
UNIVERSITY of WASHINGTON COLLEGE of the ENVIRONMENT
School of Environmental and Forest Sciences
Bridging Perspectives
in Environmental and Forest Science
Ninth Annual
School of Environmental
and Forest Sciences
Graduate Student Symposium
March 2, 2012

Schedule of Events

8:30-9:00 a.m.
Meet and greet

9:00-10:30 a.m. Keynote Panel Discussion
Ara Erickson, Forterra
Mack Hogans, M.L. Hogans Consulting
Vivek Shandas, Portland State University

10:45-12:00 p.m. Session I
Karyn Boenker, Kate Galligan, Yu-Chi Huang, Michael Hannam, Jesse Langdon

12:00-12:45 p.m. Lunch and Student Poster Session

1:00-2:15 p.m. Session II
Katherine Hoglund, Daniel Brody, Nathan Johnson, James Starr, Austin Himes

2:25-3:25 p.m. Session III
Keum Young Lee, Ellen Frohning, Betsy Vance, Lauren Grand, Megan McPhaden

3:35-4:50 p.m.
Maria Sandercock, Derek Churchill, Ben Shryock, Jenny Knoth, Chia-Hsiu Chen, Jun Won Kang

Award presentation and Dead Elk Society to follow!

Keynote Panel Discussion: *Bridging Perspectives in Environmental and Forest Sciences*

Ara Erickson, Green Cities Director, Forterra

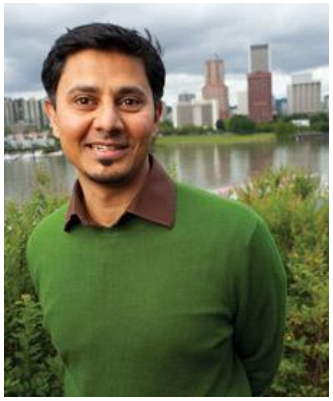
Ara Erickson is the Green Cities Director a Forterra (formerly Cascade Lanc Conservancy) where she leads a uniqu network of public-private partnership with municipalities to build community based stewardship for forested parkland and natural open spaces. Ara has more tha 10 years of experience in the natura resource and forestry fields, wit experience in community involvement and education, fiel data collection and analysis, natural resource planning an management, spatially-based research, and projec management. She holds a Master of Science in Fores Resources from the University of Washington and a Bachelor o Science in Resource Management from the University o California, Berkeley.

Mack L. Hogans, CEO of M. L. Hogans LLC, Consulting Services

As Chief Executive of his firm, Mack Hogan provides professional services to CEO's businesses and non- profits in areas o leadership, public policy, philanthropy community relations, natural resources environmental policy, and diversity. Hogan retired in 2004, as Senior Vice Presiden after 25 years with Weyerhaeuser Company He was chair of the Weyerhaeuser Company Foundation, a forester, a branch manager fo the Building Materials business, and vice president o Government Affairs. Before joining Weyerhaeuser, he worke

for the U.S. Forest Service, Maryland National Capital Parks and Planning Commission, and the National Park Service.
Hogans attended Tuskegee University, holds a Bachelor of Science degree in forestry and natural resources from the University of Michigan, and a Master of Science degree in forest resources from the University of Washington. He is a graduate of Stanford University Graduate School of Business Executive Program.

Vivek Shandas



Vivek Shandas is an Associate Professor in the Nohad A. Toulan School of Urban Studies and Planning, a Research Associate in the Center for Urban Studies, and a Fellow at the Institute for Sustainable Solutions at Portland State University (PSU). He teaches undergraduate and graduate courses in participatory geographic information systems, environmental planning, and global cities. As the founder of the newly established Sustaining Urban Places Research Lab (SUPR Lab), his team focuses on three substantive areas of investigation: (1) examining feedbacks between environmental change and human behavior; (2) developing community-based indicators for measuring social and environmental conditions; and (3) characterizing the relationship between urban development patterns and environmental quality. Prior to serving at Portland State University, he was a school teacher in Oregon; curriculum developer in California; and, a health and environmental policy analyst for New York State Governor's Office.

Session I

Karyn Boenker – kboenker@uw.edu
Advisor: Clare Ryan

From Nobel Peace Prize to International Controversy: Framing Globa Climate Change on US Cable News Outlets

Climate science is a political issue. This should be expected considering the finding and suggestions of global organizations like the International Panel on Climat Change (IPCC) and United Nations Framework Convention on Climate Chang (UNFCCC). This study looks at the flow of international scientific informatio through the lens of 24-hour American cable new outlets (FOX, CNN, MSNBC). B focusing on their messaging patterns surrounding coverage of global climat change, we provide a context for future public conversations about the issue.

I performed a content analysis of online articles from CNN, FOX, and MSNBC. Cas study periods between 2007-2009 were selected based on Google search data which was used to identify periods of significantly high public attention. The IPCC' Nobel Peace Prize, UNFCCC events, and a speech by President Bush all made the cut A climate change framing model was used on 511 articles that were distributed among four coders. Both group and individual coding took place. Collaborativ analysis was encouraged. We identified up to four frames per article in order t investigate differences between article bodies and headlines.

The US 24-hr news outlets discuss climate change most frequently under the fram of conflict. Only CNN, the outlet with the fewest total articles by far, was found t foster a neutral, middle way discussion. Given the immediate need for legislativ action on the issue this is unfortunate. Climate experts may be able to change thes patterns with greater public engagement. Based on observations from the dataset, provide a framework for public discussion of global climate change and encourag political participation among willing experts and opinion leaders.

Kate Galligan - gallika@uw.edu
Adivsor: Greg Ettl

Influence of Soil Moisture on *Alnus rubra* Ectomycorrhizal Funga Community Distribution Throughout a Growing Season

The objective of this study is to identify and analyze whether soi conditions, primarily soil moisture, impact the distributions of th ectomycorrhizal (EM) fungal species associated with an 85 year-old stan of Alnus rubra in western Washington. From May – September 2011, roo cores and soil moisture measurements were taken monthly and th presence of Frankia nodules was noted for each root sample. Soil variable (C:N, available phosphorous, pH) were also collected for analysis in August 2011. From root cores (N=150, 30/month), EM roots were sorted an

identified using morphological and DNA sequencing techniques. Phylogenetic trees to assess relatedness of species across the sampling period were generated to verify the accuracy of DNA matches in GenBank and UNITE databases. Soil variables and Frankia presence will be related to the abundance of EM fungi for each month and throughout the season using multivariate statistics. Cluster analyses and ordinations of fungal species sorted by soil variables will be generated to observe potential fungal community assemblages. Multi-response permutation procedure (MRPP) will be used to test significance of groups, while indicator species analyses will be used to determine whether certain fungus species are indicative of soil variables.

Yu-Chi Huang - kellytofly@gmail.com
Gordon Bradley

Resident Participation in River Restoration: Preferences, Attitudes, and Behaviors Case Study of Cedar River Watershed, Washington

The Lower Cedar River Basin is an urban watershed that shares the problem of urbanization and flooding with many other riparian ecosystems in the Pacific Northwest. Restoration of the watershed is not only beneficial to the ecological health of the River, but offers flood mitigation of private riverfront properties. Therefore, engaging the residents along the river is a primary concern of local non-profit conservation organizations such as Forterra.

Successful communication with private landowners begins with an understanding of the residents. This study is aimed to understand the residents in Maplewood Neighborhood in terms of their riparian landscape preference, attitudes toward environmental hazards and watershed management plans and regulations, environmental behavior, and demographic characteristics.

This research employed a photo survey along with questions regarding attitudes, behaviors, and demographics, which was hand-delivered to all households in the neighborhood. Factor Analysis was used to reduce the items of photo preference and attitudes and the relationship between preference and demographics was examined with analysis of variance. Multilinear regression models were performed to identify preference and behaviors. Relationships between preference and attitudes were examined using correlation models.

The study found that a major shared preference of riparian landscape among Maplewood residents contains elements of aesthetics, access to the river, moderate nature with proper management, and flood control, which are related to attitudes of flood control and public use oriented management objectives. Gender and education also explain the difference in management objectives and concerns for private rights.

Michael Hannam - mhannam@uw.edu

Microtopography Mediates Competition Between a Native and Non native Seagrass

The asian seagrass Zostera japonica was likely introduced to the Pacifi Coast of North America near the beginning of the 20th century, and nov ranges from British Columbia to Humboldt Bay, California. In its introduce range, Z. japonica sometimes co-occurs with native Z. marina in a patcl mosaic in conjunction with intertidal microtopography. At such sites, Z marina often inhabits depressions that retain water through a low tide, an Z. japonica often inhabits mounds that are fully exposed during low tides Topographic surveys indicated that an index of topographic position is a significant predictor of species presence at one such site in Padilla Bay, WA To elucidate the roles of abiotic limitations and biotic interactions in thi pattern, we experimentally transplanted each species, in monospecific an mixed patches, to intertidal mounds and pools. Z. japonica shoot densitie and standing crop were depressed in the presence of Z. marina, regardles of topographic position and Z. marina shoot densities and standing cro were depressed on mounds regardless of Z. japonica presence. In a secon experiment, we transplanted Z. marina into a range of densities of Z japonica on pools and in mounds. Again, Z. marina performance wa consistently depressed on mounds. Z. japonica presence depressed som measures of Z. marina, but only in pools. These results suggest that th introduced Z. japonica is competitively excluded from pools and the nativ Z. marina is physiologically restricted from mounds. Further, competitiv effects of Z. japonica on Z. marina appear to depend on topographic context

Jesse Langdon - jlangdon@u.washington.edu
Advisor: Josh Lawler

Forecasting the Future Impacts of Climate and Land-use Change o Animcal Species Distributions in the Pacific Northwest

Animal species distributions are expected to change significantly over thi century, due to predicted changes in climate and anthropogenic land use Empirical evidence indicates that human-induced climate change is already influencing many plant and animal species. Understanding the ensuing changes in species assemblages, community composition, and ecologica system functions will benefit natural resource planning and managemen efforts. This research will explore the relative impacts of predicted climat change and anthropogenic land use on animal species distributions for 12 animals found in the Pacific Northwest region of the United States. A combination of bioclimatic variables and vegetation distributions will use to predict species distributions under current climate conditions using a

correlative modeling approach. Then projections in climate change, climate-driven changes in vegetation and projected changes in anthropogenic land use will be applied to the correlative models to forecast potential changes in the species distributions. Future anthropogenic land uses will be represented by predicted housing density models.

Session II

Katherine Hoglund - hoglundk@uw.edu
Advisor: Ernesto Alvarado

Fire Severity and Vegetation Cover in the Riparian Areas of the Nile, Rattlesnake, and Dry Creeks of the Wenatchee National Forest

Riparian areas are critical components of the landscape; they contribute to landscape diversity, connect terrestrial to aquatic habitats, and act as corridors for migration and dispersal. On the east side of the Cascades, fire – once a historically integral process in maintaining composition – has been mostly removed from riparian areas. The primary objective this proposed study is to examine the effect of fire severity on understory and canopy vegetation. Fires will be set in the riparian area during a 2012 prescribed burn and fire severity will be determined by percent soil scorched. Vegetation percent cover and species composition will be determined along line transects.

Daniel Brody - Dobb14@uw.edu
Advisor: Clare Ryan

Citizen Involvement in Environmental Decision-Making: Communicative Action in Forest Service NEPA Projects

Managing natural resources is a challenging and complex task. Competing public interests over how forestland should be managed has led to increasing levels of conflict over the management of the National Forest system. Historically, bureaucratic decision-making by the Forest Service excluded the public from influencing decisions, fueling tensions and conflicts. By applying Jürgen Habermas' theory of communicative action, which states that communication should ideally lead to the building of understanding, this research evaluates current Forest Service decision-making processes and looks to better understand the public's perspectives of these processes. This information can provide insights into improving decision-making processes to build more legitimacy for decisions and reduce conflict.

This research uses an exploratory case study method to delve into two Forest Service decision-making processes. Combining both extensive document analysis and interviews this research gathers information to better understand the comprehensibility, truth, sincerity, and legitimacy o communication between the agency and the public.

This research found that the Forest Service decision-making process doe not currently give rise to communicative action. However, the majority o interview participant's trusted the agency, something that has not alway been the case in the past. Furthermore, participants indicated that whil they do not always agree with the Forest Service they respect the work the do. Lastly, this study found that current methods for communication ofte lack interactive components and divide participants so there is no way fo collective discussion of issues and interests. This leads t misunderstandings between public factions, and may increase conflict.

Nathan Johnson - ngjohnso@gmail.com
Advisor: Robert Edmonds

Influence of Root Disease on Potential Fire Behavior in and Easter Washington Ponderosa Pine Forest

Root disease and wildfire are important disturbance agents in weste North American forests. This research quantifies the effect of Armillari root disease on potential wildfire behavior in ponderosa pine (Pinu ponderosa) forests near Glenwood, Washington. Fire behavior wa modeled, using the Fuel Characteristic Classification System (FCCS), base on data collected in plots with and without Armillaria, which create differences in stand structure and composition. Modeling predicted tha both crown and surface fire intensity would be lower in areas with roo disease. This research highlights the need to consider multiple competin effects when assessing the impact of forest diseases on wildland fire.

James Starr
Advisor: Christian Torgersen

Mountain Whitefish Polymorphism in a Coastal Riverscape: Distribution, Size, Class Assemblages, and Habitat Associations

Mountain whitefish (Prosopium williamsoni) are widely distributed an abundant among temperate rivers in western North America. To date studies of trophic polymorphism in the species are rare, focusing on die genetic variation, and snout morphology. In this study, my objectives are to (1) compare the spatial distributions of morphotypes and size classes, (2 assess the assemblage structure of morphotypes and size classes and thei relationships with aquatic habitat, and (3) quantify the association between specific morphotypes and longitudinal variation in aquatic habita Spatially continuous sampling was conducted over a broad extent (29 km in the Calawah River, WA. Cumulative abundance plotted against distanc upstream was compared among size classes of morphotypes, assemblag structure. Relationships with aquatic habitat were assessed with non

metric multidimensional scaling (NMDS). Unit-scale differences between morphotypes in pool and non-pool habitats were quantified with Wilcoxan rank sum tests, and associations between specific morphotypes and habitat were quantified at the 1-km reach scale with generalized additive models (GAMs) using thin-plate regression splines. Smaller size classes of both morphotypes were distributed upstream of larger size classes. Size classes of normal whitefish were distributed downstream of pinocchio whitefish. Size classes of normal whitefish were associated with higher gradient, whereas pinocchio size classes were positively associated with depth and pool area. Normal whitefish variation was best explained by distance upstream and substrate size, whereas pinocchio variation was best explained by distance upstream and mean maximum depth. These results provide the first Riverscape perspective of trophic polymorphism in riverine mountain whitefish.

Austin Himes - himesa@u.washington.edu
Advisor: Rob Harrison

Risk Assessment for Projected Nitrogen Lost from Different Harvesting Intensities in Pacific Northwest Douglas-fir

My research will project 72 intensively management, mid-rotation, Douglas-fir stands in western Oregon, Washington and British Columbia to 50 years in the future using the SMC variation of the ORGANON growth and yield simulator. From the ORGANON output, component biomass removal will be estimated for a standard bole-only harvest and a more intense biomass removal treatment. Utilizing allometric equations for the region and existing data on total site nitrogen and foliar nitrogen of trees in the 72 stands, we will estimate nitrogen removal under the two harvest intensities as a proportion of total site nitrogen. Based on the proportion of total site nitrogen removed we can assess the risk associated with different harvest intensities on the long-term nitrogen availability of the region. This broad assessment should assist managers in future decisions about biomass removal. Currently we are simulating the stands' growth in ORGANON and researching the best allometric equations to use for component biomass and nitrogen partitioning of Douglas-fir for the Pacific Northwest.

Session III

Keum Young Lee - ky1206@uw.edu
Advisor: Sharon Doty

Phytoremediation of Chlorpyrifos Using Poplar and Willow Plants

Chlorpyrifos (CPS) is an organophosphorus insecticide that is implicated in environmental and human health problems. Our hypothesis is that these problems may be solved by the emerging phytoremediation technology,

which is the use of plants for the cleanup of environmental contaminants Here we introduce two approaches to phytoremediation of CPS. First of all seven plant species of poplar (Populus sp.) and willow (Salix sp.) were investigated to evaluate plant potential for CPS uptake. Analysis of the CPS removal from hydroponic solution showed that CPS can be taken up by all seven species. Significant amounts of CPS accumulated in plant tissues, but did not persist in the tissues, suggesting further metabolism of CPS. To our knowledge, this work represents the first report for phytoremediation of CPS using poplar and willows. The second approach is phytoremediation of CPS by transgenic poplars. The hypothesis is that the transgenic expression of genes involved in CPS metabolism is expected to increase removal of CPS. There are two enzymes involved in the metabolism. The first enzyme, cytochrome P450 (CYP), activates CPS, forming CPS-oxon, and the second enzyme, paraoxonase 1 (PON1), detoxifies CPS-oxon, forming TCP, which is non-toxic. To engineer transgenic poplar plants, two genes (CYP 2B6 and PON1) have been cloned into plant expression vectors and a poplar clone has been successfully transformed using Agrobacterium-mediated method. Selected transgenic plants showing high level of expression were investigated for CPS uptake and degradation, compared to non-transgenic poplars. However, there was no significant difference between wild type and transgenic plants.

Ellen Frohning - Ellenf3@uw.edu
Advisor: Stanley Asah

The Focus Theory of Normative Conduct: Application to Pro-environmental Grocery Shopping Behaviors

Unsustainable food systems in the United States warrant adjusting food consumption behaviors to help mitigate negative environmental impacts. To effectively influence pro-environmental ("green") consumption behaviors it is necessary to first understand purchasing behaviors. The purpose of my research is to identify which components of grocery shopping behaviors are perceived as important in lowering environmental impact. I also sought to determine what factors contribute to consumers' purchasing behaviors with regards to "green" grocery products. Existing research suggests that social normative influence is an important component in encouraging pro-environmental behavior. This study investigates the role of social norms, as well as the role of motivations and perceived barriers in influencing "green" grocery purchasing choices. I began by interviewing consumers, asking respondents which behaviors are most important in the context of "green" consumption behavior. I used data from these interviews to construct a survey that contained questions about grocery shopping behavior, motivational factors, perceived barriers, and descriptive and injunctive social norms. The survey was administered to customers at selected grocery stores in Washington State. Results indicate that perceived barriers (ex. availability) and social norms account for a

significant amount of green grocery shopping behavior. Motivational factors (ex. taste) were not salient predictors. These results emphasize the importance of social norms and barriers in the context of "green" consumption behavior. Future research may look at ways to utilize these findings by removing perceived barriers and creating social marketing plans to increase "green" consumption behaviors and thereby lessen the environmental impact of food systems.

Betsy Vance - jmvance@uw.edu
Advisors: Darlene Zabowski and Rob Harrison

Quantifying the Fate of Applied Nitrogen Fertilizer over a One-Year Period in Douglas-fir Plantations using Stable Isotope Technology

The purpose of this research is to better understand how Nitrogen applied in the form of fertilizer is allocated among the various pools of a forested ecosystem. By quantifying the amount of Nitrogen distributed to each pool, stand managers can evaluate potential environmental impacts associated with fertilization as well as use this information to make informed decisions to ultimately increase the efficiency and sustainability of fertilization at the stand-level.

Ten installations of Douglas-fir plantations are to be established across the western Douglas-fir regions of British Columbia, Washington and Oregon, five of which were established in the spring of 2011. These sites represent the major geologic, climate, and vegetation zones of the area. In each installation five trees are selected, four of which receive fertilization from an industry standard Nitrogen fertilizer labeled with stable isotope 15N, plus one control. Each installation is broken down into ecosystem components: aboveground components include the target tree (foliage, branches, bark, and bole), forest floor (organic horizons), and competing vegetation (woody and herbaceous understory, and any competing trees). Belowground components consist of roots and soil (0-15cm, 15-30cm, 30-60cm). Foliage, forest floor, and soil (0-20cm) are sampled prior to fertilization and analyzed for background levels of 15N. Foliage is then sampled at regular intervals during the growing season. At the end of a one year period, all ecosystem components are sampled and analyzed for levels of 15N.

Values for 15N prior to fertilization are compared to values obtained following fertilization to calculate the percent of 15N in each pool derived from the fertilizer Nitrogen. These percentages are then put into a mass-balance equation where the total amount of applied Nitrogen lost from the system is calculated by taking the sum of percentages of 15N determined for each pool and subtracting it from the total amount of 15N applied to the ecosystem. The remaining amount is attributed to loss from the system either via leaching, volatilization or other gaseous loss.

Results are to be determined upon completion of sampling.

Lauren Grand - laurenag@uw.edu
Advisor: Kristiina Vogt

Identification of Habitat Controls on Amphibian Populations: The Northern Red-Legged Frog in the Pacific Northwest

Historically, research addressing the vulnerability of Stillwater-breeding amphibians focused on reproductive (aquatic) habitat. However, in the Pacific Northwest (PNW), terrestrial (active-season) habitat is also important to stillwater-breeding amphibians. Locally, these terrestrial habitats are rapidly shrinking because of increasing urbanization, placing most PNW stillwater-breeding amphibians at an unidentified level of risk. The goals of my research are (1) quantify this level of risk by determining the relationship between Northern Red-Legged Frog (NRLF) occupancy and abundance in each of the aquatic and terrestrial compartments of its habitat; and (2) determine the value of NRLF as an umbrella species. I will use egg mass counts to survey 30 stillwater aquatic habitats in King County, WA across two strata: (1) within five categories of development and (2) with three size categories of aquatic habitat. Then, I will use GIS to determine the footprint of aquatic habitat with low and tall emergent vegetation and ground-truth each vegetation type. For the terrestrial habitat, I will determine different aspects of development in 250-meter intervals from the aquatic habitat at radial distances over a range of 250 meters out to the maximum recorded distance for NRLF (7 km). I expect to find that the size of terrestrial habitat is the leading driver for determining population size of NRLF. Additionally, I expect that NRLF can be regarded as an umbrella species for PNW stillwater-breeding amphibians.

Megan McPhaden
Advisor: Clare Ryan

Impacts of Landowner Ditch Maintenance and Restoration on Water Quality in the Snoqualmie River Valley

In the early years of agriculture in King County, landowners modified and straightened tributaries of the Snoqualmie River to help drain farmland. These drainage ditches are still used by fish for rearing today, and are thus both important for agricultural productivity and habitat. Conflicts over how agricultural waterways should be managed currently exist between landowners, permitting agencies, and fisheries interests. My research, in partnership with the King Conservation District, examines how ditch maintenance impacts ditch water quality in the Snoqualmie Agricultural Production Districts. Specifically, I examine how dredging reed canary grass and then planting native riparian buffers impacts water temperature

dissolved oxygen, suspended solids, and total discharge. This research will provide a scientific perspective to help inform the development of best management practices for ditch maintenance in King County.

Between July and October of 2011, I collected weekly ditch water quality and vegetative cover data on organic farms between Fall City and Duvall, Washington. I measured water temperature, dissolved oxygen, conductivity, suspended solids, and total discharge in twelve ditches. Ditches fit into three categories: not maintained and surrounded by reed canary grass, recently maintained, and maintained with a developing canopy. I also collected vegetation data, to help understand how species composition and canopy coverage may impact water quality. I will present preliminary findings.

Session IV

Maria Sandercock – mss85@uw.edu
Advisor: Daniel Vogt

Impacts of Urban Development Patterns on Stream Health in the Puget Sound Area

The "Urban Stream Syndrome" describes the consistent, negative changes that streams in urbanized watersheds experience. Several studies have documented low levels for the benthic index of biotic integrity (B-IBI) in streams with more urbanization, indicating poor stream health. Expected growing numbers of people living in urban areas around the world, imply increasing pressure on stream health. Understanding the mechanisms that cause stream degradation and the factors that can mitigate the impact of urbanization are more important than ever. The literature on urbanization and streams demonstrates that there is considerable variability regarding the range of impacts. Some urban streams remain relatively healthy and pollution free, while others decline in all measures, despite having similar levels of urban development. Some scholars have suggested that patterns of urbanization can explain part of the variability in stream ecological condition, however the evidence is limited. I propose to investigate the impact of different patterns of urbanization and urban infrastructure on stream health, while controlling for quantity of urbanization. I plan to identify watersheds that have similar levels of urbanization using a geographic information system (GIS) and measure the B-IBI in these streams, along with possible explanatory variables, such as discharge and turbidity. I will perform regressions between the B-IBI scores and selected watershed variables, such as the aggregation of urban land and composition of the riparian area. I will also perform regressions between the B-IBI and stream discharge and turbidity to gain a better understanding of the mechanisms that might lead to B-IBI decline.

Derek Churchill
Advisor: Jerry Franklin

Managing for Resilient Spatial Patterns: From Reference Condition to Silvicultural Prescription

Pre-settlement reference conditions provide much of the scientific basis fo the ongoing restoration of millions of hectares of fire-prone, dry, mixe conifer forests in the interior western United States. There is increasin recognition that structural targets for fuels reduction treatments mus incorporate information on spatial pattern to provide for the desire ecosystem services. Tree spatial pattern has been shown to influence ke aspects of ecological resilience such as fire behavior, regeneration, snov retention, habitat, and understory plant abundance. Past research ha shown these forest types were historically complex mosaics of opening clumps, and individual trees. Yet methods to quantify and explicitl incorporate spatial information from reference conditions in the desig and/or monitoring of restoration and fuels reduction treatments are no widely used. We present a method that quantifies tree spatial patterns in a intuitive and ecologically relevant manner and demonstrate its use i prescription development, marking, monitoring, and adaptive managemen in an operational case study in the Eastern Washington Cascades. W compare this approach with commonly used basal area and spacing base prescriptions in terms of achieving reference spatial patterns, specie composition, and size distribution. The method resulted in numbers an sizes of tree clumps and openings much closer to reference conditions tha the basal area and spacing based approaches. Results suggest that th method is an operationally efficient method of creating heterogeneity i stand level treatments that is tied to reference conditions.

Ben Shryock - bshryock@uw.edu
Advisor: John Marzluff

Are the Effects of Primary Productivity on Songbird Populations Altered in an Urbanizing Landscape?

Using data from 2001 to 2010, I am attempting to determine if various bir population metrics are influenced by primary productivity (as measured b NDVI) and climate differently in new suburban, established suburban an forested areas. I would also like to understand if the patterns diffe between guilds of birds with different life histories, for instance if migrator species respond differently to primary productivity and climate tha resident species.
I am using a remotely sensed NDVI product from NASA's MODIS satellite a 250m resolution; images are obtained daily and composited over a 16-da

period. Using ArcGis 9.3, I extracted average NDVI data for each of my 1 km2 study sites, yielding approximately 24 estimates of NDVI per site per year, for which I calculated mean, maximum and minimum.
I surveyed bird abundance four times throughout the breeding season at eight points within each of my 23 study sites, using a 50-m fixed-radius point count. I assigned each species into guilds based on life history traits and calculated richness and relative abundance for each species and each guild. These will serve as my dependent variables for regression.
Preliminary examination of the data indicates that forested sites have greater mean NDVI and much less variability in NDVI throughout the year than the two urban site types and that the relationship between NDVI and overall species richness is different among the three site types.

Jenny Knoth - knothj@uw.edu
Advisor: Sharon Doty

Early Growth Response in Crop Species Following Endophytic Inoculation

A selection of endophytes isolated from poplar and willow species growing in nutrient poor river beds served as inoculum in a series of studies to elucidate their role in plant growth promotion, improved plant nutrition and carbon gain. A series of inoculation trials have been conducted with hybrid sweet corn inoculated with individual or combinations of mixed endophyte species, including bacteria and yeast. We conducted two experiments: a greenhouse study and a field trial. In both experiments, plant growth was monitored through silking. Sterilized kernels were incubated in nitrogen free media with endophytic inoculums then planted in a sterilized sand:perlite mix (1:1). Greenhouse plants receiving endophytic inocula demonstrated a significant increase in total biomass during the first 4 weeks after planting, regardless of the nitrogen treatment. This increase diminished as the plants matured. A similar observation was made in the field study demonstrating significantly enhanced early growth response to endophytic inoculations. The variation in growth within each nitrogen level was attributable to endophyte treatments. Further, the rate of net CO2 assimilation under saturating light (Amax) increased with endophytic inoculation.

Chia-Hsiu Chen - chench@uw.edu
Advisor: Susan Bolton

Effects of Dam Removal on Landlocked Salmon Movement in a Mountain Stream in Taiwan

Dam removal and longitudinal connectivity is one of most rising concerns for stream restoration practices. Both the temporary impact and long-term habitat improvement might have effects on the existing fish population. A 15-meter height dam has been removed in Cijiawan Stream, in central Taiwan, to help endangered Taiwanese Landlocked salmon (Oncorhynchu masou formosanus) in-stream migration to suitable environment fo different habitat needs. Using radio telemetry tagging, this research looks t find the effects of the dam removal project on Taiwanese Landlocke salmon's movement pattern. By recording daily location of tagged salmon (total three experiments: before, during and after the dam remova implementation), this research found the new passage successfull expanded Taiwan Landlocked salmon's longitudinal movement range Although the construction did not have instant lethal impact on existing fis population, it still changed their movement pattern and expelled them fron the disturbed habitat.

Jun Won Kang - jwkang75@uw.edu
Advisor: Sharon Doty

Two Approaches to Enhance Phytoremediation of Trichloroethylene

Trichloroethylene (TCE) is a common environmental contaminant. Hig levels of TCE have the potential to cause liver damage and malfunctions i the central nervous system, and it is considered a likely human carcinogen More than 54% of Superfund sites in the United States are contaminate with TCE. We explored two approaches for enhancing th phytoremediation of TCE, which includes developing transgenic plants an adding natural TCE-degrading bacteria.
The hypothesis of the first study is that certain detoxification genes such a cytochrome P450s (CYP), glutathione-S-transferases (GST) glycosyltransferases (UGT), and ATP-binding cassette (ABC) transporter are involved in TCE metabolism in poplar. Our study found that poplar tree are able to take up trichloroethylene and degrade it with a variety of plan enzymes. We have shown in our previous study that transgenic hybri poplar plants expressing mammalian cytochrome P450 2E1 (CYP2E1) ha greatly increased metabolism of TCE. In this research, we compared th expression of poplar genes that may be involved in TCE metabolisn between wild-type hybrid poplar and transgenic poplar by microarra analysis. Through this analysis, we found and proposed many putativ genes that are likely to be involved in TCE metabolism and detoxification These genes were automatically unregulated in the transgenic plants suggesting that only the first step was the rate-limiting step in improvin phytoremediation of TCE.
The second study hypothesizes that endophytes in poplar can degrade TC more effectively than the bacteria currently used in bioremedation. Plant associate with various microbes which live around the plant's root o within intercellular spaces of the aerial part of the plant. Our research wa aimed at isolating from poplar bacteria with the ability to degrade TCE. A novel endophyte from hybrid poplar was successfully isolated an characterized. This unique endophyte, identified as Enterobacter sp. PDN3 showed high tolerance to TCE. Without the addition of inducers such a toluene or phenol, PDN3 rapidly reduced TCE levels. Nearly 80% of TC

(55.3 μM) was dechlorinated by PDN3 in 5 days with 166 μM chloride ion production, suggesting TCE degradation. Phytoremediation of TCE contaminated sites using this strain seems to be a promising cost effective remediation strategy.

Poster Session

Natalie Schmidt - schmidt.natalie@gmail.com
Advisor: Jon Bakker

Alternate hosts of castilleja levisecta (orobanchaceae): new options for restoration of a threatened species

Scientists have long been fascinated by the nature of the interaction between parasitic plants and their hosts. Understanding these relationships could greatly improve prairie restoration efforts and preserve native habitat for many threatened and endangered species in the Pacific Northwest (PNW). Castilleja levisecta (golden paintbrush) is a threatened hemiparasite native to the PNW whose known hosts include Eriophyllum lanatum (Oregon sunshine) and Festuca roemerii (Roemer's fescue). However, other species are believed to be potential hosts because C. levisecta has been observed growing robustly with no known host species in the vicinity. To test this alternate host hypothesis, we propose a multiple-species experiment to determine if alternate preferable hosts exist for C. levisecta. Host species candidates will be selected based on current presence in PNW prairies and families that include hosts for other Castilleja species. Fifteen host species will be planted with C. levisecta, including two non-native species: Holcus lanatus and Anthoxanthum odoratum. Destructive sampling will determine whether haustorial connections have been made. If connections are present, we will determine the relative benefit to C. levisecta by measuring number of connections per pair, and C. levisecta biomass and number of flowering stems. We hypothesize that several of the species tested will prove adequate hosts for C. levisecta, and should be considered viable options for restoration in the future. These findings could increase the chances for survival of this species and others, including several species of rare butterfly, which rely on prairie ecosystems for habitat.

Forest Ecology, Management and Silviculture Research at the University of Washington

Author: Gregory J. Ettl, Associate Professor

The research interests of students working in the Sustainable Forestry Lab, under Ettl's direction, are broad and interdisciplinary, reflecting the interests of their advisor. The poster presents the Lab's active work, including the following projects.

- Julianne Baroody: Silvicultural plan to address forest degradation in the pine-oak forests of Chiapas, Mexico
- Kendall Becker: Effects of fire on carbon sequestration in Yosemite and Sequoia Kings Canyon National Parks
- Andy Cockle: Growth and mortality among Douglas-fir and western redcedar seedlings in a variable retention harvest unit at Pack Forest
- Paul Fischer: Management practices effecting forest carbon sequestration and potential for forest carbon offsets (joint with Evans School)
- Rhiannon Fox: Effect of seasonal variation, moisture, weather events and temperature on transpiration and water use of western redcedar, western hemlock and Douglas-fir at Pack Forest
- Kate Galligan: Distributions of ectomycorrhizal fungal species associated with mature Alnus rubra in the Puget Sound region of western Washington
- Hyunju Lee: Cause and effects of tree mortality in coniferous forests of the Pacific Northwest
- Gregory J. Ettl: identifying differences in ecosystem services provided by various harvest strategies (ECOSEL)

Kailey Marcinkowski - kwmarcin@uw.edu
Advisor: David Peterson

Tree-ring based reconstructions of mass balance at South Cascade Glacier

Mountain glaciers are sensitive to changes in climate. Glacier net mass balance, the difference between winter accumulations and summer ablations, can be used to assess climatic variations. Proxies can extend mass balance measurements into the past and gain a better understanding of natural fluctuations and current recession trends of glaciers. The relationship between climate and radial tree growth at high elevations has been shown to be inversely related to the relationship between mass balance and climate, making it an ideal proxy for reconstructing glacier mass balance. For example, mountain hemlock (Tsuga mertensiana) growth is sensitive to winter snowpack, which affects duration of growing season (1) higher growth occurs during years of lower snowpack, conditions that cause negative mass balance, (2) lower growth is caused by deeper snowpack, conditions that cause positive mass balance. In this study, we are using mountain hemlock chronologies to assess mass balance variability of South Cascade Glacier. Mountain hemlock trees were cored in sites surrounding South Cascade Glacier and compiled into master chronologies. Correlation analysis and principal component analysis will be used to identify climatic conditions influencing tree growth and mass balance variability. Regressions will be done to reconstruct mass balance from the

chronologies. Visual comparisons will be made between the reconstructed mass balance and ocean indices, climate variables, and other glacier mass balance data from the region. It is expected that recent negative trends will be outside the natural fluctuations of mass balance, with ocean and climate variables playing a large role in the variability.

Canopy Dynamic Lab: Miranda Fix, Shawn Behling, Katri Rahkonen, Amita Banderjee

The combined research of the members of the Canopy Dynamic Lab involves investigation of forest crown and light interactions on four levels. Miranda Fix's work utilizes a novel cable-run measuring device in an attempt to quantify light heterogeneity on the forest floor. Shawn Behling's work to quantify the competition in relation to light quality has involved the construction of a unique growth chamber with a red to far-red ratio mimicking that of natural sunlight. Amita Banderjee's work investigates competition from a photosynthetic perspective, and Katri Rahkonen focuses on sustainable forestry practices.

Hyunju Lee - Hyunju22@uw.edu
Advisor: Greg Ettl

Tree mortality in coniferous forest in the Pacific Northwest: rates and causes in secondary and mature forests

My research objectives are to first identify the causes and rate of the mortality of young forests from density-dependent suppression and density-independent factors, including: drought, mechanical or animal damage, and pathogens. Second, I will determine changes in forest structure including biomass, net primary production, and growth of adjacent trees following mortality. Finally, I will investigate the effects of mortality on forest composition and understory regeneration.

I will analyze permanent plot data from 470 plots located within stands of various ages at Pack Forest (UW experimental forest). I will stratify plots by age, elevations, species components, and soil conditions. The permanent plot network has been measured every 5 years, with some plots dating back to the 1970s. Older plots in the network will be used to compare differences in forest structure following mortality, including the understory growth and regeneration responses to increased light.

I expect that the causes of mortality will differ with age, with young and old forests being subject to competitive mortality and decay from fungi, respectively. Few studies have documented mortality rates and this research will increase basic understanding of progress of forest mortality and response to disturbance. The research will also inform forest management by providing an assessment of the changing causes of mortality with stand age, soils and species composition.

Fire and Mountain Ecology Lab: C. Alina Cansler, Karen Kopper, Christina Lyons-Tinsley, Kailey Marcinkowski, Joe Restaino, E. Natasha Stavros

The objective of this poster is to introduce the rest of the College of the Environment to the work being done in the Fire and Mountain Ecology (FAME) lab by graduate students. It will include a collage of research topic outlines and diagrams. An over-arching theme in this lab's current research encompasses the effects on fire and mountain ecology under a changing climate. However, the research is not solely limited to this theme. There are six research topics currently being studied in the lab: 1) the effects of fuel treatments on carbon storage across the life cycle of forest fuels; 2) the influence of local environmental and biotic factors and regional climate on post-fire tree regeneration at the alpine-upper treeline ecotone in the Cascade range and Northern Rocky Mountains; 3) reconstruction of mass balance for South Cascade Glacier using Tsuga mertensiana ring-width chronologies to determine if current trends are within the natural range of variability; 4) model evaluation and application for a regional, stochastic wildfire simulator to improve understanding of the climate-wildfire-air quality system; 5) examination of climate-growth interactions across the North American range of Pseudotsuga menziesii; and 6) characterization of fire effects and fire frequencies in the Stehekin, Washington mixed-severity fire regime.

Korena Mafune - k.mafune@hotmail.com
Advisor: Jon Bakker

Analyzing Microbial Metabolisms Among Prairie Restoration Treatments

The UW and the Center for Natural Lands Management are contributing efforts to restore Washington's prairie ecosystems by conducting a habitat restoration study at 4 research sites. Two of the sites are near Olympia and two are on Whidbey Island. Pasture grasses and agricultural weeds dominated the sites at the beginning of the experiment. Each site was prepared with solarization, burning, and herbicide, and plots were seeded with a diverse mixture of native species following site preparation. I am researching the effect of these treatments on the physiological profile of soil microbial communities and on nitrogen mineralization. Soil samples were collected from 5 locations at each site: the three site preparation treatments, an unseeded herbicide area, and an untreated area. Each sample was used to inoculate a Biolog EcoPlateTM containing 31 carbon sources, and to extract a KCl solution to obtain N mineralization rates. With the EcoPlatesTM, the color development was recorded when the plates were first inoculated using a micro-plate reader, and were then incubated for 24 hours; readings were then taken every 12 hours for 4 days following

Each response well was blanked against its initial read, and the average well color development was calculated. The normalized data is then run through PCA and PERMANOVA analyses. For the mineralization, soil samples were taken from the 5 treatments at day 1 and day 40. All samples were mixed with a 2M KCl solution to extract NO3 and NH4 contents (the results have not yet been determined). This research is important to the larger restoration project because it is examining how strongly the restoration treatments affect the soil microbial community. The data is currently being analyzed, and some significant variation among plots has been observed, but the project is still in process.

Amy Baum - amybaum@uw.edu
Advisor: Sharon Doty

Microbes Helping Poplar Make Jet Fuel

Populus trichocarpa is a deciduous poplar tree species which thrives in nitrogen deficient rocky riverbeds throughout the Pacific northwest, growing 1-3m each season. Recently it has gained economic importance as an eco-friendly source of biomass for the production of biofuel, in large part due to a novel method for the efficient production of high quality aviation fuel from cellulosic biomass. Poplar plantations on the west side of the Cascade Mountains enjoy naturally fertile soils optimal for growth, but on the east side require weekly nitrogen fertilization, negating some of the carbon savings gained during the shift from petroleum-based fuel to biofuel. The success of a large-scale aviation biofuel industry in the Pacific Northwest will depend upon a large supply of sustainable biomass with little to no input requirements. In the last few decades, studies have revealed that nitrogen-fixing microbes carry out biological nitrogen fixation (BNF) in every possible habitat niche, including the spaces between plant cells, providing up to 70% of a plant's required nitrogen. Our lab has isolated dozens of nitrogen-fixing microbes from wild poplar that are closely related to other well-known diazotrophic endophytes. The present study will assess how a community of nitrogen-fixing endophytes isolated from wild poplar effect the growth of three hybrid poplar species grown without the addition of synthetic fertilizer.

GSS Organizing Committee
Chair: Diana Pietri

Karyn Boenker
Julianne Baroody
Danial Brody
Ellen Frohning
Lauren Grand
Kelly Huang
Maria Sandercock
Natasha Stavros

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Thank you for coming today!

We hope you enjoyed the ninth annual School o Environmental and Forest Sciences Graduate Studen Symposium. Please take a moment to fill out ar evaluation form (located on the table near the entrance). Your comments will help us plan future symposiums and tailor the event to a variety of needs.

Please come again next year!

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

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.