Urban Ecology & Conservation Symposium











16th Annual
February 5, 2018

Thanks to the following photographers
Cover photo credits

Group in upper left
Tree planting with English language learners – Marc Czornij, Friends of Trees
Oxalis suksdorfii plant – Elaine Stewart, Metro Parks and Nature
Canoe ride – Mike Houck, Urban Greenspaces Institute

Group in upper right
Beaver – Erin Poor, Portland State University, Graduate Student
Cardinal meadowhawk dragonfly – Erin Poor, Portland State University, Graduate Student
Tadpole hunting in Gresham – Katie Holzer, City of Portland Environmental Services

Group at bottom
Salamander – Gail Shaloum, Clackamas County Water Environment Services
Outdoor activity with two kids – Irina Boboia, City of Vancouver, Water Resources Education Center
Great Blue Heron – Michael Krall, retired
CHS students at Rock Creek – Gail Shaloum, Clackamas County Water Environment Services
Students looking at water samples – Gail Shaloum, Clackamas County Water Environment Services

16TH ANNUAL

URBAN ECOLOGY & CONSERVATION SYMPOSIUM

Held at
Smith Memorial Center Ballroom
Portland State University
Portland, Oregon, USA
February 5, 2018

Organized by the
Urban Ecosystem Research Consortium (UERC)

Sponsored by

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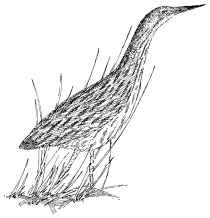

Urban Ecosystem Research Consortium (UERC)
Portland, Ore. - Vancouver, Wash. Metropolitan Region

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	*environmental policy*	*hydrology*	*sustainable development*
climate change	*env. social sciences*	*land management*	*transportation*
conservation biology	*fisheries*	*land use planning*	*water quality*
ecology	*geology*	*land/watershed mgt.*	*wildlife biology*
economics	*GIS / modeling*	*plant ecology*	
env. design	*habitat assessment*	*social sciences*	
env. education	*habitat restoration*	*stormwater management*	

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.

2018 URBAN ECOLOGY & CONSERVATION SYMPOSIUM ACKNOWLEDEMENTS

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FINANCIAL SPONSORS

Audubon Society of Portland
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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, **Ann Toledo** and **Christy Carovillano**, Metro Parks and Nature, and **Brooke Porter**, City of Vancouver, Water Resources Education Center, for their assistance and support for this event.

2018 Urban Ecology & Conservation Symposium
AGENDA

8:00 **REGISTRATION**

9:00 **WELCOME AND INTRODUCTION: Olyssa Starry**, Assistant Professor, University Honors College, Portland State University

9:10 **OPENING KEYNOTE ADDRESS: Dr. Charles Nilon**
Professor, Fisheries & Wildlife, University of Missouri School of Natural Resources
Urban Biodiversity, Everyday Nature, and Environmental Justice

COMMUNITY SCIENCE *Moderator: Joe Liebezeit, Avian Conservation Program Manager, Audubon Society of Portland*

9:50	Jennifer Karps	City of Portland, Environmental Services	Can equity metrics help achieve equity goals?
10:00	Nicole Lewis and Olena Turula	Metro	Using data and stories to understand personal connections to nature and attachment to place
10:10	Gail Shaloum and Daniel Bedell	Clackamas County Water Environment Services	A unique role for community science in stream restoration
10:20	Laura Taylor	West Multnomah Soil & Water Conservation District	Pollinator monitoring with community scientists in west Multnomah County
10:30	Q&A		

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

HABITAT *Moderator: Amy Chomowicz, Program Manager, City of Portland, Environmental Services*

11:00	Aaron Anderson	Oregon State University	Screening native PNW wildflowers for attractiveness to pollinators and natural enemies
11:10	Laura Guderyahn	Portland Parks & Recreation	Elk Rock Cliff: Vegetation surveys on a vertical cliff face
11:20	Georgia Sinimbu	Portland Parks & Recreation	Oak historical abundance and distribution using U.S. General Land Office Surveys in Portland, Oregon
11:30	Lori Hennings	Metro	Update: Mapping Oregon white oak trees within the Regional Conservation Strategy boundary
11:40	Leslie Bliss-Ketchum	Portland State University	Metro habitat connectivity toolkit: Bringing connectivity to an actionable scale
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: Judy Bluehorse Skelton**
Senior Instructor II, Indigenous Nations Studies, Portland State University
Reclaiming the Urban Forest for Food, Medicine, and Ceremony: An Overview of Indigenous Cultural Collaborative Restoration Projects in the Portland Metro Area

RESTORATION *Moderator: Paul Heimowitz, Regional Science Coordinator, US Fish & Wildlife Service*

1:40	Joe Liebezeit	Audubon Society of Portland	Bird response to habitat restoration at Fernhill Wetlands
1:50	Lauren Senkyr	NOAA Restoration Center	Habitat restoration for natural resources in the Portland Harbor Superfund Site
2:00	Elaine Stewart	Metro	So many weeds, so little time: Prioritizing use of limited resources
2:10	Desirae Wood	Dobro Design	Habitat value of ecoroofs – Phase 2
2:20	Q&A		

2:30 **BREAK** *Raffle at 2:45*

WATER & AIR *Moderator: Ted Labbe, Policy and Program Director, Urban Greenspaces Institute*

2:50	Rao Meenakshi	Portland State University	Air pollution exposure and mitigation potential in Portland, Oregon
3:00	Melissa Brown	City of Portland, Environmental Services	Monitoring ESA-protected species in the City of Portland using eDNA
3:10	Erin Poor	Portland State University	Effects of beaver dams on surface water flow during storm events in an urban landscape
3:20	Katie Holzer and Torrey Lindbo	City of Gresham	Pavement that can clean water
3:30	Erin Rivers	Portland State University	Annual precipitation influences denitrification potential in Portland's urban green stormwater infrastructure
3:40	Q&A		

3:50 **CLOSING REMARKS:** Lori Hennings, Senior Natural Resource Scientist, 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
Jason Aloisio* (Wildlife Conservation Society)	Pre-college urban ecology research mentoring: Engaging underrepresented minorities in the fields of ecology and conservation
Alexis Barton* (Johnson Creek Watershed Council)	Community science in the Johnson Creek watershed
Amy Bartow* (USDA NRCS Corvallis Plant Materials Center)	Evaluation of commercial pollinator seed mixes for western Oregon
Emma L. Brenneman*, Ashley M. Baker, Heejun Chang (Portland State University)	Spatial analysis of green streets in the City of Portland, Oregon
Baroness C. Castra Nemici* (City of Portland, Environmental Services)	City of Portland, Environmental Services Community Watershed Stewardship Program
Junjie Chen*, Heejun Chang (Portland State University)	Watershed resilience to climate change: Hysteresis behaviors of discharge-turbidity concentration relationship
David Farmer* (Portland State University)	Hydrological patterns and the effects of land use on TSS concentrations and yields in the McCarthy Creek watershed, Portland, Oregon
Keri M. Handaly* (City of Gresham)	Student interns increase stormwater awareness and improve private system maintenance in Gresham
Sarah Hartung*, Robert Emanuel (Environmental Science Associates, Clean Water Services)	Maroon Ponds Natural Area: A case study of wetland and stream habitat restoration from planning to post-construction
Dana E. Hellman* (Portland State University)	The cost of extreme heat: A cost/benefit analysis of three heat-ameliorating interventions in Portland, Oregon
Ted R. Labbe*, Laura Allen (Urban Greenspaces Institute, Greywater Action)	From greywater to green landscapes: Reducing residential summer water consumption while growing green landscapes

Gail A. Langellotto*, Isabella Messer (Oregon State University)	Bee abundance and richness in Portland-area home gardens
Rachel Lemont*, Olyssa Starry, Sean N. Gordon (Portland State University)	Identifying synergies and gaps in the Portland-Vancouver Regional Conservation Strategy under climate change
William McCune*, Delaney Riggins, Nancy Broshot, Samantha Moellmer (Linfield College)	Worms in urban Pacific NW forests - A preliminary study
Mykl Nelson*, Gail Langellotto (Oregon State University)	Characteristics of urban soils from residential vegetable gardens in two Willamette Valley cities
Benjamin J. Shetterly*, Jennifer L. Morse (Portland State University)	Characterization of soil phosphorus and its potential for mobilization in stormwater bioretention facilities
Kyle D. Spinks* (Tualatin Hills Park & Recreation District)	Community science at work in your back yard
Michelle L. Talal*, Mary Santelmann (Oregon State University)	Plant health and greenness of different income-level neighborhoods in Portland, Oregon using Landsat 8 OLI/TIRS surface reflectance
Amanda Temple*, Martin Lafrenz, Leslie Bliss-Ketchum (Portland State University)	Mapping risks across urban-wildlife connectivity
Pamela G. Thompson*, Olyssa Starry, Kevina Vulinec (Portland State University, Delaware State University)	Preliminary acoustic surveys of bats in Portland's urban parks
Maria E. Tunno* (Washington State University)	An investigation of wapato along the lower Columbia River
Jess Tyler* (Portland State University)	Assessing pollinator diversity and relations to fruit production and floral diversity at Portland community orchards
Anna Withington*, Jennifer L. Morse, Erin Looper (Portland State University)	Rates and drivers of methane production and consumption in bioretention facility soils across six U.S. cities

** Primary author*

LUNCHTIME CHATS AND TOURS

Grab your lunch and join a discussion with experienced peers from the world of urban ecology and environmental education. You can choose one of four networking opportunities that will stimulate thinking. Or, if you want to get outside, take a guided tour or guide yourself around PSU's sustainable features. *Please note: Room numbers may be changed based on group size.*

1. **Supporting Unhoused People and Sustaining Natural Areas -Room 327**

Continuing a pilot event last October, session leads will spark a conversation about challenges, opportunities and priorities for engaging unhoused people who are sheltering in natural areas. This will kick off with a thought experiment and we will take the conversation from there.

- Conversation Leads: Kathleen Guillozet, Bonneville Environmental Foundation and Quinn Colling, JOIN

2. **Resilient Urban Habitats: What are They?-Room 329**

Many conservation strategies now refer to "increasing habitat resilience" when addressing game-changing stressors like climate change. What does resilience in urban habitats really mean? Is "restoration" the answer to increasing and supporting habitat resilience? When is human intervention helpful? Can we engineer resiliency or are these qualities that cannot be "built" into a system?

- Conversation Leads: Esther Lev and Paula Gagnon, The Wetlands Conservancy and Paul Heimowitz U.S. Fish and Wildlife Service

3. **How do you find interns? How do you find internships?-Room 333**

Surprisingly, finding qualified interns is more challenging than many think. Yet, many seeking internships are also challenged by searching out intern opportunities that fit. Join the conversation with representatives familiar with intern needs from a few different perspectives: AmeriCorps, academia and informal science education. Share your experiences in finding a successful internship.

- Conversation Leads: Ashley King, Clark Public Utilities; Mary Vance, PSU Advising and Career Services and Suzanne Hebert , Vancouver Water Resources Education Center

4. **Environmental and Cultural Education- Room 328**

Network with regional environmental and cultural educators who use a variety of techniques to engage their multi-age, diverse audiences in the special places they interpret. From stewardship to ethnobotany, from paddling a canoe to traditional ecological knowledge, environmental education has many faces in our region. How do you engage your audiences?

- Conversation Leads: Juliet McGraw, Cathlapotle Plankhouse- Friends of Ridgefield National Wildlife Refuge; Sean Davis, Friends of Ridgefield National Wildlife Refuge; and James Sterrett, Lower Columbia Estuary Partnership

5. **PSU Sustainable Features Tour (including cultural and ecological features)**-Meet your PSU guide at the stage. Tours leave promptly at 12:15 pm and return by 1 pm.

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

MORNING KEYNOTE ADDRESS

Charlie Nilon, Ph.D.
Research Social Scientist
University of Missouri, School on Natural Resources
Columbia, Missouri

Urban Biodiversity, Everyday Nature, and Environmental Justice

Efforts to understand ecological as well as social drivers of biodiversity in cities could help mitigate the effects of urbanization on species abundance. This talk will begin with a discussion of urban biodiversity and lessons learned about global patterns in bird diversity. Some application of these findings to a city like Portland will then be suggested, with emphasis on the importance of places in around where people live - everyday nature - to conservation. The talk will conclude with a discussion on the differences that occur among neighborhoods that may be tied to race, poverty, and other factors, and the implications of this for conservation.

Biography

Charlie Nilon is a professor of urban wildlife management at the University of Missouri. His research and teaching focus on urban wildlife conservation and on the human dimensions of wildlife conservation. Since 1997, he has been a co-principal investigator on the Baltimore Ecosystem Study (BES). The project in Baltimore and a similar one in Phoenix are the first two urban ecosystems included in the National Science Foundation's Long-Term Ecological Research program. His work with the BES focuses on understanding how physical, ecological and socioeconomic factors influence the abundance and composition of vertebrate species. Because urban areas are homes for people as well as wildlife, Nilon's research also considers the role of nature as part of an individual's day-to-day environment, and environmental justice issues associated with access to nature. Since 2014 he has been co-director of the Urban Biodiversity Research Coordination Network (UrBioNet), a project that is developing a database of biodiversity in the world's cities and also developing a network researchers and practitioners who work on different aspects of urban nature.

AFTERNOON KEYNOTE ADDRESS

Judy BlueHorse Skelton *(Nez Perce/Cherokee)*
Senior Professor II, Indigenous Nations Studies Program
Portland State University
Portland, Oregon

Reclaiming the Urban Forest for Food, Medicine and Ceremony: An Overview of Indigenous Cultural Collaborative Projects in the Portland Metro Area

Indigenous Traditional Knowledge-based practices for land, water and traditional foods are critical to the revitalization of food sovereignty for Indigenous communities and are central to healing from the long-term effects of historical trauma. We recognize the cultural significance and value of connection with the land to heal and build community health and resilience: First Foods and Plant Medicines are essential to restore and reclaim physical, mental, emotional and spiritual health. Reclaiming the urban forest for food, medicine, ceremony and healthy lifeways have found a timely synergy with numerous agencies and community partners working in culturally responsible restoration, education, reclamation and protection practices, as well as informing holistic/adaptive land management and policies. With an emphasis on long-term relationship building and prioritizing the collaborative processes, these partnerships acknowledge the interdependence of People and Place so crucial for revitalizing healthy communities and healthy lands. This presentation highlights several collaborative projects and partnerships, including the PSU Indigenous Nations Studies Program, Portland Parks, Metro, U.S. Fish and Wildlife, and Native communities, both urban and tribal. These key practices are part of the larger Indigenous Resurgence movement occurring nationally and internationally.

Biography

Ms. Judy Bluehorse Skelton teaches *Environmental Sustainability through Indigenous Practices, Contemporary Issues in Indian Country, Indigenous Women Leadership,* and *Indigenous Gardens and Food Justice*. She has worked with federal, state and local Native organizations and tribes throughout the Northwest for more than 20 years, creating cultural activities focusing on traditional and contemporary uses of native plants for food, medicine, ceremony, and healthy lifeways. Judy is author of six collections of essays for teachers, including *Native America: A Sustainable Culture (1999),* and *Lewis & Clark Through Native American Eyes (2003*). In 2017 she received the PSU President's Diversity Award and in 2014, the Oregon Indian Education Association's award for Outstanding Indian Educator. Judy serves on the boards of Portland Parks, The Nature Conservancy, and Urban Greenspace Institute. Collaborative work includes the Confederated Tribes of Siletz Indians, the Confederated Tribes of Grand Ronde, NARA (Native American Rehabilitation Assn.), the Native American Community Advisory Council to Portland Parks and Metro, and the US Fish and Wildlife Service, integrating Indigenous land management practices with traditional ecological knowledge (TEK) to address Food Sovereignty/Justice and reclaim the urban forest for physical, mental, emotional and spiritual health.

ABSTRACTS SUBMITTED

Pre-college urban ecology research mentoring: Engaging underrepresented minorities in the fields of ecology and conservation

Jason Aloisio, Wildlife Conservation Society, Email: jaloisio@wcs.org

Despite continued efforts to recruit and retain underrepresented racial minorities (URMs) – African Americans, American Indians/Alaska Natives, Native Hawaiians/Pacific Islanders, and Latinx – in the sciences, only 21.7% of 4-year science degrees were awarded to URM's in the United States during 2014. While research mentoring programs at the undergraduate level increase the retention of URMs already majoring in the sciences, contextual (e.g., role-model relationships) and psychological (e.g., science identity) factors that develop long before college may limit the number of URMs who choose to study the sciences and pursue environmental-related careers in the first place. Therefore, to increase diversity in these areas it is critical to reach students before they make decisions about college. Funded by NSF, Project TRUE (Teens Researching Urban Ecology) is an urban ecology summer research mentoring program in NYC aimed at URM rising high school seniors. Immediately following Project TRUE, 54.9% (50 of 91) of participants reported a change in academic intent towards an ecology-related major. While some participants did not change their interest towards an ecology-related degree, 94.5% planned to pursue a STEM degree and students reported on a 7 point Likert Scale (1 = "not at all", 7 = "a lot") that Project TRUE had a mean influence of 6.5 on "knowledge of science" and "intention to go to college" and a mean influence of 6.2 on "want to help take care of the environment". These data suggest that Project TRUE had a strong influence on student academic intentions, science identity, and pro-environmental attitudes.

Keywords: Environmental education, Environmental policy, Environmental social sciences

Screening native PNW wildflowers for attractiveness to pollinators and natural enemies

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Lucas Costner, Oregon State University, Email: costnerl@oregonstate.edu
Gail Langellotto, Oregon State University, Email: Gail.Langellotto@oregonstate.edu

Many organizations have published pollinator friendly planting lists for home gardeners. However, most of these lists lack empirical evidence to support their choices. To our knowledge no such list exists in the Pacific Northwest; thus, there is a need for baseline research on the relative attractiveness of native wildflowers to floral visitors in our region. Such data would better inform targeted plantings designed to increase habitat value in urban areas. During the summer of 2017, we conducted the first field season of a study screening 23 native Willamette Valley wildflowers for their attractiveness to pollinators and natural enemies. We planted these species at the North Willamette Research and Extension Center in meter square plots spaced six meters apart. We monitored floral visitation, floral bloom, and vacuum sampled insects weekly between April and October. Though this research is ongoing, we have early findings on the attractiveness of these wildflower species to bees and natural enemies. *Solidago canadensis* and *Symphyotrichum subspicatum* were two of the more attractive perennial species, and *Clarkia amoena* and *Gilia capitata* were annual flowers highly attractive to a variety of pollinators. This project will run for several more seasons, and will result in recommended pollinator planting lists for home gardens and for agricultural areas.

Keywords: Habitat restoration, Conservation biology, Plant ecology

Community science in the Johnson Creek watershed

Alexis Barton, Johnson Creek Watershed Council, Email: alexis@jcwc.org

Johnson Creek Watershed Council's Community Science program has expanded significantly in the past two years. Salmon Surveys have been occurring since 2011 and all other programs are new as of 2016. This poster will summarize results from 2016 Salmon Surveys, and 2017 Eco-Blitzes, Lamprey/Steelhead, Beaver, and Dragonfly Surveys. It will bring together key elements from each program such as numbers of sites and surveyors, with the map showing the sites for each survey. Not only is community science an engaging way for community members to volunteer their time, the projects are collecting valuable data that is shaping our understanding of wildlife in the watershed. While Eco-Blitzes are collecting data on stream fauna overall, dragonfly populations are indicative of wetland habitat quality, beaver surveys are telling us about how beaver behave in an urban environment, and salmon, lamprey and steelhead surveys are characterizing the presence of significant fish populations in Johnson Creek. As a small nonprofit with a large volunteer base that is growing through community science, Johnson Creek Watershed Council's community science programs can serve as a model for future surveys in the area. Working with scientific advisors – ODFW, Metro, and independent experts – and with the in-the-field efforts of trained community members, Johnson Creek Watershed Council has been gathering interesting and exciting data throughout the watershed.

Keywords: Wildlife biology, Habitat assessment, Animal ecology

Evaluation of commercial pollinator seed mixes for western Oregon

Amy Bartow, USDA NRCS Corvallis Plant Materials Center, Email: amy.bartow@or.usda.gov

There are many pollinator seed mixes available on the commercial market, but not all are likely to establish and perform well in our region, or provide high quality pollinator habitat. The purpose of this study was to evaluate a number of commercially available pollinator mixes for use in western Oregon. This 3-year study, started in the fall of 2014 at the Corvallis Plant Materials Center, includes small plots of seven different commercial pollinator mixes seeded at a standardized rate of 60 seeds/ft^2. Plots were monitored every two to four weeks throughout the 2015, 2016, and 2017 bloom seasons (late February through September) for plant canopy cover, bloom period, flower abundance, and pollinator visitation. Results from the first three years of the study showed that most mixes had at least three species in bloom in early, mid and late season for their first year of establishment, but diversity tended to drop the second year, with many plots dominated by just a few species the second year (lupines in particular). The "standard" Xerces Society mix (comprised almost exclusively of Willamette Valley native species) appeared to attract the most native bees, while some of the other seed mixes (containing non-native species) attracted more European honey bees.

Keywords: Habitat restoration, Habitat assessment, Plant ecology

Metro habitat connectivity toolkit: Bringing connectivity to an actionable scale

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Lori Hennings, Metro, Email: lori.hennings@oregonmetro.gov

Habitat fragmentation is a serious threat to maintaining biodiversity, particularly in urbanizing areas. Methods exist to model habitat connectivity. However, many of these are applied at large scales and rely on data that may be a decade or older, resulting in inaccuracies when compared to on the ground conditions, particularly in dynamic urban systems that experience rapid change. These issues make taking action to preserve or enhance these connectivity zones difficult, if not impossible. The Metro Regional Habitat Connectivity Toolkit approaches this problem by combining GIS analysis with on the ground assessments at realistic scales for land acquisition, restoration projects and/or barrier mitigation. We employed a surrogate species approach to address connectivity needs in a way that incorporates empirical data. Local information and research was combined with other habitat attributes to focus development of field assessments for habitat quality and barrier permeability. The field assessments allow technicians to verify GIS data, identify barriers and record habitat attributes in a way that is comparable across multiple habitat connectivity zones and for multiple species. Once assessments are concluded the resulting information is used to generate two species-specific scores for habitat quality and barrier permeability. These scores identify where on the landscape restoration and/or land acquisitions would provide the most connectivity benefit versus areas where mitigation for barriers such as wildlife passage structures across roads are the priority. This toolkit is in the final stages of development and is currently being testing in pilot areas in the Portland Metro region.

Keywords: Conservation biology, Habitat assessment, GIS / modeling, Land/watershed management, Transportation, Wildlife biology, Animal ecology

Spatial analysis of green streets in the City of Portland, Oregon

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Heejun Chang, Portland State University, Email: changh@pdx.edu

We seek to explain the spatial distribution of Green Streets, a type of Stormwater Green Infrastructure (SGI), within the City of Portland. SGI offers multiple benefits, such as improved water quality, runoff regulation, and reduction of combined sewer overflows. This is complemented by SGI's ability to improve perceived aesthetic and economic value within urban areas. We used sociodemographic and physical variables acquired from a variety of governmental agencies to investigate the relationship between the density of green streets and explanatory variables. Sociodemographic variables are based on tax lots and census data and include population characteristics (income, education) and building structural characteristics (building size, building age, and building value). Physical parameters include elevation, slope, impervious surfaces, and soil type and are derived at the lot scale and the census block group scale. Our results showed that there is a distinct spatial pattern of green street density, and a combination of these physical and sociodemographic variables influence placement of green streets throughout the city. Additionally, the determinants of green street density vary over space, suggesting that different local spatial processes are related to the placement of green streets. This research offers decision-relevant information for future urban spatial planning. To ensure the ideal placement of SGI projects throughout the city, it is necessary for municipalities to consider both biophysical constraints and sociodemographic settings of different neighborhoods within the City.

Keywords: Land use planning, Hydrology, GIS / modeling

Monitoring ESA-protected species in the City of Portland using eDNA

Melissa Brown, City of Portland - Bureau of Environmental Services, Email: melissa.brown@portlandoregon.gov

A method that extracts DNA from aquatic habitats has been used to explore fish population structure in City monitoring efforts. In such sampling, genetic material shed by organisms – environmental DNA (eDNA) – is collected by filtering streamflow, and analyzed for species-specific DNA arrangements using polymerase chain reaction (PCR) sequencing. The Bureau of Environmental Services has been using this passive method to sample reaches throughout its watersheds, often where and when conventional methods are not feasible. Here I will briefly present recent salmon, trout, and lamprey results, focusing on the Crystal Springs Creek reach of the Johnson Creek watershed.

Keywords: Conservation biology, Land/watershed management, Fisheries

City of Portland Bureau of Environmental Services Community Watershed Stewardship Program

Baroness C. Castra Nemici, City of Portland - Bureau of Environmental Services, Email: b.castranemici@portlandoregon.gov

The Community Watershed Stewardship Program (CWSP) is a 22-year partnership between the Portland Bureau of Environmental Services (BES) and Portland State University. The program engages Portlanders in enhancing the health of our watersheds while promoting public awareness of our connection to these natural systems. It offers funding for community projects that enhance watershed health, help with project planning, and assist in connecting community groups with resources for their projects. Through the administration of two grant programs, CWSP has enabled Portlanders to engage in the stewardship of their watersheds and ecosystems. Through CWSP programs, the city has awarded $1,446,094 in CWSP Stewardship Grants funding (total amount awarded as of the 2016-2017 grant cycle), which has been invested in a total of 275 community driven projects (number of projects as of the 2016-2017 grant cycle). Portlanders are heavily invested in the success of CWSP, demonstrated by the community's generous contribution of a total of $3,964,774 (community matching funds total as of 2014-2015 grant cycle) and 225,811.5 volunteer hours to CWSP projects (total number of volunteer hours as of 2014-2015 grant cycle). In 2010, opportunities for improvement emerged when CWSP instituted equity scoring and assessment. CWSP responded by making changes to outreach efforts and application formats. Additionally, CWSP identified eight promising practices to improve equity. As a result, there has been a positive trend in the CWSP equity score since the analysis began.

Keywords: Economics, Environmental policy, Environmental social sciences, Habitat restoration, Land/watershed management, Sustainable development, Water quality

Watershed resilience to climate change: Hysteresis behaviors of discharge-turbidity concentration relationship

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Understanding urban watershed resilience to climate change and variability in the Clackamas River Basin (CRB) can aid stakeholders in managing stormwater and sanitary sewer treatment facilities to provide high-quality drinking water and watershed services. Changing precipitation regimes are likely to affect the relationship between discharge and water quality in the CRB. We examined the dominant hysteresis patterns of the discharge-turbidity relationship after major storm events in three nested watersheds using statistical analysis by season. By using available high-resolution discharge and turbidity data, we quantified hysteresis relation between discharge and water quality parameters by Hysteresis Index (HI) and classified hysteresis loops to examine HI variability to seasons, storm intensity, soil type, and land use. This paper uses five years of high-resolution water quantity and quality parameter data (2012-2016) from three monitoring stations in CRB to observe hysteresis behaviors. Watershed characteristics such as land cover type, hydrologic soil group, and drainage area were identified as potential factors that explain HI patterns. Furthermore, water quantity and quality parameters were analyzed using multiple linear regression models and correlation matrix. Results show that the maximum discharge, discharge range, and turbidity range correlates with hysteresis patterns while storm intensity moderately correlates with hysteresis behaviors. The empirical results from this research serves as an observational baseline for model evaluation and future projections in hydroclimate and water quality. A deeper understanding of discharge-concentration relationship can yield knowledge to stakeholders seeking effective ways to increase resilience of watershed services to climate change in the CRB.

Keywords: Water quality, Climate Change, Hydrology

Hydrological patterns and the effects of land use on TSS concentrations and yields in the McCarthy Creek watershed, Portland, Oregon

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The spread of impervious surface areas and the reduction of tree canopy via urbanization has numerous water quality impacts on Pacific Northwest watersheds. One such impact is elevated levels of Total Suspended Solids (TSS) in run-off during storm events, particularly in steep, forested watersheds undergoing urbanization. This project was developed in collaboration with the West Multnomah Soil and Water Conservation District and focused on the McCarthy Creek Watershed, as a case-study watershed located in Portland, OR. The study aimed to identify elevated TSS concentrations and yields during storm events on both mainstem and tributary sampling locations, establish the relationship between TSS and rainfall variables (rainfall depth, rainfall intensity, and rainfall duration), and determine the most significant land cover variables as predictors of TSS based on delineated sub-watersheds in McCarthy Creek. These data were collected through a combination of grab sampling, hourly autosampling, and GIS analysis during the course of the later winter and early spring. All of the sampling locations exceeded informal TSS thresholds during storm events, but no statistically significant differences were found in TSS concentrations or yields for any of the sampling locations. Rainfall depth was the most significant predictor of TSS concentrations in the mainstem locations and autosampler results, while rainfall intensity was the most significant predictor of TSS in tributary sampling locations. Land cover regression models did not uncover any significant relationships between TSS and land cover variables. McCarthy Creek Watershed may so spatially homogenous in terms of land cover that TSS concentrations are similar throughout the watershed, resulting in low variance explained by land cover variables.

Keywords: Land/watershed management, GIS / modeling, Water quality

Elk Rock Cliff: Vegetation surveys on a vertical cliff face

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At river mile 19 of the Willamette River, Portland Parks and Recreation (PPR) manages a 3.3 acre (1.3 ha), 300ft tall basalt cliff, the unique phytogeology of which historically attracted botanists from around the region. Of the 106 plant taxa reported historically from Elk Rock Cliff, 29 are (locally) rare, 3 species (*Delphinium leucophaeum*, *Bolandra oregana*, *Sullivantia oregana*) have state and federal status and 18 taxa have no recent records from our area. This is likely due to the difficulty of accessing the cliff and the fact that no one had attempted a thorough survey of the cliff face. In 2017, PPR, in partnership with the Bureau of Environmental Services, developed a method of using high resolution photography and GIS technology to undertake a comprehensive botanic survey of Elk Rock Cliff. A series of 122 individual photographs were taken of the cliff in March and again in May to capture both leaf off and peak bloom times of rare plant species. Examining individual photographs and comparing them to real time examination of the cliff face with spotting scopes and binoculars allowed ecologists to identify dozens of species of invasive and native plants across the cliff. GIS technology was used to resolve the fact that the cliff face varies in all three dimensions to determine canopy cover for each species. The results of this survey will allow the City to prioritize and implement restoration tasks to preserve and protect the rare species that still exist on Elk Rock Cliff.

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

Student interns increase stormwater awareness and improve private system maintenance in Gresham

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In 2016-17, The City of Gresham Water Resources Program launched an initiative to map, mark, and inspect all private stormdrains utilizing SummerWorks 15-19-year-old interns. Over two summers eleven interns were employed for about 2,000 hours. Their $2,500/person stipend was funded by the Multnomah County Youth Connect program. The private drains are located on approximately 1,200 tax lots that comprise churches, apartments, schools and businesses. The interns were trained on how to use GPS units to collect data on drain locations, apply "Dump No Waste" stickers in English and Spanish, and identify whether drains needed to be cleaned. Interns were provided with maps of tax lot priority locations, public transit passes and map routes, and rolling carts of supplies and equipment. Youth gained valuable project planning and public communication skills while also learning about local threats to water and salmon. The project resulted in about 3,400 drains being marked and mapped on about 1,000 tax lots. This effort has resulted in 400 additional drains required for maintenance by the city. This will prevent an estimated 30-70 additional cubic yards of debris and pollutants from entering the public stormwater system and local streams. Interns were also trained to identify evidence of spills, dumping, or poor management practices at commercial properties. This resulted in five significant code violations such as: dumping of wash water & milk at local schools and unmaintained/leaking grease and garbage containers at restaurants and grocery stores.

Keywords: Environmental education, Water quality, Land/watershed management, GIS / modeling

Maroon Ponds Natural Area: A case study of wetland and stream habitat restoration from planning to post-construction

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Clean Water Services (CWS) in partnership with Metro as well as other public and private parties has been engaged in landscape-scale wetland and stream restoration in the upper Tualatin River Watershed. Environmental Science Associates (ESA) has assisted CWS and Metro in conservation planning, design, and permitting for key properties in the watershed, including the 47-acre Maroon Ponds property along the main stem river. This poster presentation describes a case-study of wetland/stream habitat restoration from planning to post-construction. The Maroon Ponds Natural Area contains several types of palustrine wetlands; riparian habitat and upland terraces altered from past agricultural use. Several decades ago a 175-foot long berm was constructed across hillside drainages to create a small irrigation pond. Project highlights include: 1) designing, permitting, and constructing the project in one year; 2) incorporating beaver activity into the project design and seeing almost immediate results after construction; 3) Using the Oregon Rapid Wetland Assessment Protocol (ORWAP) to estimate habitat benefits as part of justification for transforming a small impoundment to historic low-gradient streams and connected riparian habitat; and 4) describing three years of results of vegetation, amphibian and turtle monitoring, and on-going management of the site to achieve high-value riparian forest, wetlands, as well as upland woodlands and savanna.

Keywords: Habitat restoration, Wildlife biology, Plant ecology

The cost of extreme heat: A cost/benefit analysis of three heat-ameliorating interventions in Portland, Oregon

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The detrimental, sometimes fatal effects of urban heat are well documented, and it is generally accepted that extreme heat poses a threat to human health and quality of life. Less understood is the financial impact of heat, including such factors as energy consumption, health care expenses, and the economic loss associated with premature death. This analysis examines several potential cost factors associated with extreme heat, as well as the potential savings offered by three heat-ameliorating interventions: eco roof installation, road lightening, and street tree planting. The cost of each intervention is assessed based on the best available data, and compared to the expected financial benefits for Portland, Oregon, with focus given to the hottest, most exposed census block groups (CBGs). One extreme heat event can cause billions of dollars of damage in health costs alone (premature death, emergency room visits, treatment of illness). This analysis shows that any/all of the three proposed interventions (which cost anywhere from $17-160 million each to implement in the hottest CBGs) are well worth the price, and that the cost-saving benefits far outweigh the implementation costs. Furthermore, street trees have the added financial benefit of increasing property values and property tax revenue. Results strongly indicate that heat-ameliorating interventions are a smart investment for the City of Portland, particularly as climate change causes more frequent and severe urban heat waves.

Keywords: Climate Change, Environmental policy, Sustainable development

Update: Mapping Oregon white oak trees within the Regional Conservation Strategy boundary

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The Oak Prairie Work Group's Oregon white oak map is nearly complete. All areas within the Oregon side of the >2,800-square mile Intertwine Alliance Regional Conservation Strategy (RCS) boundary will be completed by June 30, 2018. We will describe the mapping process and show the results. Purpose: This work fulfills a high priority RCS goal. The results will be used to update RCS habitat maps; prioritize important oak habitat and connectivity areas; and support effective, collaborative habitat protection, stewardship and education. Methods: In 2012 we collected field samples of oak habitat to help develop a potential remote sensing model approach. From 2013-2015 Metro used thousands of oak tree locations collected by >180 community scientists, plus points collected via aerial photographs, to refine model iterations. Despite our best efforts, models substantially overestimated the amount of oak, partially due to the hundreds of tree species present in urban areas. We needed more accurate information. We became skilled at identifying oak trees from aerials by checking every oak point collected by community scientists. In 2015 we abandoned remote sensing efforts and began to systematically hand-map oak trees using aerial photos. Results: Approximately 10% of all mapped oaks are in protected areas. The results show clear spatial patterns in oak distribution, including large patches and potential wildlife connectivity pathways in both urban and rural areas. Many fall outside of RCS "high value habitat" areas modeled in 2012, which lacked oak data at the time. We will freely share the data and are currently developing data viewing tools.

Keywords: Habitat assessment, GIS / modeling, Habitat restoration

Pavement that can clean water

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Pervious pavement allows rain water to soak through it rather than running off. This type of pavement is known to reduce polluted stormwater runoff going to urban streams by infiltrating water into the soil below. But can it have benefits in areas where the soil drains too slowly for infiltration? We studied water quality and road conditions from test sections of pervious pavement on a large arterial road in Gresham, Oregon that is on top of slowly draining soil. We compared road sections of: A) conventional asphalt, B) 8"-think pervious pavement with an underdrain, and C) 3"-think pervious pavement on top of conventional asphalt. We found that runoff from both types of pervious pavement had lower levels of several pollutants of concern than runoff from conventional asphalt, including sediment, bacteria, nutrients, and heavy metals. The pollutant reduction of the pervious pavement was found to be similar to, or even higher than, reductions from other stormwater management practices in Gresham. Additionally, we noted that both types of pervious pavement had fewer potholes, less road spray, and less road noise than the conventional asphalt. This study indicates that pervious pavement can have multiple benefits to urban stream water quality as well as local road conditions, even when the soil below it drains too slowly for infiltration.

Keywords: Sustainable development, Transportation, Water quality

Can equity metrics help achieve equity goals?

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The Environmental Services Tree Program plants trees with partners in Portland to benefit watershed and human health. Since our work began in 2008, outreach, education, and tree planting services have aimed to improve connectivity in the urban forest and reduce inequities in the benefits residents enjoy from our urban trees. To these ends, our work focuses in low-tree-canopy, low-income, racially diverse communities. A new tool to support this work is a five-year contract with nonprofit Friends of Trees that contains two key elements: dedicated resources for community benefit organizations to help improve service delivery in communities where socioeconomic barriers impede progress, and equity metrics to ensure at least 75% service delivery where trees are needed most. With one year of the contract completed, preliminary qualitative and quantitative data are available to begin to answer the question: does the inclusion of equity metrics improve outcomes?

Keywords: Environmental social sciences, Land/watershed management

From greywater to green landscapes: Reducing residential summer water consumption while growing green landscapes

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Greywater – gently-used water from sinks, showers, and washing machines – can be simply and safely reused for outdoor irrigation. Greywater use has many benefits including saving water, reducing energy consumption, encouraging healthier product choices, connecting people to their water supply, and reducing strain on wastewater and septic systems. As droughts become more frequent and prolonged in the Northwest, we must explore and develop additional avenues for water conservation and re-use, such as greywater re-purposed for outdoor irrigation. Oregon legalized greywater in 2012 but relatively few have permitted new systems over the past 5-6 years. More work is needed to educate people about how to reuse this resource. In the poster, we will describe potential water and financial savings, give a brief introduction to greywater system types, and provide a link to the Oregon greywater partnership website where folks can learn more. In summers 2016 and 2017 Greywater Action, Depave, Recode, and Oregon Tradeswomen with financial support from East and West Multnomah SWCDs implemented a greywater educational workshop series. We completed ten workshops, built the first eight legally permitted systems in Portland, and reached over 150 people. We also trained a cadre of landscape professionals who can install these systems, and developed a standardized greywater permit plan to assist early adoptees. We estimate that collectively the eight demonstration greywater systems save over 15,000 gallons of water/year.

Keywords: Hydrology, Sustainable development, Land/watershed management

Bee abundance and richness in Portland-area home gardens

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Research has demonstrated that urban gardens support diverse, abundant, and intact bee communities in New York, California, Ohio, and the United Kingdom. In fact, the abundance and diversity of bees visiting urban gardens has been observed to approach, and even exceed, numbers in nearby natural and/or agricultural systems. To date, no comprehensive study has been conducted of Oregon's garden bees. We sampled 24 residential gardens in the Portland Metropolitan region, to document the abundance and richness of Portland's garden bees. We used a combination of pan trapping and hand collection to sample bees. Study sites varied in their composition (i.e. pollinator garden, perennial plant garden, edible garden, lawn-dominated garden, etc.), and were located in one of three landscape contexts: (1) Urban Core: gardens located within Portland, in highly populated neighborhoods, (2) Forest Edge: gardens located within Portland, located adjacent to Forest Park, and (3) Portland Suburbs: gardens located outside of Portland, in a peri-urban landscape. This presentation will review the diversity of bees that we have collected and identified, and explore the ecological characteristics of Portland's garden bees.

Keywords: Wildlife biology, Plant ecology, Conservation biology

Identifying synergies and gaps in the Portland-Vancouver Regional Conservation Strategy under climate change

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Our understanding of the benefits from urban nature has expanded considerably in the last decade, including the benefits of green infrastructure for managing stormwater and air pollution and for physical and mental health. However, an already difficult environment for natural systems is likely to be exacerbated by climate change. A lunch discussion at the 2017 Portland-Vancouver Urban Ecosystem Research Consortium symposium showed considerable interest in the topic from diverse stakeholders. In this poster, we describe our survey which aims to determine to what extent both the Regional Conservation Strategy and concerns about climate change are influencing local organizational activities and decisions. We further aim to identify gaps and overlapping areas of interest on this topic as well as innovative practices which we plan to share along with our overall findings at a stakeholder meeting later this year.

Keywords: Climate Change, Land/watershed management

Using data and stories to understand personal connections to nature and attachment to place

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Metro conducted two studies to better understand perspectives of people of color in parks and nature. A region-wide survey conducted in partnership with Oregon State University resulted in statistically significant data representative of residents across the region. Meanwhile, community engagement invited people of color to share their experiences of nature through a series of workshops. This session will explore how these data and stories deepen our understanding of what it means to facilitate connections between people and nature. Results highlights: Seventy-eight percent of all participants agreed that their favorite Metro park or natural area facilitates social bonding, and 65% agreed that their favorite park fosters emotional connections to place. Workshop participants described the importance of spending time outside with friends and family. Ninety-four percent report feeling a connection with nature when visiting their favorite Metro park. When asked “what words or short phrases would you associate with the word "nature”, the most common themes focused on nature as a place that provides a sense of calm, relaxation and tranquility. There were no clear differences between responses of people of color and white people. Workshop participants portrayed nature as healing, peaceful and rejuvenating. People of color were more interested than white people in the hands-on experience of caring for trails; harvesting seeds or planting native plants; storytelling in nature; and in learning how agencies manage and care for public land. Workshop participants expressed the desire to help actively care for the land and foster respect for public space in their own communities.

Keywords: Environmental social sciences

Bird response to habitat restoration at Fernhill Wetlands

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In 2014-15 Clean Water Services implemented a massive habitat restoration project at Fernhill Wetlands in Forest Grove, Oregon that transformed 90 acres of unused sewage ponds into native wetland habitats designed to naturally treat wastewater. Since spring 2015 the Audubon Society of Portland (ASOP) has assessed bird response to this habitat restoration effort through a community science effort involving local birders, formal bird surveys conducted by ASOP, and analysis of historical eBird surveys conducted at the site for decades. Our general predictions were that 1) Overall avian species richness and abundance would increase, 2) Open-water dependent species would diminish in abundance, and 3) Species dependent on native wetland habitats would increase. Our key preliminary findings include: 1) Species richness was significantly higher post-restoration and is particularly accentuated during the summer season; 2) Overall species abundance does not appear to have changed significantly between pre- and post-restoration periods, however, at the individual species level we document significant shifts in abundance. Most of these shifts fit our *a priori* predictions. In general, most waterbird species (including Virginia Rail and Sora), wetland-dependent songbirds (including Red-winged Blackbird and Common Yellowthroat), and dabbling ducks (Mallard and Gadwall) have higher abundances post-restoration while wintering grebes and fall migratory shorebirds have lower abundances post-restoration, and 3) We provide evidence that community science eBird surveys and the formal transect surveys were directly comparable. Our findings demonstrate benefits to native bird communities that can be achieved through integration of green infrastructure strategies to manage wastewater.

Keywords: Habitat restoration, Wildlife biology, Animal ecology

Worms in urban Pacific NW forests - A preliminary study

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In the past few years, we have been analyzing soils in Forest Park and at control sites in the Mount Hood National Forest to elucidate causes for the dearth of seedlings and saplings in the urban forest. We found significantly deeper O horizons, higher levels of C, and a higher C/N ratio at control sites than at sites in Forest Park. One suggestion as to a cause of our soil findings was the presence of invasive earthworms at more urban sites. Last summer, we censused earthworm populations using a mustard extraction technique at sites in Forest Park and in the national forest. We also measured the depth of the O horizon and rates of soil respiration. We found the depth of the O horizon and the amount of CO2 produced by the soil were significantly greater at control sites than in the urban forest. Neither the number of worms nor the biomass of worms were significantly different, however there was a tendency of lower worm biomass at the control sites. Because we did not have a large sample size, we intend to continue our investigation of worms and soil characteristics this coming summer.

Keywords: Plant ecology, Soil science

Characteristics of urban soils from residential vegetable gardens in two Willamette Valley cities

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We conducted an observation study of urban gardens in Corvallis and Portland, Oregon. A brief site analysis recorded weed pressure, season extension techniques, and crops grown, among other details. We took soil samples from every vegetable bed at each participating site. We are in the midst of testing these samples for nutrient content, heavy metal contamination, as well as biological and physical parameters. We intend to contrast raised-beds vs in-ground beds as well as suggest alteration to sampling procedures for garden soil. This research will result in increased precision of vocabulary by refining the defining differences between bed types and to describe mulch in greater detail. This effort will provide novel data about the content of urban garden soils. We seek to improve communication between researchers and producers by coupling the soil analysis with improved definitions. This will also enable recommendations to be made with urban soil data, rather than extrapolated from related but larger agricultural studies.

Keywords: Environmental policy, Land use planning, Soil science, Sustainable development

Effects of beaver dams on surface water flow during storm events in an urban landscape

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Urban land-use generally alters the hydrologic cycle, leading to changes in the natural flow regime of local streams. Runoff from impervious surfaces and routing of stormwater to streams causes urban streams to respond quickly and more intensely to storm events – more so than would be observed in a less urbanized landscape. The rapid pulse of water that is routed to streams during precipitation events can degrade the physical structure of the channel and alter water quality and habitat availability. To manage these common urban stream issues, agencies have been seeking alternative ways of restoring and enhancing resilience in urban stream networks within the constraints of existing infrastructure. One potential strategy may be to support beaver recolonization of urban streams. This is because beaver dam building activity has been found to attenuate streamflow in areas that have experienced minimal human impact. Currently, however, no studies have been published that examine how beaver dams affect stream flow in altered urban systems. This study seeks to determine if the presence of beaver dams and ponds in urban stream reaches in the Tualatin River basin, Oregon, modifies the stream's response to storm events. Continuous surface water levels are being collected upstream and downstream of two beaver affected reaches in order to determine how the presence of dams and ponds affect the flow regime, and whether this more closely resembles a less degraded state.

Keywords: Water quality, Land/watershed management, Hydrology

Portland's got worms! How earthworms are transforming the ecosystem

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Earthworms have colonized most of Portland's forested natural areas and are transforming many aspects of the soil, plant interactions, and nutrient cycling. Earthworms eliminate the soil duff layer by consumption of plant material and bioturbation. They transform the spongy topsoil layer into a compacted one with worm castings on the surface. This has implications for native plant germination and rooting and can impact habitat for amphibians, invertebrates, and ground nesting birds. Earthworms increase the leaching of nitrogen and phosphorus, reduce the mycorrhizal community, increase soil bulk density, and reduce the diversity of native plants. Using the mustard extraction method, we surveyed forested natural areas throughout Portland for earthworms. We found earthworms to be abundant (some sites have nearly 2 million/acre) on all plots. The effects of these "ecosystem engineers" have been overlooked and need serious consideration in the management of natural systems. With no realistic way of eliminating earthworms, managers need to determine new strategies for achieving restoration goals in colonized sites.

Keywords: Animal ecology, Climate Change, Conservation biology, Habitat assessment, Habitat restoration, Land/watershed management, Plant ecology, Soil science, Water quality

Air pollution exposure and mitigation potential in Portland, Oregon

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The majority of humans today live in cities, making cities the hub of human activity. Much of this activity leads to chemical emissions into the urban atmosphere causing air pollution, which in turn leads to increased death rates and higher incidence of diseases such as asthma, stroke and heart disease. What can cities do to mitigate the health impacts of air pollution? We develop a model of the US criteria pollutant NO_2 for the Portland metropolitan area based on ~150 observations in summer and ~80 observations in winter. Using this model in conjunction with BenMAP (a health impact assessment tool from the US EPA), we assess the annual impact of NO_2 on respiratory health in the Portland metropolitan area. Further, we explore how two different mitigation strategies, namely reducing vehicle miles traveled and increasing tree cover, implemented either at the local or city-wide scale, affect ambient concentrations of NO_2 and respiratory health. We find that respiratory problems associated with NO_2 exposure have an economic cost of $40 million USD annually. A 2% decrease in VMT city-wide provides an annual benefit of $37,000 USD through NO_2 mitigation; and a 2% increase in tree cover provides an annual health benefit of $1.2 million USD. Given the spatial scale of mitigation provided by land cover change (100 - 2,000 m), these mitigation strategies are ideally suited for neighborhood-scale air quality improvements.

Keywords: Air quality, Land use planning

Annual precipitation influences denitrification potential in Portland's urban green stormwater infrastructure

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Urban areas are challenged with developing management solutions to mitigate the effects of urban stormwater. Municipalities across the US are adopting green stormwater infrastructure (GSI) to manage urban runoff due to its potential environmental and economic advantages over conventional "gray" infrastructure. GSI is designed to emulate natural hydrologic and ecological functions by infiltrating, filtering, storing, detaining, and evaporating local runoff and retaining and transforming contaminants through biogeochemical processes. However, GSI ecosystems are unlike their natural analogs in many ways: they are isolated in the environment, experience more frequent and intense flooding events, and receive supplies of organic and inorganic pollutants in urban runoff. Little is known about the ecological processes in GSI that are intended to provide environmental benefits and how these processes vary across seasons and differences in annual precipitation. This study investigates potential nitrogen removal through denitrification [as denitrification enzyme activity (DEA)] in bioswale-type GSI during a dry year (2015) and a wet year (2016) in Portland, OR. Preliminary results show seasonal and annual differences in DEA response. DEA was higher during the winters than summers and was higher in the wet year (2016) than the dry year (2015). Additionally, results show differing relationships between soil infiltration rates and DEA. Slow-infiltrating soils showed higher rates of DEA than fast-infiltrating soils. Further analyses will explore the extent to which soil physiochemistry influences potential nitrogen removal in Portland GSI.

Keywords: Soil science, Water quality, Land/watershed management

Habitat restoration for natural resources in the Portland Harbor Superfund Site

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The Portland Harbor Superfund site is a highly contaminated, industrialized section of the Willamette River (RM 1 to 11.8) that provides important habitat for potentially injured fish and wildlife including Pacific salmon and lamprey, piscivorous birds such as bald eagle and osprey, shorebirds such as spotted sandpiper, and water-dependent mammals such as mink and river otter. The Portland Harbor Trustee Council is working to plan and carry out actions that will restore injured resources in Portland Harbor. During summer 2016, the Trustee Council published a restoration plan that proposes an integrated habitat restoration approach, which will restore habitat for a suite of fish and wildlife species and prioritize restoration within the urban harbor. To date, construction has started at three restoration projects that aim to restore injured resources in Portland Harbor: 1) Alder Creek Restoration Project- constructed in 2014 and 2015 by Wildlands, Inc.; 2) Linnton Plywood Restoration Project – RestorCap began building demolition in fall 2017 and plans to complete habitat construction in 2018; and 3) Rinearson Creek Natural Area – Falling Springs began habitat construction summer 2017 and will complete the project in 2018. This talk will provide updates on these 3 projects, share monitoring results where available, and describe the Trustee Council's plans for ongoing monitoring, maintenance, and stewardship.

Keywords: Habitat restoration, Environmental policy

A unique role for community science in stream restoration

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Portland State University's Student Watershed Research Program (SWRP) and Clackamas County Water Environment Services partner to monitor benthic macroinvertebrate communities with high school students in local watersheds. In 2014, one of our monitoring sites underwent an in-stream restoration project, allowing Community Science to provide insight into the biologic response of a stream to restoration construction. Goals of this outreach program include raising awareness by students about restoration efforts, evaluating the impact of an in-stream restoration project on biological communities, and determining the caliber of student-collected monitoring data. Using student-collected data, we conducted a Before-After-Control-Impact (BACI) study, comparing macroinvertebrate communities at the restoration site to those at a local reference site before and after restoration project construction. Students learned to identify macroinvertebrates to family-level, and SWRP scientists verified identifications in the field. Trait-based macroinvertebrate data showed a strong response to initial restoration construction disturbance and a return to pre-restoration conditions within 2 years. The findings of this study suggest that Community Science can generate biological monitoring data at restoration sites while also providing a unique opportunity for public participation in local restoration projects. The study also represents one of the few BACI-oriented datasets focused on stream restoration and the only published example of Community Science applied to biological monitoring of a stream restoration project. The study was recently published in Restoration Ecology, The Journal of The Society For Ecological Restoration. We present background information on the study site (the Rock Creek Confluence restoration project in Clackamas), and discuss methods and findings.

Keywords: Environmental education, Habitat restoration, Conservation biology

Characterization of soil phosphorus and its potential for mobilization in stormwater bioretention facilities

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Urban bioretention facilities (BRF) are designed to reduce peak discharges to streams, while also retaining pollutants in soils and plants. While these structures have been shown to function well hydrologically, the nutrient retention aspects are poorly understood. The target pollutant in this study was soil phosphorus (P), with the objective of understanding whether P is vulnerable to mobilization in BRF soils. Low-oxygen conditions during flooding can cause P release from soil minerals, while oxidizing conditions during drier periods enables microbial mineralization of organic P, with either scenario potentially releasing soluble phosphate. We sampled 16 bioretention soils from municipally managed "Green Streets" facilities in Portland, OR, across an infiltration rate gradient. Sequential P extractions and tests for degree of P saturation (DPS) and P sorption index (PSI) were performed alongside other soil characteristics. We assessed the effects of drying and flooding on P mobilization from soils with experimental soil incubations. The 16 sites showed a wide range in total P (TP), organic matter (OM) and P forms. The finding of a strong relationship between water-extractable inorganic P and DPS suggests that phosphate is being released from associations with iron and aluminum minerals. Flooding and drying treatments showed evidence of phosphate release, particularly in a soil with greater TP and mineral-associated P forms. These findings show that hydrological patterns might alter profiles of P forms, and stress the P retention capacity of some bioretention soils that experience extended drying and flooding cycles.

Keywords: Soil science, Sustainable development, Water quality

Oak historical abundance and distribution using U.S. General Land Office Surveys in Portland, Oregon

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In the Pacific Northwest region, oaks are a valuable species for their ecological role in attracting and supporting biodiversity in their areas of occurrence. In the Portland area, multiple agencies are interested in tracking individual occurrence for guiding restoration efforts. Today's oak population is a consequence of historical forest landscapes. In this study, I investigated the distribution and abundance of oaks on the Portland metropolitan area from the years of 1850 -1865. I used original Public Land Surveys to map trees distribution and abundance. The results of this study should foster conversations on oak population dynamics and provide historic framework for current ecological efforts on the Portland metropolitan urban ecosystem.

Keywords: GIS / modeling, Plant ecology, Habitat restoration

Community science at work in your back yard

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Tualatin Hills Park & Recreation District (THPRD) covers many small watersheds in eastern Washington County that ultimately feed into the Tualatin River. Living within these watersheds are the Western Painted Turtle, the Western Pond Turtle, and the Northern Red-legged Frog, all of which are listed on the Oregon Sensitive Species list, making the preservation of their habitat and existing populations of great importance to landscape managers and wildlife biologists alike. To this end, THPRD has employed community scientists to survey for these species for the last several years. Data collected has helped guide park and wetland management and has added to the library of information on these species that is being collected regionally.

Keywords: Environmental education, Land/watershed management, Wildlife biology

So many weeds, so little time: Prioritizing use of limited resources

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Invasive species have many impacts, including reduced crop production, toxicity to livestock, native plant community disturbance, and water quality degradation. There are many resources for invasiveness and impacts, ranging from web sites (e.g., invasives.org, NatureServe), jurisdictional weed lists developed by state and local governments, published literature and professional expertise. However, practitioners have little time for research and must decide where and how to allocate limited resources. At Metro, the Parks + Nature program maintains and restores more than 17,000 acres of parks and natural areas in a region with more than 500 exotic plant species. We manage upland forests, wetlands, oak and prairie habitats, riparian forests and nature parks. I will present a decision support tool developed to distill hundreds of plants into a framework that guides Metro scientists and technicians in assessing treatment needs. A two-way table places species in treatment contexts such as public areas where toxic plants cannot be tolerated. A number of species are targeted for treatment in prairie and oak habitats that would not be controlled in other settings such as riparian plantings. This framework helps staff focus resources where they are needed most. It provides consistent guidance across the natural areas program and saves time in planning treatments among areas. A discretionary tool, it is designed to be flexible and adaptable as new weeds arrive and new tools and knowledge emerge.

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

Plant health and greenness of different income-level neighborhoods in Portland, Oregon using Landsat 8 OLI/TIRS surface reflectance

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In order to promote equitability in urban areas, it is important to identify communities that could most benefit from increased green infrastructure planning and investment. Green infrastructure has several definitions, but can be broadly defined as an interconnected system of natural areas, open spaces, and human-designed elements that provides many benefits to both people and wildlife. The purpose of this study is to examine plant greenness and health in different income-level neighborhoods of Portland, Oregon. Using the Landsat 8 Operational Land Imager (OLI)/Thermal Infrared Sensor (TIRS) data, a standard index for measuring plant density and health can be calculated, which is called the Normalized Difference Vegetation Index (NDVI). A higher NDVI indicates a higher density of green leaves, while a lower NDVI indicates a lower density of green leaves. Tests for statistical significance were calculated to help determine if NDVI is distributed equally among different income-level neighborhoods of Portland. The results indicate that plant greenness and health are not equally distributed between the high and middle-high median income household groups with the low, low-middle, middle-low, and middle median income groups. As this research develops, it will be useful to examine levels of financial investment (e.g., private vs. government), as well as current and future planning for increasing plant greenness and health equitably within various median household income neighborhoods of Portland.

Keywords: Plant ecology, Conservation biology, Habitat assessment

Pollinator monitoring with community scientists in west Multnomah County

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Over the past six years West Multnomah SWCD has embraced the initiative of pollinator conservation to help with declining pollinator populations. We have incorporated pollinator habitat into opportune projects throughout the district and developed informative tools such as the Meadowscaping Handbook and Pollinator Bloom Time Chart to help people develop their own pollinator habitats in both urban yards and rural landscapes. Two years ago we began a Community Science Pollinator Monitoring Program to investigate how well our habitat plantings supported different types of pollinators and what practices worked best. Over this time we have engaged 23 volunteers, monitored 35 properties spanning the urban to rural gradient, and provided training opportunities to five other partner organizations. Most rewardingly, many of our volunteers have become leaders in pollinator conservation and education in their communities. In this presentation, we will summarize our community science model and share results and lessons-learned from two seasons of pollinator monitoring using volunteer community scientists in West Multnomah County.

Keywords: Animal ecology, Environmental education, Habitat assessment

Mapping risks across urban wildlife connectivity

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Habitat connectivity enables wildlife to access resources for their survival in and around an urban landscape. The question of connectivity becomes especially important as urban growth and development continue across Portland. Undeveloped areas within the city are expected to be most at risk. Vacant lots and private property are more likely to be developed than publicly owned spaces (i.e. parks) within the urban growth boundary. Site-specific effects of development vary across multiple scales and for many species. Wildlife moving within areas of concern will benefit from the connectivity of available habitat. The objective of this work is to map locations at high risk of development within and surrounding the city, and to assess the effects of these risks using statistical clustering Getis-Ord Gi* 1) inside the urban growth boundary (UGB) 2) within carefully selected connectivity zones at pilot sites and 3) at currently undeveloped areas. Land ownership, vegetation characteristics, and aerial photography will be used to identify hot spots with GIS analysis. A high risk area of development map would influence the site selection process for land managers and the public to identify areas of concern, and the needs of wildlife. The resulting maps can be overlaid with habitat quality and permeability assessment scoring for future research initiatives.This research will assist managers and partners to protect the values associated with urban wildlife habitat.

Keywords: GIS / modeling, Habitat assessment, Land use planning

Preliminary acoustic surveys of bats in Portland's urban parks

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Bats are a diverse group of animals that serve important roles in the ecosystem; they contribute to pollination and seed dispersal, and are the principal predators of night-flying insects. Certain bat species are sensitive to habitat changes and are used as indicators of ecosystem integrity, but others are highly adaptable, and frequently observed in urban environments. Several bat species and populations in North America are under threat from White Nose Syndrome (WNS), which has been characterized as the largest wildlife epidemic in the past century. WNS was detected in Western states for the first time in 2016, highlighting the need for studies on bat populations in this region. We conducted preliminary acoustic surveys of bats in parks around Portland, OR during late summer 2017. We surveyed many of the sites described in a report by the City of Portland's Bureau of Environmental Services in 2008, which had the following parameters: within 0.25 miles of water, with some forest structure, and easily accessible. We used a Pettersson's M500 microphone to detect ultrasonic bat calls, and then ran three of the surveys through Sonobat's automatic classification. Sonobat identified three bat species with high confidence: *Eptesicus fuscus* (big brown bats) at Laurelhurst Park and Kelly Point Park, *Lasionycteris noctivigans* (silver-haired bat) at Kelly Point Park, and *Myotis lucifigus* (little brown bat) at Pier Park. These represent significant differences in species found in the 2008 report. Future work will focus on surveying bats at more locations, to determine ecological constraints on species occurrences.

Keywords: Animal ecology, Conservation biology, Wildlife biology

An investigation of wapato along the lower Columbia River

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Sagittaria latifolia is a northwest native aquatic perennial known commonly by its Chinook Jargon name 'wapato.' *S. latifolia* has long held cultural significance for the role of its edible underground tubers as an essential food source and trade commodity to early indigenous tribes located along the Lower Columbia River. With its ability to readily absorb heavy metals from soil, *S. latifolia* is also a valuable indicator of wetland conditions. The compilation of known wapato-patch locations along a 40 mile stretch of the Lower Columbia River was the focus of this project. Additionally, samples of wapato tubers and their surrounding substrates were taken from three separate locations along this stretch and analyzed for the presence of heavy metals. The purpose of this study is to provide preliminary data for future investigations of S. latifolia and wetland conditions in the Columbia River Basin.

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

Assessing pollinator diversity and relations to fruit production and floral diversity at Portland community orchards

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Recent attention has been given to the plight of insect pollinators and scientists and gardeners alike are struggling to determine how to protect them. In urban areas, residential and community gardens are potential floral resources for pollinators. While "pollinator friendly" gardens are becoming popular to support this cause, the plant recommendations lack concrete evidence to show which plants are more effective to the widest range of potential pollinators. In urban Portland, the Portland Fruit Tree Project (a small nonprofit) manages five community orchards and has paid special attention to planting "pollinator enhancement" plants at their orchards to help support pollinators and increase fruit production. This project used a community science survey to monitor each orchard to determine pollinator diversity and the relation to fruit production and floral diversity. Using community science increased understanding of the ecology of urban pollinators and promoted awareness of this important ecological issue. Overall, orchards with higher floral richness supported higher richness and abundance of pollinators, but higher pollinator richness had a weakly negative correlation with fruit set. While having more flowering plants thoughout the growing season supported pollinators over a longer time, the fruit set of an orchard was more influenced by the age of the trees. This research will help build evidence for the dynamics of urban pollinators and the role that urban agriculture can play in supporting this vital ecosystem service or even provide urban refuge for pollinators.

Keywords: Animal ecology, Environmental education, Plant ecology

Rates and drivers of methane production and consumption in bioretention facility soils across six U.S. cities

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Urban bioretention facilities are one form of low impact development intended to manage stormwater. These facilities are designed in part to retain organic and inorganic contaminants and in some cases, promote their removal. One such removal process is denitrification; in anoxic, saturated conditions, denitrification converts nitrate to nitrous oxide or dinitrogen gas. However, these conditions also promote the production of methane, a potent greenhouse gas. Preliminary studies measuring in-situ methane emissions indicate bioretention facilities can be a strong source of methane. We compared both potential methane production and consumption rates between 36 bioretention facilities across six U.S cities: Portland, Phoenix, Charlotte, Baltimore, New York City, and Syracuse. Soil cores were collected and shipped overnight to our laboratory in Portland, OR. CH_4 production incubations were carried out within an 8-day window; consumption assays, a 48-hour series. Soil characterization includes bulk density, moisture, total organic carbon, conductivity, pH, WHC, texture, C:N ratio, and soil temperature. Within-city variables include management and climactic regime. We determined whether the rates of potential methane production and potential methane consumption varied between cities and to what extent.Results indicate strong differences in production between Portland and Phoenix, with maximum daily average rates of 0.12 ng CH_4/g/day in Portland and 8.81 ng CH_4/g/day in Phoenix. Soil characteristics varied as predictors of methane production between cities. Linking methane production and consumption with their predictive variables will inform the next generation of design for low impact development to balance tradeoffs between contaminant retention and methane emissions.

Keywords: Climate Change, Soil science, Sustainable development

Habitat value of ecoroofs - Phase 2

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Phase 2 continues the original ecoroof habitat study purpose to compare the habitat value of industrial ecoroofs designed to provide habitat with the habitat value of industrially-located ground sites in the Pacific Northwest. Both Phase 1 and Phase 2 studies found that ecoroofs designed for habitat offer the same and possibly greater value of habitat than comparable ground sites (Dobro Design 2015). The study entailed comparing the habitat value of four ecoroofs that were designed to provide habitat to two ground sites with vegetation. All sites are located in heavy industrial settings. Data was collected on average monthly over a 24 month period. Methods: From studying the basic elements of habitat such as food, water, and shelter; habitat parameters were identified and used in a matrix appraisal system for evaluating the habitat value of the Phase 2 sites. The following parameters were assessed using a rapid habitat assessment tool: Plant Type Richness, % Plant Cover, Bloom Type Richness, Bloom Abundance, % of Visits Blooms are Present, Soil Temperature, Soil Moisture %, Insect Morphospecies Richness, and Insect Abundance. Findings: Data showed that ecoroofs designed to provide habitat have higher abundance and richness of plant and insect species when compared to industrial ground sites. This among other parameters contributes to a higher value of habitat. The presentation will include a brief description of Phase I purpose and findings, a more in-depth description of Phase 2 methods, specific findings from the data collected, and a discussion of conclusions from both studies.

Keywords: Habitat restoration, Land use planning, Habitat assessment

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