Preliminary results support the theory of Social Constructivism -an adult learning theory that argues that learning is an active process, and when adult learners converse with their peers they can negotiate knowledge and construct their own meaning. This theory lends itself to collaborative hands-on learning activities such as anonymous site reviews, demonstration site tours, and simulations. A discussion of instructional design and program development strategies for interdisciplinary audiences will be presented.

Keywords: Environmental social sciences, Sustainable development, Water quality

Ted Labbe[1], David Hedburg[2], Angie DiSalvo[3], Jim Gersbach[4]

[1]Kingfisher Ecological Services, Phone: (503) 758-9562, Email: ted.labbe@gmail.com
[2]Portland State University History Department, Email: david.b.hedberg@gmail.com
[3]Angie DiSalvo, Urban Forestry, Portland Parks and Recreation, Email: angie.disalvo@portlandoregon.gov
[4]Jim Gersbach, Urban Forestry, Portland Parks and Recreation, Email: james.gersbach@portlandoregon.gov

Changing composition of Portland's changing urban forest, 1938-present

City of Portland street tree inventories from 1938, 1976, and 2010-16 reveal shifts in the composition of the urban forest over time. The City's first street tree inventory was conducted in 1938 under the Works Progress Administration and counted 78,886 trees across the then 67-square-mile City. In 1976, City staff conducted a partial survey of 39,652 trees along 676 street miles, or 57% of then approximately 70-square-mile City. Although the complete tree inventory data and maps have not been relocated for 1938 or 1976, tabular summaries offer useful comparisons with the present-day 2010-16 inventory data. In 1938, there were a total of 37 families represented among Portland's street trees, with maple (29%), walnut (17.8%), rose (16.2%), elm (8.5%), and birch (7.6%) families dominating. By comparison, in 2016 there were a total of 51 families represented, with maple (27.4%), rose (25%), and birch (5.2%) families dominating, and no other family representing more than 5% of the inventory. The 1938 inventory recorded 71 genera, including the following most abundant genera: Acer (22.9%), Juglans (17.7%), Ulmus (8.5%), Crataegus (8.1%), Betula (7.1%), Aesculus (6.1%), Sorbus (4.2%), and no other genera representing more than 4%. In 2016, there were 146 genera recorded – an increase of 105%, with the most abundant genera including: Acer (26.2%), Prunus (11.9%), Pyrus (5.3%), Malus (4.5%), Fraxinus (4.2%), and no other genera representing more than 4%. The 1976 inventory, though incomplete, shows patterns of composition that are generally intermediate between the 1938 and present-day surveys. In 1976 there were 37 families represented, with walnuts (4.8%) and elms (4.5%) declining in importance and certain families like rose (33.2%) and birch (10.4%) showing marked expansions as compared to the 1938 inventory. In the 1976, there were 75 genera represented, with Prunus (21.3%), Acer (20.4%), Betula (9.3%), and Crataegus (7.4%) dominating. In 1938, large-form trees composed 52% of the inventory, with medium- and small-form trees at 16% and 32%, respectively. In 2016, the percentage of large-form trees dropped to 19%, with medium- and small-form trees at 48% and 33%, respectively. Neighborhood-scale street tree stocking levels are available for 1976 in select neighborhoods and for 2010-2016 City-wide, but were not available for the original 1938 inventory. In 1976, stocking levels averaged 35.7% (range 11.5-71.8%), versus 66.2% in 2016 (range 48-90%, for neighborhoods surveyed in 1976 only). Individual neighborhoods that were surveyed under both efforts showed average stocking level gains of +32% (range +6 to +62%). Comparisons among past street tree inventories chart patterns of change over the last eighty years. Within Portland's developed street grid, Portland is more treed at present than at anytime since 1938, with a greater diversity of families and genera. Although stocking levels are higher at present relative to the past, large-form trees show steep declines over the historical period relative to small- and medium-form trees, which are on the rise.

Keywords: Habitat restoration, Environmental policy

Robert Lascheck[1], Elaine M. Stewart[2], J. Alan Yeakley[3]

[1]Portland State University, Phone: (208) 720-6883, Email: rlascheck@gmail.com
[2]Metro, Email: elaine.stewart@oregonmetro.gov
[3]University of Maryland, Baltimore County, Email: yeakley@umbd.edu

The effects of long-term managed flooding on *Phalaris arundinacea* and native vegetation in a large palustrine wetlands ecosystem

We sought to determine the effects of mechanical hydrologic management on the wetland plant community in a roughly 2,000 acre palustrine lake wetland complex, Smith and Bybee Wetlands Natural Area (SBW), in north Portland, Oregon. The goal of the hydrologic management is to retain water within SBW during spring and summer months to reduce invasive reed canarygrass (*Phalaris arundinacia*) cover and promote native wetland vegetation growth. Vegetation monitoring has been carried out in three phases since project initiation (2003-2004, 2008-2009, and 2015-2016) to assess restoration efforts. Using line-intercept and differential leveling methods, we measured 25 randomly established transects during monitoring years for vegetation and elevation to determine percent cover of vegetation in relation to seasonally varying water levels. Overall, reed canarygrass percent cover has decreased from 44.4% in 2003 to 17.2% in 2015. Several native species have increased in overall percent cover since 2003 such as *Cyperus erythrorhizos* (redroot flatsedge; 5.7% in 2003 to 11.1% in 2015), *Eleocharis palustris* (common spikerush; 1.8% in 2003 to 8.1% in 2015), and *Persicaria amphibia* (water smartweed) which has replaced reed canarygrass as the dominant species in this emergent zone (increasing from 20.0% cover in 2003 to 56.4% in 2015). These findings suggest that late spring-early summer inundation of at least 0.6 meters in lake-wetland complexes can be successful at managing reed canarygrass while also promoting native wetland vegetation cover.

Keywords: Habitat restoration, Land/watershed management, Plant ecology

Kaitlin Lovell[1], Chip McConnaha[2]

[1]City of Portland Bureau of Environmental Services, Phone: (503) 823-7032, Email: Kaitlin.Lovell@portlandoregon.gov
[2]ICF International, Email: Willis.McConnaha@icfi.com

Strategic prioritization of restoration projects in an urban stream under climate change

The City of Portland has a strategic watershed approach to habitat restoration investments in its urban streams that achieves ecological and infrastructural benefits. A fish-habitat model based on Ecosystem Diagnosis & Treatment (EDT) was constructed to identify restoration potential, prioritize restoration areas and define environmental targets for restoration based on the needs of ESA listed salmonids. Analysis of Johnson Creek, the largest stream within the Portland metropolitan area, indicated two major priorities for restoration: upper watershed sites linking mainstem reaches to Kelley Creek, and lower watershed sites linking Tideman Johnson Park and Crystal Springs. Limiting factors identified for restoration included high water temperature, water quality and lack of woody structural elements. Crystal Springs is a 2.7 mile spring fed tributary to Johnson Creek in urbanized southeast Portland. Intrinsic habitat potential of the stream is relatively high for salmonids but is limited by numerous culverts that restrict fish passage and aesthetic ponds that increase water temperature. In 2008, the City of Portland committed $2 million to upgrade 8 culverts in Crystal Springs to provide for fish passage, remove ponds and improve stormwater management. The potential value of these and other restoration investments in Johnson Creek appears to be high. However, their biological value could be compromised by climate change. To address this issue, restoration priorities and projects were re-evaluated using the EDT model and a set of assumptions regarding potential increases in water temperature and changes in precipitation that could result from climate change in the Portland area. These presumed future conditions altered the underlying environment and the EDT model then predicted a population and life history response for salmonids. The EDT analysis demonstrated that climate change could significantly reduce salmonid habitat potential in Crystal Springs and Johnson Creek. However, restoration projects, particularly those in Crystal Springs, moderated the impact of climate change; improved habitat fared better than degraded habitat under the climate change assumptions. Important synergisms between projects were revealed that contributed to the benefits under climate change. Because Crystal Springs has the potential to be a steady source of cooler water in the lower watershed with appreciable habitat potential in its own right, its restoration had very high potential under climate change scenarios. These results highlight both the urgency and the continued benefit of salmon restoration projects in urban streams even with expected changes due to climate change.

Keywords: Climate change, Environmental policy, Habitat restoration

David Lowenstein[1], Nik Wiman[2]

[1]Oregon State University, Dept. Horticulture, Phone: (646) 789-6149, Email: david.lowenstein@oregonstate.edu
[2]Oregon State University, Department of Horticulture, Email: nik.wiman@oregonstate.edu

Public engagement as a tool to monitor the distribution of Brown Marmorated Stink Bug and a newly introduced biocontrol agent

Cities are typically the first detection points for many invasive insects including Brown Marmorated Stink Bug (BMSB). Although the risk of economic damage by BMSB is highest in agricultural crops, BMSB is a nuisance pest in urban areas due to emission of foul odors and aggregation on structures. Recently, populations of non-native specialist parasitoids, known by the common name samurai wasp, were recorded in Vancouver and Portland. This egg parasitoid is a primary candidate towards improving management of BMSB. We discuss the use of citizen science efforts and experimental projects towards monitoring the distribution of BMSB and an adventive population of parasitoid wasps that parasitize stinkbug eggs. Sampling along 8 Portland transects in 2016 identified at least 5 sites with samurai wasps, while a monitoring program in 30 residential yards across the Portland metropolitan area failed to detect the samurai wasp. A webpage for citizen reports has been successful at locating BMSB in Multnomah County, and we anticipate creating a similar reporting mechanism for public detection of the samurai wasp. Citizen science experiments provided educational value regarding BMSB management but remain a challenge for detection of mobile, small-bodied insects. As samurai wasp is expected to become a component of BMSB management, we will continue to identify strategies for detecting the parasitoid and forecasting its spread across Oregon.

Keywords: Animal ecology, Environmental education

Celeste Searles Mazzacano[1], Janel Hull[2]

[1]CASM Environmental, LLC, Phone: (503) 652-7477, Email: cmazzacano@gmail.com
[2]Johnson Creek Watershed Council, Email: janel@jcwc.org

Community-based dragonfly & damselfly monitoring in Johnson Creek Watershed

In 2016, Johnson Creek Watershed Council worked with CASM Environmental, LLC to establish a new community-based research project to monitor populations of odonates (dragonflies and damselflies) in the Johnson Creek watershed. For this pilot project, two sites within the watershed were selected, both with extensive stream and wetland habitat: Westmoreland Park (Crystal Springs Creek) and Brookside Park (Johnson Creek). Volunteers received classroom and field training in odonate ecology, life history, identification, survey protocols, and data reporting. From June through October, survey teams walked transects at each site and recorded odonate species, abundance, sexes, and behaviors (mating, egg-laying, etc.). Over 200 observations were made of 23 odonate species among both sites (18 dragonfly, five damselfly). Diversity was greater at Westmoreland Park, where 22 species were reported (17 dragonfly, 5 damselfly); Brookside Park had 18 species (13 dragonfly, 5 damselfly). Notable findings included the addition of a new species to the known list for Multnomah County (Autumn Meadowhawk, *Sympetrum illotum*), the first vouchered and geo-referenced record of Black Meadowhawk (*S. danae*) in what is an unexpected lowland area for this species to occur; and a new early flight date for Twelve-spotted Skimmer (*Libellula pulchella*) in the state of Oregon. This community science project enabled collection of new data about a still understudied group that is helping to expand our knowledge of local biodiversity, impacts of site restoration on local biota, and effects of climate change on local life-history of dragonfly species.

Keywords: Animal ecology, Climate change, Conservation biology

Alex McManus[1], Charles Simenstad[2], Mary Ramirez[3], Phil Trask[4], Allan Whiting[5]

[1]PC Trask and Associates, Phone: (503) 208-2893, Email: alex@pctrask.com
[2]School of Aquatic and Fishery Sciences, University of Washington, Email: simenstd@u.washington.edu
[3]School of Aquatic and Fishery Sciences, University of Washington, Email: ramirez9@u.washington.edu
[4]PC Trask and Associates, Email: phil@pctrask.com
[5]PC Trask and Associates, Email: allan@pctrask.com

Landscape Planning Framework: A strategic planning tool for habitat restoration and conservation

The Landscape Planning Framework (LPF) is a landscape ecology-based, geospatial approach to strategic planning for restoration and preservation of habitat in the 233-rkm Columbia River estuary. This project adapts the structure of the Columbia River Estuary Ecosystem Classification (hence, Classification; Simenstad et al. 2011, USGS 2012) to identify and compare sites that could benefit unique, at-risk genetic stocks of Columbia River salmon. This adaptation of the Classification could be applied to other estuary dependent species, including shorebirds, wading birds, amphibians, or mammals. University of Washington and PC Trask & Associates delineated aquatic habitat area, called fish habitat catena (FHC), based on existing scientific data on estuarine habitat requirements of juvenile Chinook salmon (*Oncorhynchus tshawytsacha*). The LPF is designed to address juvenile Chinook habitat because their ocean-type life history forms tend to be most dependent on estuarine habitat and because their populations are depleted in the Columbia River basin with 5 Evolutionary Significant Units (ESU) listed under the Endangered Species Act. Recent policy initiatives highlight the need for additional scientific rigor in the identification and selection of projects, to support strategic, long-term investment in estuary restoration and protection to benefit ESA-listed salmon. The LPF compares possible estuary restoration / protection scenarios to evaluate benefit to juvenile salmon.

Keywords: Fisheries, GIS / modeling, Habitat restoration

Adam Nayak

Cleveland High School Student, Stormwater Intern at Johnson Creek Watershed Council, Phone: (503) 522-7705, Email: adamnayak1@gmail.com

Modeling the effects of land use change on flooding in Northwest streams

Due to population growth, urban areas in Oregon have been expanding, leading to increases in impervious surfaces and net losses in wetlands, riparian vegetation, and forestation in the Northwest. Utilizing ArcGIS and NOAA's C-CAP imagery, this study classifies and analyzes urban land use changes between 1996 and 2010. Developmental trends were first analyzed alongside historical flood records to validate the relationship between flood severity and land use. Through regression analysis, predictions of annual impervious change were then calculated using NOAA's Impervious Surface Analysis Tool within four urban stream basins (Johnson Creek, Tualatin River, Pudding River, and Clackamas River). Based upon these predictions, changes in flood severity were determined through a novel application of NOAA's CHPS Streamflow Modeling System. Significant discharge change predictions due to development were calculated, and represented visually in flood inundation maps using USGS's GIS Flood Tool. With this information, projected necessary rates of wetland and green infrastructure implementation were able to be formulated, quantifying the necessary changes needed to counteract urban development within the Willamette River Basin. These findings shed light on the importance of land use management in urban settings and can be used by local watershed councils to advocate for changes within their stream basins.

Keywords: GIS / modeling, Land use planning, Land/watershed management

Vanya North

Clark Public Utilities, Phone: (360) 992-8539, Email: invasivestech@clarkpud.com

Eradication Nation: Controlling knotweed in the Salmon Creek Watershed

Clark Public Utilities founded Eradication Nation in 2011, after the utility's restoration program, StreamTeam, recognized the growing threat of knotweed at planting sites. The program was founded with the goal of controlling invasive plant species, specifically knotweed. Knotweeds are native to Asia and were originally brought to the United States as ornamental plants. These plants are extremely fast growing and form dense stands that out-compete native plants. Knotweeds do not provide adequate shade to cool stream water and their roots do not hold soil well, ultimately creating unsuitable habitat for salmon, native plants and other wildlife. The primary objective of Eradication Nation is to increase public knowledge and landowner participation in invasive plant control in the Salmon Creek watershed. The program has worked in conjunction with private landowners, community volunteers, interns and AmeriCorps members in the surveying, treatment and monitoring of knotweeds. Eradication Nation originally received funding in 2011 from the National Fish and Wildlife Foundation (NFWF) to control knotweeds in the more urbanized lower third of the Salmon Creek Watershed. This year, the Department of Ecology Centennial Grant Program has awarded an additional grant to cover the East Fork of the Lewis River. To date, Eradication Nation has surveyed 62 acres and walked five miles of stream bank along the East Fork Lewis River. With the help of volunteers, EN has recorded a 48% decrease in knotweed coverage in treated sub-basins from 2015 to 2016. This strongly suggests injection and foliar treatments are working. Future plans for Eradication Nation include expanding survey and treatment areas and increasing landowner participation in the East Fork.

Keywords: Habitat restoration

Amber Paige[1], Jeremiah Harris[2], Ryan Ashton[3]

[1]Mt. Hood Community College, Phone: (503) 522-7141, Email: a.paige1@saints.mhcc.edu
[2]Mt. Hood Community College, Email: j.harris33@saints.mhcc.edu
[3]Mt. Hood Community College, Email: ryanashton63@gmail.com

Beaver Creek spawning surveys conducted over time by MHCC Fisheries Technology students

Since the fall of 2011, MHCC (Mt. Hood Community College) Fisheries Technology students have surveyed Beaver Creek in Troutdale, Oregon, for spawning salmon regularly using a standard ODFW (Oregon Department of Fish and Wildlife) spawning fish survey protocol. This data adds to the periodic spawning fish surveys conducted from the early 1990's to 2010 by ODFW and MHCC Fisheries Technology students. Surveys found spawning populations of fall-run Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*Oncorhynchus kisutch*) and winter-run steelhead (*Oncorhynchus mykiss*) in the mainstem of Beaver Creek. Several road culverts (Troutdale Road, Stark Street and Cochrane Road) have been identified as partial and complete barriers to fish migration in the Beaver Creek system and are slated for replacement or improvement. These surveys provide baseline data for these major culvert replacement and improvement projects on the mainstem of Beaver Creek. No fall Chinook Salmon and very few Coho Salmon have been found upstream of the Stark Street culvert where spawning habitat is available. Over twice as many fall Chinook Salmon return to Beaver Creek than Coho Salmon (in most years) and the fish are concentrated in the lower reaches of the mainstem, below the fish passage barriers at Troutdale Road and Stark Street. After the culvert replacements with fish-passage friendly designs begin in summer 2017, spawning surveys will continue to record the effectiveness of the fish passage work.

Keywords: Environmental education, Fisheries, Transportation

Meenakshi Rao[1], Linda George[2], Derek Expinoza[3], Bennett Battaile[4]

[1]Portland State University, Phone: (503) 244-8727, Email: mrao@pdx.edu
[2]Portland State University, Email: georgel@pdx.edu
[3]Portland State University, Email: espid@pdx.edu
[4]Spatial Reasoning, Email: bb@spatialreasoning.com

iSmell: An app for reporting and mapping environmental odors and enabling citizen science

Many communities across the USA are affected by environmental odors, often from emissions not regulated under the Clean Air Act. The Centers for Disease Control acknowledges that environmental odors can decrease the quality of life and sense of well-being, and encourages affected community members to maintain odor diaries to support odor investigations. We adapt the odor diaries to modern communications technology and develop a mobile app that enables the real-time reporting of environmental odors. We additionally leverage Weather Underground APIs to record weather data, capturing wind speed and direction at the time of the odor report. An interactive map of odor reports with date and time filters allows communities to better understand the spatial and temporal patterns of odors in their community. This mobile app demonstrates how current technology can be harnessed to enable citizen science and promote local stewardship. While iSmell was developed for reporting outdoor odors, the same framework can be used for monitoring other urban characteristics, ranging from nuisance odors to the location of potholes; from bird sightings to invasive weed reporting.

Keywords: Air quality

Zuriel Rasmussen

Portland State University, Phone: (503) 208-0314, Email: zuriel@pdx.edu

Why did the coyote cross the road? Analyzing coyote sighting reports from the Portland metropolitan area

The Portland Urban Coyote Project (www.portlandcoyote.com) has collected over 1,500 coyote sighting reports from volunteers in the Portland Metropolitan Area (PMA) in the past year alone. These sighting reports include basic information (i.e. when and where coyotes have been seen) and a peek into how people and coyotes interact across the PMA. Preliminary analysis of these sighting reports are presented; trends by time of day, time of year, and sighting report content provide a snapshot of human-coyote interactions in the PMA. The special considerations required for citizen science data analysis are discussed. Improved understanding of human-coyote interaction will help to inform better management practices. By incorporating these findings into the wider body of urban coyote research, opportunities for future research are identified and presented.

Keywords: Animal ecology, Environmental education, Environmental social sciences

Arthur Rodriguez[1], Andrea Hanson[2], Christina Donehower[3], Susan Barnes[4]

[1]Oregon Department of Fish and Wildlife, Phone: (503) 947-0126, Email: arthur.h.rodriguez@state.or.us
[2]Oregon Department of Fish and Wildlife, Email: andrea.V.Hanson@state.or.us
[3]Oregon Department of Fish and Wildlife, Email: christina.e.donehower@state.or.us
[4]Oregon Department of Fish and Wildlife, Email: susan.p.barnes@state.or.us

Introducing OregonConservationStrategy.org: A blueprint for conservation in Oregon

The Oregon Department of Fish and Wildlife (ODFW) released the updated Oregon Conservation Strategy in September, 2016 with the launch of OregonConservationStrategy.org. This fully interactive website covers a suite of conservation priorities, including Strategy Species, Strategy Habitats, Key Conservation Issues, and Conservation Opportunity Areas. Each Strategy element includes information on conservation issues, recommended actions, links to projects and potential partners, and much more. All elements are connected to one another, allowing a user to easily navigate among the conservation priorities within Oregon, and updated on a regular basis to ensure the most current and up-to-date projects are included. Many components are mapped across the Oregon landscape using associated spatial data and presented within the ODFW Compass interactive mapping application. Compass not only provides a way to create and share customized maps related to the Strategy, but also produce reports of Strategy elements within a specific area of interest. Conservation in urban areas is an important topic discussed within the Strategy, connected to many of the Strategy Species, Strategy Habitats, and Conservation Opportunity Areas. These issues are greatly impacted by ongoing and future conservation efforts in the Portland metro area. This poster will not only highlight some of the ways to use these new tools developed by ODFW, but we also hope to initiate discussions with new potential partners, to help ensure the most current and useful projects, science, and data are included.

Keywords: GIS / modeling, Land use planning, Land/watershed management

Natalie Rogers[1], Leslie Bliss-Ketchum[2], Martin Lafrenz[3], Catherine de Rivera[4]

[1]Portland State University, Phone: (503) 432-9740, Email: nmr@pdx.edu
[2]Portland State University, Email: bliss.ketchum@gmail.com
[3]Portland State University, Email: lafrenz@pdx.edu
[4]Portland State University, Email: derivera@pdx.edu

Urban Connections: Assessing greenspace wildlife connectivity in Portland, Oregon

Habitat connectivity in urban settings is critical for facilitation of safe species movement, species health and biodiversity. Predicting the movement of wildlife through the urban environment is difficult due to the presence of barriers - natural or built features in the landscape that restrict or prohibit movement of species. Using three connectivity assessment methods, we attempt to predict habitat permeability for wildlife in a North Portland greenspace and determine the relative achievements and failings for each method. The study area is composed of multiple mitigation sites, natural and recreational areas held by local government and private agencies, including Metro, City of Portland, and Port of Portland. The three assessment tools include professional judgment-based corridors mapping, GIS modeling, and the Habitat Connectivity Toolkit, a novel in-field surveying method developed by Portland State University researchers and Metro. Connectivity is measured for three surrogate species: American beaver (*Castor canadensis*), northern red-legged frog (*Rana aurora*) and western-painted turtles (*Chrysemys picta*). By comparing professional judgment-based corridor mapping, GIS modeling, and in-field survey methods, the best approach for accurately and efficiently predicting habitat permeability can be determined and presented with site-specific recommendations.

Keywords: Animal ecology

Lauren Senkyr[1], Jill Ory[2], Jennifer Thompson[3]

[1]NOAA Restoration Center/ERT, Phone: (503) 231-2110, Email: Lauren.Senkyr@noaa.gov
[2]NOAA Restoration Center & ERT, Email: jill.ory@noaa.gov
[3]US Fish and Wildlife Service, Email: jennifer_thompson@fws.gov

Habitat restoration update for the Portland Harbor Superfund Site

The Portland Harbor Superfund site is a highly contaminated, industrialized section of the Willamette River (RM 1 to 11.8). Portland Harbor provides important habitat for fish and wildlife, including Pacific salmon and lamprey, piscivorous birds such as bald eagle and osprey, and water-dependent mammals such as mink and river otter. The Portland Harbor Trustee Council is comprised of eight federal, state, and tribal Trustees. Together the Trustee Council is working to plan and carry out actions that will restore injured resources in Portland Harbor through a process called natural resource damage assessment. The goal is to restore, rehabilitate, replace, or acquire the equivalent of natural resources and their services that have been injured by contamination. In 2012, the Trustee Council released the Draft Portland Harbor Programmatic EIS and Restoration Plan. A central tenet of this plan is an integrated habitat restoration approach. Several restoration projects are currently under development. In 2014, the first of these habitat restoration efforts got underway at the Alder Creek site on Sauvie Island. The 52-acre project site was formerly a lumber mill. Now it is a mosaic of wetlands, beaches, shallow water, riparian, and upland habitats. The project is owned and managed by Wildlands, a habitat development company. Wildlands intends to sell natural resource "credits" from the project to potentially responsible parties to help those parties meet their obligations for environmental damages resulting from contamination in the Superfund site.

Keywords: Habitat restoration

Courtney Shannon[1], Jim Labbe[2]

[1]Community member, Phone: (503) 475-7052, Email: jlabbe@urbanfauna.org
[2]Community member, Email: chjshannon@gmail.com

Voter support for natural area bonds & levies 1992-2016

Since 1992 voters of the Portland-Metro region have voted five times on regional natural area bonds or levies (1992, 1995, 2006, 2013, and 2016). How has the geography of support for regional natural areas evolved over time and with changing turn-out? How does it compare to local parks funding efforts? What does it tell us about voters who support regional conservation efforts? We explore this story in a series of regional precinct maps and draw some preliminary conclusions.

Keywords: Environmental policy, GIS / modeling, Land/watershed management

Mike Skuja[1], Rania Ayoub[2], Ruth Williams[3], Crista Gardner[4], Juan Carlos Gonzalez[5]

[1]Tualatin Riverkeepers, Phone: (503) 797-1627, Email: mike@tualatinriverkeepers.org
[2]Muslim Educational Trust, Email: rania@metpdx.org
[3]Oregon Community Trees, Email: Ruth.Williams@davey.com
[4]Nature in Neighborhoods Grants, Metro, Email: crista.gardner@oregonmetro.gov
[5]Centro Cultural, Email: jgonzalez@centrocultural.org

Growing Green: Training diverse leaders for tomorrow's jobs

In 2016 Tualatin Riverkeepers, Centro Cultural, Muslim Educational Trust, and Oregon Community Trees partnered to deliver culturally relevant vocational training and internships for people of color in urban forestry to address Washington County's increase in green industry jobs. We will present the lessons learned, results and success of the training and placement of interns in urban forestry and restoration careers. For more information: http://www.oregonmetro.gov/news/nature-neighborhoods-grant-provides-forestry-career-training-diverse.

Keywords: Environmental education, Habitat restoration

Kristin Smith

Tualatin Hills Park & Recreation District (THPRD), Phone: (503) 466-8369, Email: ksmith@thprd.org

Nature Revealed: Incorporating public art in natural areas

Interpretation of natural resources in parks is often done via wayside exhibits and interpretive signs. While most effective for one-time visitors, the long-term interpretive impact of stationary signs decreases with repeat visitation. In an attempt to engage local residents, foster repeat visitation, and increase natural resource knowledge, we created Nature Revealed: Discovering Nature through Art; an interactive, multi-site public art installation at Tualatin Hills Park & Recreation District (THPRD). Through the assistance of the Regional Arts & Culture Council, we interviewed, selected, and commissioned four artists to design, create and install art in five THPRD parks. Artists were free to create their own designs as long as they met our goals of focusing on change over time, observing natural resource processes, and encouraging repeat visitation. Final designs were vetted through public meetings with neighbors of the parks where artwork would be installed. While largely supported by the public, there were some who wanted different art than what was proposed and others that had concerns about spending public dollars on artwork. Little to no feedback about the environmental impact or natural resource concerns was received. Final designs and final locations of the art installations were influenced by feedback received from the public, as well. Overall, our experience installing public art as a unique way to provide natural resource interpretation in local parks with repeat visitors has been positive. Additional community involvement in selection of the artwork and greater public understanding of the goals of the project could benefit future projects.

Keywords: Environmental education, Environmental social sciences

Michelle Talal[1], Mary Santelmann[2]

[1]Oregon State University, Phone: (503) 330-2613, Email: talalm@oregonstate.edu
[2]Director of Water Resources Program, Oregon State University, Email: santelmm@oregonstate.edu

Vegetation biodiversity patterns and ecosystem functioning relationships within various types of green infrastructure of Portland, Oregon

Green infrastructure is likely to play an increasing role in conserving biodiversity as urbanization increases. Green infrastructure has several definitions, but can be broadly defined as designed urban green space that generates a diversity of ecosystem services. Previous studies indicate how green infrastructure can promote or inhibit biodiversity; however, more empirical evidence is needed to fully understand the environmental benefits of green infrastructure. The purpose of this study is to quantify vegetation biodiversity patterns and ecosystem function in different green infrastructure types within Portland, Oregon. These relationships will be assessed through field studies, multivariate analyses, and geospatial analyses. This study evaluates potential differences in environmental benefits between four types of green infrastructure, including bioswales, urban parks, detention basins, and riparian areas. Our goal of presenting this project at UERC is to start a discussion with local stakeholders about information needs and best available data sources. Study results will be used to provide recommendations to water managers about increasing biodiversity and ecosystem functioning within various types of green infrastructure of Portland, Oregon. This study is in conjunction with the Urban Water Innovation Network (UWIN), a nationwide consortium of universities and partners that seeks to address challenges to water systems. Our cross-collaboration with other researchers will help share information and create solutions to increase water management system resiliency.

Keywords: Habitat assessment, Plant ecology, Sustainable development

Ashlyn Teather[1], Jesse Seals[2], Kimberly Koller[3]

[1]City of Gresham Natural Resources Program, Phone: (503) 618-2383, Email: ashlyn.teather@greshamoregon.gov
[2]City of Gresham Natural Resources Program, Email: jesse.seals@greshamoregon.gov
[3]City of Gresham Natural Resources Program, Email: krjkoller@gmail.com

Johnson Creek beaver survey results in Gresham

In September 2016, the City of Gresham's Natural Resources Program (NRP) conducted a beaver activity survey in an effort to catalog a 4 water mile stretch of Johnson Creek that runs through the city. The objective was to gather beaver data to be utilized in-house and shared with our partners, such as Johnson Creek Watershed Council. Nineteen active and inactive beaver dams were found, as well as evidence of how beavers use the creek and banks. The findings were overlaid with the 2015 Riparian Vegetation Survey conducted by the NRP which documented invasive species, vegetation types, ecological health and herb diversity in riparian areas. The department plans to continue the beaver survey annually to track beaver activity over time, and enhance our understanding of the city's watershed health and diversity.

Keywords: Habitat assessment, Land/watershed management, Wildlife biology

Ruth "Anna" Thurston

The Evergreen State College, Phone: (253) 227-4923, Email: thurut04@evergreen.edu

Insights from Green Roof Failure

Like other municipalities, the City of Portland encourages installation of publicly funded green roofs (GRs) to obtain environmental services in lieu of more costly stormwater infrastructure. Such benefits support development and climate change adaptation. Literature addressing vegetative roofing includes North American GR installation statistics, nearly twenty public and private benefits and a plethora of evolving GR product and design choices. Absent from the literature, however, is analysis of GR failure rates. To fulfill benefits, meet consumer expectations, and avoid failure, GRs require stringent planning, sensible installation, plus owner commitment to on-going evaluation and maintenance. Using operational definitions of GR failure provided by affiliated agencies, planners, product providers, contractors, plus GR owners and managers, an observational survey measures the failure rate of GRs within the City of Portland – a municipality representative of others in North America. Definition-dependent results reveal a 2% – 35% rate of GR failure. Findings lead me to conclude that the rate of needed GR installation will remain modest without the aid of incentives until these issues are addressed, collaboratively, by GR industries, their educators and by the agencies that incentivize GR installations. Towards greater installation of GRs, results invite GR risk and rate of return assessments by the North American GR industry and incentivizing agencies in ways that acknowledge consumer objectives. Results also encourage research for continued enhancement of green infrastructure, and GR installation BMPs. Further, responses to failure as defined by these consumer objectives, enhances all policies promoting green infrastructure.

Keywords: Climate change, Environmental policy, Sustainable development

AUTHOR INDEX

KEYWORD INDEX