

The Graduate Student Symposium Vision

A forum for graduate students to share their research with fellow School of Environmental and Forest Sciences and College of the Environment students, professors, staff, and members of the larger University of Washington community.

A symposium that will continue to grow as the years go on, becoming an annual event supported and encouraged by the School of Environmental and Forest Sciences.

A time for graduate students to share ideas.

A place for the School of Environmental and Forest Sciences to gather and show others the wealth of knowledge housed in these buildings.

GSS Organizing Committee

Chairs: Samuel Israel and Melissa Pingree

Luke Dow
Sean Jeronimo
Shyam Kandel
Raelani Kesler
Miku Lenentine
Caitlin Littlefield
Caileigh Shoot

Thanks to

The School of Environmental and Forest Sciences

SEFS Director's Funds

XSP Forestry Honors Society
The Staff of SEFS



Clear as Mud: Interpreting a Changing Environment

The School of Environmental and Forest Sciences
12th Annual

Graduate Student Symposium

Forest Club Room
Anderson Hall
6th March 2015

Schedule

6th March 2015 - Forest Club Room

- 9:00 a.m. **Meet and Greet
Research Posters**
- 10:00 a.m. **Welcome from Dean Graumlich
and Director DeLuca**
- 10:10 a.m. **Keynote Speakers**
Dr. Andrew Bower, USFS
Dr. Sarah Doherty, UW/NOAA
Dr. Daniel Donato, WA DNR
John Squires, Pinchot Partners
- 11:15 a.m. **Panel Discussion**
- 11:50 a.m. **Session I**
Moderator: Luke Dow
Miku Lenentine
Ashley Mihle
Jacob Pederson
Lena Easton-Calabria
Skadi von Reis
- 1:00 p.m. **Lunch
Research Posters**
- 1:30 p.m. **Session II**
Moderator: Sean Jeronimo
Kathryn Hill
Allison Rossman
Paulina Llamas
Ashley Blazina
Christiana Dietzen

Schedule

6th March 2015 - Forest Club Room

- 2:50 p.m. **Session III**
Moderator: Caitlin Littlefield
Chris Vondrasek
Korena Mafune
Jonnie Dunne
Caileigh Shoot
Russell Kramer
- 4:15 p.m. **Session IV**
Moderator: Miku Lenentine
Luyi Li
Natalie Schmidt
Nate Haan
Matthew Schwartz
Si Gao
- 5:20 p.m. **Awards Presentation**
- 5:30 p.m. **Dead Elk Social**

Keynote Speakers

Clear as Mud:
Interpreting a changing environment

Dr. Andy Bower
Area Geneticist and
Restoration Lead
U.S. Forest Service,
Region 6



***“Whitebark Pine in the Pacific Northwest:
Impossible to see, the future is”***

Andrew is a geneticist with the US Forest Service in Olympia, Washington. He has a bachelor’s degree in forestry from U.C. Berkeley, M.S. in forest science from Oregon State University, and a Ph.D. in forest sciences from the University of British Columbia. He is the Forest Service Area Geneticist for Western WA and Northwest OR and covers the Olympic, Gifford Pinchot, and Mt. Hood National Forests. He is also currently the Project Leader for the Forest Service’s Whitebark Pine Restoration Program in the Pacific Northwest. His professional interests include population and conservation genetics of forest trees and native plants and conservation/restoration of whitebark pine.

Keynote Speakers

Clear as Mud:
Interpreting a changing environment

Dr. Dan Donato
Natural Resource
Scientist
Washington DNR

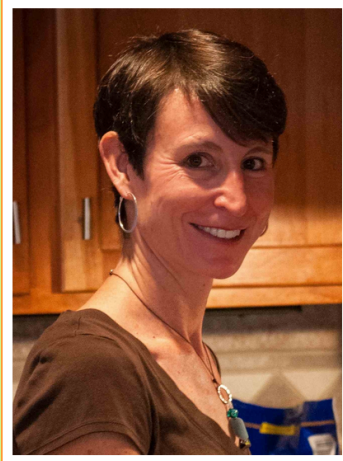


***“ Bark beetles, windstorms, and other mayhem in
the forest: Keeping up with changing disturbance
regimes in Eastern Europe.”***

Daniel Donato is a Natural Resource Scientist with the Washington Department of Natural Resources, and affiliate faculty here at UW. He is an alum of UW Forestry (BS 1998) and Oregon State University (PhD 2008), and has worked in most western states as a technician, postdoc, consultant, or ski bum. His research focuses on major disturbances like fire, insect outbreaks, and windstorms; and how these influence forest development and wildlife habitat.

Keynote Speakers

Clear as Mud:
Interpreting a changing environment



Dr. Sarah Doherty
Associate Prof. and
Sr. Research Scientist
Dept. of Atmos. Sciences
University of Washington

***“Soot in the context of climate and health goals:
It's a hazy view!”***

Sarah Doherty is a Senior Research Scientist at the University of Washington/NOAA Joint Institute for the Study of the Atmosphere and Ocean, and an Associate Professor in the Dept. of Atmospheric Science. She has a PhD in Atmospheric Sciences from the University of Washington. She studies how particles in the atmosphere and on snow affect climate. Most of her work has been on making field measurements of these particles, but she has also done work on climate modeling. More recently she's developed an interest in the overlap between the effects of particulate pollution on climate and on public health.

Keynote Speakers

Clear as Mud:
Interpreting a changing environment



John Squires
Collaborative Member
Pinchot Partners
Collaborative

***“Science, politics, collaboration and a changing
environment”***

John is the fourth generation of his family to live in Packwood, WA on the north end of the Gifford Pinchot National Forest. He is married and has two daughters (Brook 19 and Zoe 11) who are the fifth generation of his family to live in Packwood.

John has served on two Federal Advisory Committees, chartered Forest Service committees, and participated with the Rural Voices for Conservation Coalition. He has represented and advocated for his community and the forest that surround it in Washington D.C. numerous times.

John, with Friends of the Cowlitz, and a group of local fisherman played a key role in restoration of wild salmonids above the dams to the upper Cowlitz basin. John is a Charter member and the first Chair of the Pinchot Partners - a community based collaborative group that was formed in response to the gridlock on the National Forest. John spends numerous days in the woods with either a chainsaw or a fishing pole in his hands.

The Symposium

Session I

Miku Lenentine, PhD Student

miku2@uw.edu

Human Dimensions of Natural Resource
Management

Advisor – Dr. Stanley Asah

Anticipating Social Acceptability of Biofuels in the Pacific Northwest

As America progresses through the 21st century the need for sustainable and renewable forms of energy and materials to fuel the economy and sustain life is growing increasingly important. The blossoming biofuels industry in the Pacific Northwest may be a viable alternative to help address this problem. However, the contentious history of ethanol and “first generation” biofuels may affect the social acceptability, and thus feasibility of establishing hybrid-poplar biofuels in the region. I propose to examine stakeholder perceptions of biofuels in order to inform and enhance the social acceptability of hybrid poplar biofuels in the Pacific Northwest. I plan to achieve this goal through examining the subjective structures of key stakeholder perceptions of biofuels as they are framed as a benefit, concern, problem or solution; through an ethnographic content analysis of the issue publics’ perceptions of biofuels as they exist in the Twittersphere; and lastly through a comparative analysis of these research findings and presentation of specific actionable recommendations for decision makers and communication specialists.

The Symposium

Session I

Ashley Mihle, Masters Student

amihle@gmail.com

Hydrology

Advisors – Dr. Susan Bolton & Clare Ryan

The Importance of Water, Climate Change and Water Policy for Potential Biorefineries in Washington State

Biofuels outperform fossil fuels on many environmental indicators, except for water use. With climate change, shifting water resource availability may affect the feasibility of growing feedstock in certain locations. In this research, water use was analyzed for bioethanol production from cradle to gate, using hybrid poplar feedstock and an acetogen pathway conversion process. Volumetric water use and availability was quantified, using the water footprint methodology by Hoekstra et al. (2011). Two hypothetical biorefineries near Mount Vernon, WA and Spokane, WA using rainfed and irrigated feedstock, respectively, were analyzed for three crop yield scenarios. Two climate change scenarios will be presented to demonstrate the effect of higher temperatures and variable precipitation. A policy analysis of water regulations was also conducted. Results show that water use for bioenergy from hybrid poplar is 70-250 times higher than estimates for crude oil, though lower than many estimates for other bioenergy crops and conversion processes. Results vary by climate and crop production, with the rainfed crop using significantly less water than the irrigated crop. Climate models predict increased irrigation demand and decreased site suitability. In Washington State, limited opportunities to obtain senior water rights exist, so policy constraints add another layer of complexity to biofuel expansion. To fully assess the viability of a biofuels industry, water use must be evaluated alongside life cycle analyses, economic assessments, technical process improvements, and policies. By doing so, the full range of sustainability trade-offs can be evaluated for this industry.

The Symposium

Session I

Jacob Pederson, Masters Student
pederso@uw.edu
Social Sciences
Advisor – Dr. Clare Ryan

Institutional Impacts of Urban Forest Management Plans: Six Case Studies from Washington State

Urban forest management plans (UFMPs) are developed by many communities in order to provide a common vision for urban forest health and sustainability, establish goals, and coordinate actions toward achieving them. This study used document analysis and semi-structured interviews with city staff in six cities to investigate how UFMPs have been implemented in Washington State. Results indicate that staff actively use UFMP documents to guide and justify action, solve disputes, and promote awareness of urban forestry issues within city bureaucracies and to the community at large. Positive and negative social impacts of implementation efforts influence the political standing of urban forestry programs, suggesting that the political skill of urban forestry staff and their supervisors are key factors in the success of implementation. In some cases, successful implementation strategies focus on connecting urban forestry to community identity, public safety, and storm water management. In others, implementation is highly dependent on regulatory mandates specified by local ordinance.

The Symposium

Session I

Lena Easton-Calabria, Senior Capstone
lenacec@uw.edu
Advisor – Dr. Steven Harrell

Ayahuasca Use and the Positionality of the Shaman in the Peruvian Amazon Rainforest

The shaman is a historically important cultural and healing figure in the Madre de Dios region of the Peruvian Amazon rainforest. Shamans work with the ayahuasca vine, an important cultural medicine and strong hallucinogen. The knowledge of the shaman and use of ayahuasca is changing with the recent influx of tourism, one of many important challenges relating to shifting understandings of indigenous knowledge as a result of globalization. The aim of my research is to document the changing positionality of the shaman and the effects of tourism on the indigenous cultures, specifically their ethnobiological knowledge, of the region. The central research question is: how do the local indigenous and touristic worlds position the shaman and the ethnobiological knowledge the shaman holds, and how do shamans respond to the pressures that arise at the intersection of these two worlds? Study locations include the city of Puerto Maldonado, Peru as well as three indigenous communities located on the Las Piedras river, 50 to 200 kilometers from the city. These communities are part of the Yine tribe, and hunt and gather for sustenance. To address this research question, I have used participated observation, formal and informal interviews, and visual and auditory anthropology. Data will be analyzed and presented to improve understanding of local indigenous and touristic views of the shaman, as well as how shamans view themselves and their knowledge. The results of this research will be significant to understanding the current cultural role of the shaman and the effects of tourism on this role, as well as the impact of globalization on ethnobiological knowledge.

The Symposium

Session I

Skadi von Reis, Masters Student
svonreis@uw.edu
Washington Sea Grant
Advisor – Dr. Gordon Bradley

Homeowner motivations, decision-making factors, and evaluations of their soft shore projects in the Puget Sound

The continued armoring, or placement of concrete bulkheads, along Puget Sound's shoreline continues to be a major threat to the ecosystem functioning of the region. The impacts of these structures include the disruption of normal sediment delivery to the beach, changes to the overall beach composition, loss of shoreline vegetation, and changes in the nearshore habitat that is home to many creatures. Currently about a third of the Sound is armored and the rate of new armoring still surpasses the rate of bulkhead removal. About three quarters of new bulkhead installation is concentrated in private single-family homeowner properties. Multiple efforts are underway around the region to find ways to change the trajectory of increasing shoreline armoring in Puget Sound. One important research gap is to gain a nuanced understanding of homeowner experiences with the soft shore projects that have already been implemented. This study will look at those bright spots where homeowners have taken positive actions on their shoreline. My goal is to understand homeowners' motivations for pursuing a soft shore project on their property, their decision-making process, and how homeowners evaluate their soft shore projects in the Puget Sound. In this talk I will discuss the purpose of this study, describe the research questions and how they evolved, and describe the social science methods I will be using for the research.

The Symposium

Research Posters

Tessia Robbins, Masters Student

tessiar@uw.edu

Fire and Mountain Ecology Lab

Advisor – Dr. Don McKenzie

Canada lynx connectivity assessments under an uncertain climate: Treatment of dispersal behavior

Because changing climate modifies temperature and moisture dynamics within landscapes, it is anticipated to significantly modify the relationships between these landscapes and the animals that use them, particularly for species whose preferences and requirements are tied to climatic gradients. This raises questions as to how climate change will impact population viability of sensitive species at southern range peripheries and how this in turn will impact metapopulation viability. Habitat connectivity improves overall population resilience to changing environmental conditions by facilitating movement between suitable environments, preventing physical and genetic isolation. Movement and dispersal processes underlie habitat connectivity. Dispersal behavior can vary with landscape structure because it is evolutionarily advantageous to have diverse strategies for responding to fragmentation. Therefore, to assess how climate change will impact habitat connectivity for a given species, the mechanisms underlying dispersal behavior in response to landscape grain and quality must be characterized.

The Canada lynx (*Lynx canadensis*) is a threatened species in the contiguous United States and very little is known about their dispersal ability and behavior. For Canada lynx, I propose to model the relationship between three stages of dispersal behavior and the landscape structure and to assess connectivity for populations in Washington State under five stages of a climate change scenario.

The Symposium

Research Posters

Cindy Chen, PhD Student

Cxchen11@uw.edu

CINTRAFOR

Advisor – Dr. Indroniel Ganguly

Modeling Transportation Logistics of Forest Residue Removal: A Life-Cycle Analysis

Forest harvesting has left massive amounts of residues in the forest region. It is estimated that around 40 million metric tons of forest residues resulting from harvest are available. Recent studies have shown that residues can be generated into electrical power and used in various industries as a source of energy, and it is crucial to investigate the impacts of transporting these residues. This study uses a Life Cycle Assessment approach to investigate the environmental impacts from three biomass collection and transportation systems, including 1) bin truck with grinder at a centralized landing, 2) bundling, and 3) mobile chipper with set-out trailers, and studies the role of road condition and distance during the transportation process. Environmental impacts are indicated by factors such as global warming potential and acidification potential. Results showed that although the grinder system may post higher environmental impacts compared to other systems when the highway distance is short, its impact declined rapidly as the highway distance increased, and finally produced less burden than the bundling system. The overall environmental impacts of the bundling system is lower, but it may not be the best solution when the distance between forest sites and the bioenergy facility is long, and if we include the costs of labor, it may not be as economically feasible as other systems. This study can serve as a reference in bioenergy facility establishment in the future.

The Symposium

Research Posters

Mahsa Khorasani, PhD Student
mkh2612@uw.edu
Advisor – Dr. Sharon Doty

Metagenomic analysis of poplar endophytes

Study of the collective genomes of the members of a microbial community is important because it facilitates assessment of the microbiome regardless of culturability.

Sequence-based metagenomic approaches could improve our understanding of microbial diversity and function. This in particular can be beneficial in the study of plant- microbe interactions. Bacterial endophytes that reside inside plants are able to enhance plant growth in several ways such as by fixing nitrogen, producing phytohormones, increasing resistance against pathogens, detoxifying contaminants, solubilizing phosphate and generally reducing plant stress. More information about their community diversity, community dynamics, signaling and function could have a number of implications for agriculture, carbon cycling, biomass production for biofuels, forestry practices, etc. Development of increasingly fast, accurate, and inexpensive sequencing technologies, coupled with significant improvements in bioinformatics enable us to investigate these potential bio-fertilizers in their natural habitat and in association with each other and the plant. In this work, we used a developed technique to isolate and amplify microbial 16S rRNA as well as NifH gene from polygenomic DNA isolated from leaves and stems of *Populus trichocarpa*. The amplified bacterial 16S rRNA and NifH products were sequenced using the 2x300bp protocol on an Illumina miSeq. Analysis of the sequences obtained from 16S rRNA showed that *Massilia*, *Sphingomonas*, *Methylobacterium* and *Burkholderia* were the most common genera found in about 75-90% of the bacterial reads in both tissues. Sequences obtained from NifH gene analysis showed the existence of a diverse bacterial community belonging to proteobacteria phylum.

The Symposium

Research Posters

Reanna Jarchow, Senior Capstone
rjarchow@uw.edu
Advisors – Dr. John Marzluff and Dr. Julian Sachs

Macrobenthic Invertebrate Communities within Mangrove Habitats in Kosrae, Micronesia and Discussion for Conservation

Kosraean mangrove forests have recently befallen conversion and degradation. By taking core sediment samples I determine which of *Bruguiera gymnorrhiza*, *Sonneratia alba*, *Rhizophora stylosa*, and *R. mucronata* accommodates the highest macrobenthic invertebrate species richness and abundance. ANOVA F tests and Shannon Weiner Diversity Indices determined Kosrae's benthic community to be relatively evenly distributed with no significant variance in composition between genuses. Mangroves are still regarded highly in intrinsic value for benthic macro invertebrate populations on Kosrae as well as the island's its holistic tropical ecology. Conservation efforts are in act to conserve local forests and educate the public about sustainable use.

The Symposium

Research Posters

Steven Norton, Masters Student

smnorton@uw.edu

Forest Soils

Advisor – Dr. Darlene Zabowski

Douglas-Fir Stump Decomposition: Modeling Carbon Residence Times

Stumps are a significant portion of the coarse woody debris in Douglas-fir (*Pseudotsuga menziesii*) plantation forests here in Western Washington. Many studies have looked at the role of coarse woody debris in carbon cycling of Douglas-fir forests including decomposition rates. However, very few studies have attempted to quantify the amount of carbon that is held in stumps of any species, or the rate at which that carbon is lost (carbon residence). In this study we looked at a chronosequence of stumps that had been cut in 1992, 1999, 2006, 2010 and 2013 for density and carbon content. Using a conventional drill with a 1cm x 9.5cm bit, we excavated a known volume of material and calculated the densities of these stumps. We then modeled the rate of decay. Using the collected material we did CHN analysis to determine an estimate of carbon held in stumps at a site with a given density and thinning regime. This should in turn determine the potential for conversion of stumps to biofuels at these sites.

The Symposium

Session II

Kathryn Hill, Masters Student

kch24@uw.edu

Terrestrial Restoration Ecology Lab

Advisor – Dr. Jon Bakker

Effects of prescribed fire on spatial structure of vegetation in South Puget Sound prairies

Prescribed fire is the primary large-scale tool used in restoration of western Washington prairies, providing invasive species control, growing space for natives through thatch removal, and habitat enhancement for rare and endangered species. Fire weather and fuel conditions during a burn can affect overall risk to organisms present on the landscape, but also may impact vegetation structure by altering fuel continuity and consumption. The objective of this thesis centers on potential butterfly habitat and is twofold: (1) quantify risk to butterfly larvae in diapause during prescribed burns in relation to weather and fuel conditions; and (2) determine how these same burning conditions affect post-burn vegetation structure in terms of promoting quality butterfly habitat. Twenty plots were burned in summer 2014 on Joint Base Lewis-McChord and surrounding prairies across a wide range of weather and fuel conditions, namely temperature, relative humidity (RH), wind speed, and fuel moisture. Preliminary results from burn data on 1-cm subsurface soil temperatures and qualitative severity indicate that burning in conditions <20°C (68°F) and >54% RH produced no lethal heat dosages at that depth in relation to insect thermal tolerance. In spring 2015, the relationship between burning conditions and post-burn vegetation will be explored to determine if weather and fuel conditions during a burn can influence the subsequent spatial pattern of structural habitat elements. Cover, spatial distribution, and patch size of open areas, as well as heterogeneity of height, will be quantified as these elements can provide space for thermoregulation and microclimates for buffering of insect populations.

The Symposium

Session II

Allison Rossman, Masters Student

arossman@uw.edu

Terrestrial Restoration Ecology Lab

Advisor – Dr. Jon Bakker and Dr. Charlie Halpern

Long-term responses of forest understory vegetation to restoration treatments

Ecological restoration using mechanical thinning and prescribed burning is under way in many dry western forests, but long-term outcomes of the practices are not well understood. By resampling an established restoration experiment in central Washington, I will investigate the response of the understory plant community to thinning and burning 12 years after treatment implementation and compare the results to those found ten years ago. Studies show that understory diversity and abundance can take 5-20 years to respond to fuel treatments, so it is likely new measurements of the restoration site will show new responses. I will test the commonly-used metrics of species richness and abundance as well as less-common heterogeneity metrics with several explanatory variables to examine the mechanisms by which the plant community is changing.

The Symposium

Session II

Paulina Llamas, PhD Student
llamasp@uw.edu

Advisor – Dr. Ernesto Alvarado

Historic fire regime of conifer forests in south western Mexico

The fire history of conifer forests from the Sierra de Manantlán (Jalisco, México) was described using dendrochronology methods, and its zonal and intrazonal variation was characterized. From six bioclimatic, topographic and land use contrasting sites, we collected transversal sections for wildland fire frequency dating, epidometric cylinders to describe age structure and construct a ring-width series to use as reference for this work. Site vegetation structure was characterized. The ring-width series covered 174 years (from 1837 to 2010), with a sample size of 5 cores in the earlier date. Intercorrelation between series was 0.438. Mean fire interval (MFI) composed for each locality varied between 5.1 and 12.4 years using all samples, whereas variation with a 33% filter was between 5.0 and 18.3 years. Median interval values from Weibull probability (MIW) were similar. Evidence of the importance of fire and past wood extraction was found based on forest composition, structure and dynamics in the Sierra de Manantlán. Bottom-up controls influence strongly the fire frequency. Results show that a fire return interval shorter than 35 years, commonly used to define a frequent fire regime, can be considered long under the conditions of the study zone. Even though fire suppression activities, which are part of the management objectives, have been successful in some parts of the study area, other activities such as prescribed burning, should be practiced since the last few years the management tendency has been directed towards a simplification of historic fire frequency. The evidence found in this study indicate that, at least since the beginning of the XX century, the area has been subject to human influence modifying the fire frequency of the area as well as other fire regime attributes. Current vegetation structure and composition also has been influenced by human activities in the zone.

The Symposium

Session II

Ashley Blazina, Masters Student
ajblazin@uw.edu

Advisor – Dr. Sally Brown

Assessing the Viability of Biochar as a Soil Amendment in Traditionally-Burned Puget Sound Prairies

The prairies of Washington's Puget Sound Lowlands were traditionally burned to help cultivate many edible and medicinal plants. In the mid-1800s, westward expansion and treaties made many prairies inaccessible to tribes. Lacking regular burns, some prairies were encroached by both native and invasive species, while others were reclaimed for agriculture. Today, 3 percent of the original Puget Sound prairies remain. Although restoration through prescribed burn protocols have been developed, Clean Air Act regulations severely limit the days and seasons that burns can take place. Biochar is a plant-based material similar to charcoal, and has been used in several Midwestern prairie restorations. My study will conduct growth pattern analyses of Puget Sound native and non-native prairie species planted in biochar-amended soil. Biochar may demonstrate the potential to provide prairie soil with many chemical properties seen in burnt prairies, as well as a new option to restore a culturally- and ecologically-important ecosystem.

The Symposium

Session II

Christiana Dietzen, PhD Student
cdietzen@uw.edu
Advisor – Dr. Rob Harrison

Deep soil carbon pools in a highly productive Andisol do not differ in response to intensity of silvicultural treatments.

Soil contains more carbon than the atmosphere and plant biomass combined. Consequently, it is the most important long-term sink for carbon within terrestrial ecosystems. An understanding of the potential to induce carbon sequestration in soils through management is crucial in light of increasing anthropogenic CO₂ emissions. Nevertheless, soil has historically been under-represented in carbon cycling research, especially in regards to subsurface (>30 cm) layers and processes. Research on the effects of forest management practices on deep soil carbon has been particularly lacking. In order to study the effects of various biomass removal and vegetation control treatments on deep soil carbon, soil samples were obtained from 8 depth intervals reaching a depth of 3 meters from the Fall River Long-term Soil Productivity Site in western Washington. Soils at this site are Andisols of the Boistfort series. Treatments were installed 15 years previously in a randomized complete block design with four replicates. Results indicate that there is no statistically significant difference in soil carbon between treatments. These results suggest the stability of soil carbon pools at Fall River and indicate that more intensive management practices may not deplete carbon pools at this site. However, 58% of the soil carbon pool is located below 30 cm, which suggests that previous research may be significantly underestimating soil carbon pools. This underestimation may influence current understanding of global carbon cycling and limit the accuracy of climate models. It also highlights the importance of quantifying deep soil carbon pools and understanding the processes that control them.

The Symposium

Session III

Chris Vondrasek, Masters Student
cvon@uw.edu

Remote Sensing and Geospatial Analysis
Advisor – Dr. Monika Moskal

Lidar applications under the forest canopy: better delineations of river and riparian floodplain hydrology and habitats

Critical riverine habitats for juvenile salmon include riparian wetlands, intermittently flooded side channels, small tributaries, and reaches in the active channel reshaped by large wood. These hydrological features are frequently unmapped or inaccurately delineated, especially in and near smaller rivers obscured by dense riparian forests. To help achieve salmon recovery goals, statewide resource management regulations such as the WA Forest Practices Habitat Conservation Plan (HCP) have been developed. For the HCP to succeed accurate delineation of these critical riparian habitats is essential. Remotely sensed data, in particular lidar offers great promise for this task, with high spatial resolution at a whole watershed scale. In two forested watersheds on the Olympic Peninsula, I used recently acquired lidar data and developed two new models, a hydraulic model and a topographic model, that improved our ability to capture key hydrologic features in the riparian floodplain. To model 2 ecologically meaningful flows with the hydraulic model, I created a 2-year over-bankfull flow to inundate the floodplain, and a 50 year flood event that can potentially cause significant lateral channel movement. I also developed a 'relative-elevation-above-water-surface' model with the goal of creating an informed but simpler to use GIS tool that produces similar results to the more complex, hydraulic model. These models demonstrate the potential of remote sensing to improve salmon habitat conservation and restoration planning in forested watersheds as well as inform future river restoration opportunities.

The Symposium

Session III

Korena Mafune, Masters Student
kmafune@uw.edu

Forest Ecology and Conservation
Advisor – Dr. Dan Vogt

Identification and Comparison of Mycorrhizal Species in Canopy Soil and Forest Floor Soil in an Old-Growth Temperate Rainforest

The purpose of this study is to identify what mycorrhizal species are present in the canopies, and to better understand the fungal associations that happen within the canopy soils compared to the forest floor. The objectives include gathering information on the fungal footprint and symbiotic associations found in the canopy and forest floor in Washington's coastal old-growth forests, and applying it to canopy soil properties and evolutionary traits. Both canopy soils and mycorrhizal fungi play large roles in ecosystem function and dynamics, and pursuing this research could be beneficial to the field of ecological science. Root sampling took place on 4 designated research plots in the Queets Rainforest. Adventitious and forest floor roots were collected from 4 Big-leaf Maples. Once back in the lab, roots were prepped for DNA extraction. Following extraction, PCR reactions were proved successful and the DNA was prepared for cloning using a ligation mix and cloning vector. Once the DNA from each individual root-tip was successfully cloned, individual colonies were picked for PCR, and successful reactions were prepared for sequencing and BLAST. Results not only provide mycorrhizal ID, but a fungal footprint of these microcosms. As results are being analyzed, it has been found that a recently discovered ericoid mycorrhiza, *Cryptosporiopsis ericae*, is present in the canopies of these Sapindaceae species. There is also potential that we are working with species that have never been identified in the BLAST database. The last few procedures are currently running, and results are still being interpreted.

The Symposium

Session III

Jonnie Dunne, Masters Student

jonniebd@uw.edu

Remote Sensing and Geospatial Analysis

Advisor – Dr. Monika Moskal

Using Aerial Photos to Produce Digital Terrain Models for Use in Land Cover Mapping

Human land use has degraded ecological function for millennia. In order to stem this loss regionally the Washington State Department of Ecology now requires that all shoreline communities in Washington State develop Shoreline Master Plans that regulate land use to produce, “no net loss of ecological function”. We believe that developing a high resolution land cover mapping system will allow communities to precisely monitor and regulate land use, and study its effects on shoreline ecological function. State-of-the-art land cover mapping typically consists of Object Based Image Analysis (OBIA) of spectral data in the form of an orthophotograph and structural data in the form of a Digital Terrain Model (DTM) derived from LiDAR data. In this study we determine the suitability of a DTM derived from photogrammetry of aerial photographs (0.15m per pixel) of Bainbridge Island, WA for use in OBIA. We test the effects of Ground Control Points and output spatial resolution on the quality of the final DTM. Results show that digital photogrammetry can produce accurate (2.6m error) and continuous DTMs at high resolution (0.5m per pixel). Preliminary results show that this product is suitable for OBIA, as it can be normalized to ground level with small losses in fidelity, and can be used with an orthophotograph to consistently classify trees, shrubs, groundcover vegetation, bare ground, buildings, roads, and water. This method of DTM and land cover map production can be applied to any stereo photo pairs and facilitates novel analysis of historic and future imagery.

The Symposium

Session III

Caileigh Shoot, Senior Capstone

shootc@uw.edu

Remote Sensing and Geospatial Analysis

Advisor – Dr. Monika Moskal

Using LiDAR to Detect Shrubs

Shrubs are an important part of earth’s many ecosystems because the variety of roles that they play. Shrubs are an important habitat component for wildlife and they play a significant role in the spread of wildfires. Despite their importance, mapping shrub cover in the past has been arduous and fairly inaccurate on larger scales. LiDAR has been proven to measure upper canopy features fairly accurately when compared with field measurements. The purpose of this study is to determine if LiDAR can be used to detect and map where shrubs are on a landscape. High-resolution field maps of all shrub patches greater than 2 m² provided by Dr. Jim Lutz (Assistant Professor, Utah State University) and >40 points per m² LiDAR data over the ~26 hectare Yosemite Forest Dynamics were the only data sources used in this research. Fusion software (developed by the US Forest Service) was used to extract a variety of grid-based metrics from the LiDAR data. Topography metrics (slope, aspect, and topographic position index) were also extracted from the available digital elevation model of the area. The grid-based metrics, topography metrics, and the shrub map were input into Random Forest, a modeling package for R. Preliminary results show that using only topography metrics, shrub presence or absence can be predicted with ~ 70% accuracy. Using only LiDAR metrics, we have shown that shrub species for the most common species can be predicted with ~70% accuracy. More results will be available soon.

The Symposium

Session III

Russell Kramer, PhD Student

rdk10@uw.edu

Ecosystem Structure and Function

Advisor – Dr. Jerry F. Franklin

What are the limits to Northern expansion of coast redwood?

Is the northern frontier of the redwood range a vestigial characteristic dictated by past conditions, or are there current measurable controls on northward redwood expansion?

Redwoods inhabited a broad range of the Northern Hemisphere the northern frontier of the redwood range a vestigial characteristic dictated by past conditions, or are there current measurable controls on northward redwood expansion? Redwoods inhabited a broad range of the Northern Hemisphere about 34 million years ago, but their range contracted under conditions of low atmospheric CO₂ concentration, a seasonally drier climate, and arctic ice expansion in the late Cenozoic. The ice is long gone, CO₂ concentration is rising, and redwoods in the heart of their range are growing as fast as ever. Climate models predict warmer and drier times ahead to the south, which may not bode well for redwoods, but perhaps northerly range expansion is biologically inviting. Redwoods have low seed viability and utilize asexual reproduction to maintain site dominance. Seeds are redwoods' best means for long-distance dispersal, but resulting seedlings are the most vulnerable life history stage. What does the ground-based evidence tell us about the status of the redwood range? There are many working hypotheses including limitations due to fog decline, cold northern minimum winter temperatures, competition, dispersal, and water availability. In this talk I will be introducing a set of research objectives designed to shed light on these lines of inquiry.

The Symposium

Session IV

Luyi Li, Masters Student
luyi108@uw.edu
Advisor – Dr. Eric Turnblom

The Effects of Soil Parent Material and Nitrogen Fertilization on Tree Growth and Wood Quality of Douglas-fir in the Pacific Northwest

The influence of four soil parent material types and nitrogen fertilization treatment on Douglas-fir plantation growth and wood quality was studied on seven sites across western Washington and Oregon. Six aspects regarding wood quality were assessed and analyzed, (1) tree sonic acoustic velocity (TSAV), (2) log resonance acoustic velocity (LRAV), (3) dynamic modulus of elasticity (MOEd), (4) specific gravity (SG), (5) latewood percentage (LWP), and (6) rings per inch (RPI). Analysis of tree growth suggests the Mixed SPM type (combining Sedimentary and Igneous) is the most productive type in terms of timber volume increment. Fertilization has significantly enhanced Douglas-fir lateral growth and volume gain, but a variety of effects upon wood quality attributes were detected. In general, growth increment was negatively associated with quality observed in the breast height region. From the perspective of a whole tree, higher quality wood can be found in the segment from stump height to the live crown base. A strong correlation ($R^2 = 0.92$) between TSAV and LRAV was observed, and TSAV was 8% higher than LRAV.

The Symposium

Session IV

Natalie Schmidt, PhD Student
schmidt.natalie@gmail.com
Terrestrial Restoration Ecology Lab
Advisor – Dr. Jon Bakker

Implications of host plant suitability for restoration of a threatened parasite

Restoration efforts for *Castilleja levisecta*, a federally threatened plant, are complicated by the parasitic nature of this species. Understanding the role of host plants in the growth and reproduction of *C. levisecta* is essential for recovery. We used a variety of known and novel host species to assess the effect of host identity on the growth and reproduction of *C. levisecta*. Each host was paired with a *C. levisecta* individual in the greenhouse and in the field. Results from this study may be used to shape applied methods and planting strategies for land managers and restoration practitioners.

The Symposium

Session IV

Nate Haan, PhD Student
nhaan@uw.edu
Terrestrial Restoration Ecology Lab
Advisor – Dr. Jon Bakker

Parasitic plants as mediators between host plants and herbivores

Indirect interactions occur when the relationship between two species is modified by a third. Hemiparasitic plants may serve as mediators of these interactions. These plants perform photosynthesis, but also attach to root systems of neighboring host plants, siphoning resources from them. Therefore, hosts may indirectly influence herbivores that feed on the hemiparasite by changing the hemiparasite's traits. I am exploring interactions between the hemiparasitic golden paintbrush (*Castilleja levisecta*), several of its host plants, and Edith's checkerspot butterfly (*Euphydryas editha*), which feeds on golden paintbrush. Golden paintbrush produces iridoid glycosides, bitter secondary chemicals that deter most herbivores but serve as feeding stimulants to checkerspot larvae, which sequester these compounds as a defense against predators. I hypothesized that the identity of golden paintbrush's host would indirectly affect survival and growth of the larvae, and that this pattern could be explained by host effects on the hemiparasites (e.g. size, leaf nitrogen, secondary chemistry). I grew golden paintbrush in pots with six different hosts, and released checkerspot larvae on the paintbrush plants. I measured survival, growth, and secondary chemistry of both golden paintbrush and the larvae. Preliminary evidence suggests host identity affected survival and mass of both the hemiparasites and the larvae feeding on them. I am still in the process of analyzing effects of host identity on levels of nutrients and iridoid glycosides. Results of this research will have implications for management and restoration efforts related to golden paintbrush and Edith's checkerspot, both of which are federally listed.

The Symposium

Session IV

Matthew Schwartz, Masters Student
mateos@uw.edu
Restoration Ecology
Advisor – Dr. Kern Ewing

Incorporating Native Pollinator Habitat into PNW Restoration Projects

As in many discontinuous urban forests, restoration efforts cannot target habitat creation for large wildlife species. However, habitat for birds and insects, several of which are endangered in the Pacific NW, has critical potential in urban restoration projects. Furthermore, as climate change instigates phenological mismatches, the need to bridge this gap at the interface between scientific research and practice, is urgent. "What Methods Most Effectively Improve Native Pollinator Habitat in Pacific NW Urban Forests?" This project aims to re-establish mutualisms between native plants and native pollinators in Kincaid Ravine, a historically neglected 4-acre urban forest on the University of Washington Seattle campus. Restoration of this essential ecological process will enable autogenic regeneration through positive pollination feedback loops, encouraging a more diverse plant gene flow with neighboring forest fragments. The methodology involves research into native plant associations, traits and growing conditions as they relate to pollinator abundance and diversity. The resulting plant combinations are out-planted at Kincaid Ravine in 'pollinator patches'. Data on plant location, associations, bloom time and bloom color is mapped using ArcGIS. Twelve layer maps reveal these flower traits for each month of the calendar year, offering a colorful visual of a sequential pollinator food supply. The research and maps are currently being compiled together to produce an educational handbook entitled "Pollinator Habitat for Pacific NW Restoration Projects". Surveys of local restoration project managers and project owners from the private and public sector are assisting to conform the handbook to the most relevant and applicable information possible.

The Symposium

Session IV

Si Gao, Masters Student
gaosi@uw.ed
Advisor – Dr. Tom DeLuca

Using Biochar as a Soil Amendment for Sustainable Agriculture

Biochar is a carbon-riched product produced from the pyrolysis of organic feedstock such as wood, and is intended to use as a soil amendment to sequester carbon and enhance soil quality. Sustainable biochar is produced from waste biomass such as woody slash piles using modern thermochemical methods or models. Biochar potentially offers significant environmental benefits for sustainable farming including enhancement of soil physico-chemical properties, such as water holding capacity, aeration and nutrient retention levels. Therefore, the use of biochar as a soil amendment is an innovative and highly promising practice for sustainable agriculture. In this project, two proposed tasks will be conducted.

First, biochar characterization before and after production will be conducted in 2 parts: 1) Investigate the effects of pyrolysis temperature and the type of woody feedstock on the properties of charcoal. 4 types of common tree species will be chosen to make charcoal under 2 different temperatures using muffle oven. 2) 3 designs of field-scale biochar production methods will be conducted using the same mixed woody slash pile as feedstock, compare the difference of biochar properties within these 3 models as well as the overall difference between lab- and field-generated biochar.

Second, field trial will be conducted on 5 different organic farms to investigate the impacts of biochar addition on soil nutrient retention levels. Soil physical, chemical and biological properties will be tested before and after biochar addition. Compare the results of soil properties and find out the appropriate biochar production model for each of these farms.

GSS 2015

Join us again next year!