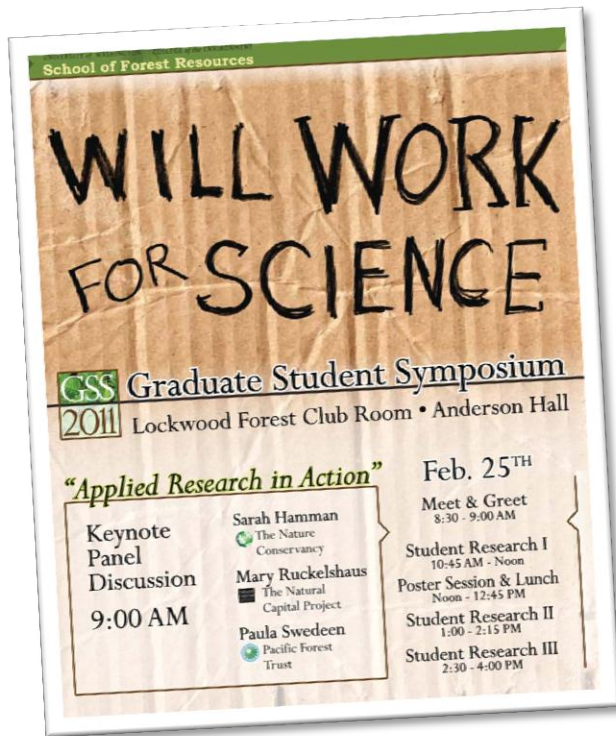


# Eighth Annual School of Forest Resources



# GRADUATE STUDENT SYMPOSIUM

February 25, 2011

# Schedule of Events

## 9:00 – 9:10 Opening Remarks

Dr. Tom Hinckley, Interim Director, School of Forest Resources

## 9:10 – 10:30 Keynote Panel Discussion: “Applied Research in Action”

Dr. Sarah Hamman, The Nature Conservancy

Dr. Mary Ruckelshaus, The Natural Capital Project

Dr. Paula Swedeen, Pacific Forest Trust

## 10:30 – 10:45 Break

## 10:45 – 12:00 Session I

10:45 – 11:00 Eric Delvin

11:00 – 11:15 Megan Halabisky

11:15 – 11:30 Karen Hutten

11:30 – 11:45 Diana Pietri

11:45 – 12:00 Jason Walter

## 12:00 – 1:00 Poster Session & Lunch

## 1:00 – 2:15 Session II

1:00 – 1:15 Gabrielle Roesch

1:15 – 1:30 Chad Wilsey

1:30 – 1:45 Eva Dettweiler-Robinson

1:45 – 2:00 Austin Himes

2:00 – 2:15 Stephan Gmur

## 2:15 – 2:25 Break

## 2:25 – 3:40 Session III

2:25 – 2:40 Josh Kubo

2:40 – 2:55 Maria Petrova

2:55 – 3:10 Dave Hays

3:10 – 3:25 Brooke Sullivan

3:25 – 3:40 Alex Adams

## 3:45 – 4:45 Session IV

3:45 – 4:00 Jeff Richardson

4:00 – 4:15 Mohit Rastogi

4:15 – 4:30 Karyn Boenker

4:30 – 4:45 Rebecca Singer

## Dead Elk and Award Presentation to follow!

Graduate Student Symposium 2011 \_\_\_\_\_

## Keynote Panel Discussion: “Applied Research in Action”

*Dr. Sarah Hamman, Restoration Ecologist, The Nature Conservancy*



Sarah Hamman is the Restoration Ecologist for the Washington Chapter of The Nature Conservancy. Her work is aimed at restoring native prairie and oak woodland habitat throughout the Pacific Northwest using rigorous science and collaborative conservation planning. Sarah holds a B.A. in Biology from Wittenberg University and a Ph.D. in Ecology from Colorado State University. Her dissertation examined prescribed and wildfire effects on soil nutrient cycling and microbial community dynamics in

California and Colorado mixed conifer forests. She has also studied climate change impacts on Minnesota tallgrass prairies, wolf behavior and demographics in Yellowstone, fire effects on invasive species in Sequoia National Park and restoration techniques for endangered species in central Florida rangelands. She has also taught fire and forest ecology at Colorado State University and backcountry field ecology courses in the Sierras.

*Dr. Mary Ruckelshaus, Managing Director, The Natural Capital Project*



Mary Ruckelshaus is the Managing Director of The Natural Capital Project (NatCap), a collaboration among Stanford University, The Nature Conservancy, World Wildlife Fund, and the University of Minnesota. NatCap provides scientific capacity and technical tools allowing incorporation of ecosystem service values into decisions at the intersection of human development and conservation interests. Until September, 2010, she lead the Ecosystem

Science Program at NOAA Fisheries’ Northwest Fisheries Science Center in Seattle, WA, USA. Dr. Ruckelshaus is a population biologist who is interested in using basic ecological and evolutionary principles to design recovery strategies for imperiled species and ecosystems. The main focus of her current work is on developing ecological models including estimates of the flow of ecosystem services and their values under different management regimes and future climate conditions within the Pacific Northwest of the U.S. and in marine systems worldwide. Dr. Ruckelshaus was chief scientist for the Puget Sound Partnership, a public-private

institution charged with achieving ecosystem-based recovery of natural and human systems in Puget Sound, WA. She has published over 70 scientific papers in peer-reviewed journals, book chapters and Federal technical reports. In addition to her work on salmon, ecosystem services and ecosystem-scale planning, Ruckelshaus has worked for more than fifteen years on marine conservation issues. She serves as a trustee of The Nature Conservancy's Washington Chapter and is a past chair of the Science Advisory Board of the National Center for Ecological Analysis and Synthesis (NCEAS). Before joining the National Marine Fisheries Service in 1997, Ruckelshaus was a faculty member in Biology for three years at Florida State University. She has a bachelor's degree in human biology from Stanford University, a master's degree in fisheries from the University of Washington, and a doctoral degree in botany, also from the University of Washington.

*Dr. Paula Swedeen, Director, Ecosystem Services Program, Pacific Forest Trust*



Paula Swedeen, Ph.D., Director of Ecosystem Service Programs. Swedeen has 21 years of forest conservation and management experience as a wildlife biologist, policy analyst, and ecological economist, and has applied her expertise to a wide array of issues, including endangered species conservation, forest carbon protocol and project development and valuation of ecosystem services. She joined PFT after working for the Washington Departments of Natural Resources and Fish and Wildlife, and as a private consultant. She holds a Ph.D. in Ecological Economics from The Union Institute, a master's degree in Political Science and Environmental Studies from Western Washington University and a Bachelor of Science degree in Biology from Indiana University.

## Session I

Eric Delvin, Jonathan Bakker, Peter Dunwiddie

### **Investigating the Role of Host Plants in Recovering Golden Paintbrush (*Castilleja levisecta*) in Severely Degraded Habitat in Puget Lowland Prairies**

edelvin@tnc.org

Advisor: Jonathan Bakker

Native prairies of western Washington are one of the most endangered ecosystems in the United States and have been nearly extirpated from the region. A suite of rare and endangered species are associated with this habitat, including *Castilleja levisecta* (golden paintbrush), a federally threatened hemiparasite endemic to prairies in the Pacific Northwest. The recovery of rare, parasitic plants such as *C. levisecta* is a challenge for restoration practitioners, as the species may be limited by their host plant requirements in addition to the usual issues of small population size. Understanding the availability and quality of host plants at restoration sites is critical for parasitic plant reintroductions. There is currently limited information on the host requirements of *C. levisecta*. The primary objective of this project is to test the effects of host plants on *C. levisecta* performance in a field setting. Three field experiments involving out-planting and direct seeding, with and without different host plants, will be conducted to evaluate host preference in a restoration context. To date, recovery efforts for *C. levisecta* have focused exclusively on extant prairie sites that still retain a significant component of native species. This research project also provides a new approach to recovery of *C. levisecta* by testing these outplanting and direct seeding techniques on severely degraded sites with no native component present. These replicated experiments should provide more definitive results on the effects of outplanting or seeding with hosts for *C. levisecta* reintroduction efforts, and should provide solid recommendations for its recovery.



Megan Halabisky, L. Monika Moskal, Sonia A. Hall

### **Object Based Classification of Semi-Arid Wetlands**

halabisk@uw.edu

Advisor: L. Monika Moskal

The goal of this research was to develop a time-efficient, automated, low-cost method to map wetlands in a semi-arid landscape that could be scaled up for use at a county or state level, and could lay the groundwork for expanding to forested areas. Therefore, it was critical that the research project contain two components: accurate automated feature extraction and the use of low-cost imagery. For that reason, we tested the effectiveness of geographic object based image analysis (GEOBIA) to delineate and classify wetlands using freely available true color aerial photographs provided through the National Agriculture Inventory Program (NAIP). The GEOBIA method produced an overall accuracy of 89% ( $khat=0.8129$ ), despite the absence of infrared spectral data. GEOBIA provides the automation that can save significant resources when scaled up while still providing sufficient spatial resolution and accuracy to be useful to state and local resource managers and policymakers. A next step to this research is combining multi-temporal Landsat satellite imagery with high-resolution aerial photography to provide additional details about the water regime for each wetland.



Karen Hutten

### **Balsam woolly adelgid and subalpine fir mortality, Olympic Peninsula, WA**

huttenk@u.washington.edu

Advisor: Christian Torgersen

I am investigating spatial and temporal patterns of tree mortality and occurrence of balsam woolly adelgid (*Adelges picea*) in relation to physical geography and associated disturbance agents on the Olympic Peninsula, WA. The balsam woolly adelgid (BWA) is an exotic herbivorous insect first documented on the Peninsula in 1969. Aerial surveys and satellite imagery were used to identify areas of tree mortality within the range of the subalpine fir host. We hypothesized that mortality would be correlated with annual weather, aspect, elevation, and presence of BWA. Preliminary data indicate that BWA has affected subalpine fir trees of all ages across the peninsula, but distribution is patchy and severity is variable. The most severe gouting and defoliation occur on trees on south-facing slopes and adjacent to meadows at low elevations. Western balsam bark beetle (*Dryocoetes confusus*) and burl deformation appear to be more prevalent in mortality areas than previously documented.

Diana Pietri

## **Learning Networks as a Tool to Strengthen Coastal Resource Management**

dianap@uw.edu

Advisor: Stanley Asah

Traditional approaches for conserving marine resources have centered on narrow actions, such as the management of a single fishery stock or the establishment of a small marine reserve limiting fishing and other uses. However, in recent years there has been a heightened recognition of the need to manage marine resources at the scale of ecosystems and regions. This emphasis on regional planning has led to the creation of new collaborative initiatives to protect marine resources that bridge political, national, and cultural boundaries and unite diverse participants. A result of these cooperative efforts is the creation of associated learning networks. Learning networks provide a forum for participants to: work together build collective knowledge; stimulate innovations; and facilitate the diffusion of useful lessons and information between participants. In this presentation, I shall explore a prominent example of a new collaborative marine conservation initiative and learning network: the Coral Triangle Initiative (CTI). CTI is a multilateral, multi-donor partnership between the governments of Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor-Leste to protect the diverse marine ecosystems of the Coral Triangle. My proposed research shall investigate the ways in which the CTI learning network can be used to strengthen the protection and management of marine resources in the Coral Triangle region. I will also explore the role of leaders with the learning network and whether leaders facilitate the dissemination of knowledge and innovations to other participants in the network.



Jason Walter, Christian Torgersen, Robert Bilby, Thomas Quinn, Brian Fransen

## **Variability of Coastal cutthroat Trout Abundance and LiDAR-Derived channel morphometry in headwater catchments**

jkwalter@u.washington.edu

Advisor: Christian Torgersen

Current practices in place to protect aquatic biota and their habitats potentially impacted by forest management typically recognize differences among these habitats at a relatively coarse-scale, fish bearing versus non-fish bearing streams, for example. This approach does not address the significant heterogeneity of headwater habitats that exists at finer-scales, and contributes to the inability of scientists, managers, and regulators to agree on best management practices to provide protection to aquatic systems. Spatially continuous, single-pass electrofishing and physical stream habitat surveys were conducted within the fish-bearing portions of 16 catchments where coastal cutthroat trout are the sole salmonid species present. Each catchment was sampled twice, first in the autumn and then again the following spring, prior to the emergence of young-of-the-year cutthroat trout. Spatial and temporal (seasonal) variability of cutthroat trout abundance within each study catchment is being assessed at the coarse, or catchment scale, the fine, or channel unit scale using stream habitat data collected during field surveys, and the intermediate, or segment scale using channel morphometry characteristics derived from LIDAR remote sensing. Stream segments will be identified and grouped by analyzing intermediate-scale stream habitat variables that may affect fish abundance and stream channel characteristics, including channel gradient, confinement, and size. By identifying intermediate-scale habitat characteristics associated with high cutthroat trout abundance land managers can better identify areas of high biological potential where specific habitat protections or restoration efforts may be warranted or most productive.

## Session II

Gabrielle Roesch

### **Public Willingness-to-Pay for Forest Ecosystem Services and Relative Preferences for a Private or Public Payment Mechanism: A stated preference survey of WA and OR households**

roescg@u.washington.edu

Advisor: Sergey Rabotyagov

Private forests in Washington and Oregon are facing changes in the availability and consistency of markets as well as an increased risk of conversion. The emergence of markets for forest ecosystem services offer one solution for private forestland financing while also increasing the provision of environmental benefits. State agencies are exploring the potential for an ecosystem services marketplace. However, little information is available on public preferences for specific forest ecosystem attributes. In

addition, little research has been done on identifying public willingness to participate in privately or publicly financed ecosystem markets.

This study elicited Oregon and Washington household values for particular forest ecosystem attributes, including carbon sequestration, mature forest habitat, water quality, foregone development, recreation and cost. Research was conducted using both qualitative and quantitative methods for assessing value, including focus groups and an attribute based stated choice survey for assessing willingness-to-pay for specific forest ecosystem services. Survey respondents responded to one of two surveys in which they chose management alternatives based on weighing the trade offs associated with a series of environmental attributes. Two surveys were administered in order to elicit preferences for private versus public payment mechanisms for forest ecosystem services. Preliminary results show clear preferences for specific forest ecosystem attributes and the payment mechanism.

This study contributes to an understanding of the opportunities and limitations of a market for forest ecosystem services and respondents' willingness to pay. This research is relevant to forest landowners and policy makers evaluating the potential for forest ecosystem services markets.



Chad Wilsey, Joshua J. Lawler. David A. Cimprich

**Contribution of LIDAR-derived measures of vegetation structure to a habitat suitability model for the black-capped vireo**

chadwilsey@gmail.com

Advisor: Joshua Lawler

Identifying transitional shrubland habitats suitable to the Black-capped Vireo (*Vireo atricapilla*) across broad spatial scales is a challenge. Field-based measurements identify important habitat characteristics, but are often difficult and time consuming to scale-up. Laser altimetry (i.e. LiDAR) produces a three-dimensional, high-resolution representation of vegetation structure at broad spatial scales. We used presence/absence data for territorial male Black-capped Vireos collected throughout the Fort Hood Military Reservation, Texas, in 2002 and 2003 to constructed habitat suitability models with (1) LiDAR-derived measures of vegetation structure, (2) vegetation composition data mapped from aerial imagery and soil data, and (3) both the LiDAR-derived and aerial imagery and soil-data derived

variables. Models were built with the cforest classification algorithm, a non-parametric machine-learning tool similar to Random Forest Predictors. We evaluated model performance with both threshold independent (AUC) and dependent (classification accuracy and Cohen's  $\kappa$ ) metrics and characterized the relative importance of predictor variables in the full model. Both the LiDAR model and the vegetation and soil model correctly predicted a median 77% of observations in 25 randomly generated test datasets, whereas the combined model correctly predicted 83% of observations. Vegetation and soil depth were more important predictors of habitat suitability than LiDAR measures in the full model. Edge density was the most important measure of vegetation structure. Results suggest that LiDAR-derived measures can provide accurate, high-resolution predictions of habitat suitability, but that incorporation other data on vegetation composition and other factors known to be important to the species, such as soil characteristics, results in superior model performance.



Eva Dettweiler-Robinson

### **Disturbance history, abiotic conditions, and biotic factors as drivers of biological soil crust**

evadr@u.washington.edu

Advisor: Jonathan Bakker

Biological soil crusts (BSC) are composed cryptic photosynthetic organisms. BSCs live on the soil surface in arid lands and perform many ecological functions such as preventing erosion and fixing nitrogen. Topographic position, soil characteristics, vegetation, and disturbance history may interact to affect cover. Using structural equation modeling, I identified the factors that are the strongest drivers, through both direct and indirect effects, on moss and lichen cover. Number of recent fires, litter cover, and invasive species were strong driver of moss cover, while soil nutrients, topographic position, and moss and invasive species cover were direct drivers of lichen cover. These relationships are crucial for understanding the limitations and requirements for this cryptic group.



Austin Himes, Kim Littke, Rob Harrison

## **Ecosystem allocation of nitrogen from three controlled release urea fertilizers in Pacific Northwest Douglas-fir**

himesa13@gmail.com

Advisor: Rob Harrison

The objectives of this research are:

- 1.) Determine the nitrogen uptake efficiency in Douglas-fir of three controlled release urea fertilizers compared to plain urea in the Pacific Northwest.
- 2.) Expand our understanding of nitrogen cycling in Pacific Northwest Douglas-fir ecosystems.

The proposed methods for this study are to apply four treatments of  $^{15}\text{N}$  enriched urea fertilizers to  $10\text{m}^2$  plots at 10 sites in western Oregon and Washington over two years (five sites each year). The fate of the fertilizer nitrogen throughout the course of a year and through multiple ecosystem components will be tracked by the  $^{15}\text{N}$  label. Ecosystem allocations of nitrogen in the four treatments will also be compared to an unfertilized control. The four treatments will be:

1. Plain urea pellets
2. *Urea+NBPT*: Urea pellets coated with N(n-butyl) thiophosphoric triamide, commercially available as *Agrotain*, which binds to the active site of the enzyme urease and prevents it from catalyzing urea hydrolysis.
3. *Urea CUF*: Urea pellets coated in a boron solution that inhibits urease and acts as a binding agent for secondary nutrients like Phosphorous in the commercial variety *Arborite*.
4. *ESN urea*: Polymer coated pellets of urea commercially available under the brand *Agrium* designed to delay urea release to the soil by creating a permeable physical barrier that breaks down in time.



Stephan Gmur, Daniel Vogt, Darlene Zabowski, L. Monika Moskal

## **Comparing Soils Using VIS and NIR Hyperspectral Remote Sensing**

sgmur@u.washington.edu

Advisor: Daniel Vogt

The characterization of soil attributes using hyperspectral sensors has shown that the shapes of soil spectra are known to respond to mineral

composition, organic matter, water (hydration, hygroscopic and free pore water), iron form and amount, salinity and particle size distribution. These attributes of soil characteristics basically determine the unique soil spectral signature, which can be measured using portable and satellite spectroradiometers. Using replicate soil samples located within Washington and Oregon, surficial or A horizon soils we placed under a ASD fieldSpec HandHeld Portable Spectroradiometer to measure the unique spectral signature of each sample. Spectra were also sampled from the Soil Information System (ISIS) of the International Soil Reference and Information Centre (ISRIC) for different soil samples taken within the United States. Comparisons of the different spectral signatures highlight differences between soils not only across soil orders but also across Suborders and Great Groups of the USDA taxonomic soil classification system. In this research the creation of unique soil spectral signatures from cataloged soil samples located cross Washington and Oregon create a local catalog of spectral signatures, which can be utilized in future remote sensing applications.

### Session III

Josh Kubo\*, Anne Weekes, Christian Torgersen, Susan Bolton, Robert Gara

#### **Assessing aquatic insect assemblages within geohydrologic categories in sub-alpine headwaters of Mt. Rainier National Park**

joshkubo@gmail.com

Advisors: Susan Bolton, Christian Torgersen

Ecological monitoring requires the dynamic assessment of environmental processes and biotic communities found within unique habitats. Because environmental shifts are likely to influence high latitude/altitude ecosystems, the physical processes and biotic communities found within montane headwaters can provide ideal indicators of hydrological and ecological responses. In an effort to characterize these indicators, we used aquatic insect community composition to evaluate geohydrologic stream categories within relict glaciated headwaters in Mt. Rainier National Park, WA. Aquatic insects were collected from July to October 2010 in three basins, which contained comparable stream segment types (colluvial groundwater source, fluvial stream segment, bedrock outlet). Aquatic insect densities within each segment type were assessed using Ward's hierarchical cluster analysis and nonmetric multidimensional scaling (NMDS). Ordinations were used to identify potential indicator taxa found within each

segment type. Preliminary cluster results indicated that aquatic insect densities significantly align with categorized headwater segment types (cophenetic correlation = 0.79). Two-dimensional NMDS ordinations further supported clustering and indicated that distinct taxa significantly influence each segment category (stress = 17.462;  $p < 0.001$ ; goodness of fit  $R^2 = 0.84$ ). In addition to providing support for physical categorization and potential indicator groups, this study documented several rare/endemic taxa and confirmed a new species of *Lednia*. This assessment helps to support the use of scale-dependent emergent properties and related biotic community abundances in the monitoring and conservation of relic glaciated headwater systems. Additionally, our efforts emphasize the importance of considering site- and time-specific measurements (both physical and biotic) when assessing sub-alpine headwaters.



Maria Petrova, Jonathan Bakker, Eric Turnblom

### **A New Growth Model for Southwest Ponderosa Pine**

mpetrova@uw.edu

Advisors: Eric Turnblom, Jonathan Bakker

Forest Vegetation Simulator (FVS) is an individual tree, distance independent growth and yield model. It can predict forest growth under a large range of growing conditions and management scenarios. The model has been adapted to different geographic areas to produce individual variants. The Central Rockies (CR) variant is used in the Southwest.

The current large tree diameter growth model in FVS-CR over-predicts diameter of Ponderosa Pine. To determine if its performance can be improved the structure of the model is evaluated using Sensitivity Analysis (SA). SA is useful in examining the importance of input parameters and in model building and development. We used simulated data to rank how sensitive diameter growth is to variables currently in the model and to stand and tree variables external to the model.

Results show that the model is sensitive to some external variables such as Top Height and QMD. I expect the addition of these variables to improve diameter growth predictions. We used the results from the SA and a long-term dataset, obtained from plots in the Coconino National forest, to build a new diameter growth model for Ponderosa Pine. Our future work

includes comparing the new diameter growth model to the FVS model and repeating the analysis with FVS-CR Height growth model.



Dave Hays

**Physiological responses of Himalayan blackberry (*Rubus armeniacus*) to flooding and implications for upland wetland restoration in the Pacific Northwest**

davehays@uw.edu

Advisors: Kern Ewing, Soo-Hyung Kim, Jim Fridley

*Rubus armeniacus* (Himalayan blackberry) is a common invader of anthropogenically-disturbed wetlands in the Pacific Northwest. Therefore wetland restoration projects that will modify the hydrological regime in *R. armeniacus*-infested areas must be planned with an understanding of the weed's physiological response to inundation and associated anoxic conditions. *R. armeniacus* was subjected to partial and complete inundation, as well as treatments involving shading and/or cutting/resprouting, in a greenhouse experiment. Preliminary results indicate that *R. armeniacus* is highly tolerant of anoxic conditions and can induce morphological changes in its roots and stems to tolerate long periods of anaerobic respiration or facilitate gas exchange, including hypertrophic swelling of stems, aerenchyma formation, and development of extensive networks of adventitious roots. Fully submerged plants were able to survive more than 30 days underwater in laboratory conditions. This information will better inform restorationists as to what kinds of pre-treatments are required before flooding infested areas and what native plants may out-complete *R. armeniacus* post-wetland restoration.



Brooke Sullivan

**Isolation and Identification: A pilot study exploring 'wasting disease' ecology and techniques for culturing a known seagrass pathogen, *Labyrinthula zosterae***

brooke@backtonaturedesign.com

Advisor: Kern Ewing

The marine pathogen *Labyrinthula zosterae* is capable of spreading leaf to leaf, causing necrotic lesions in seagrass plant tissue, which may eventually cause death of seagrass meadows on a global scale. Many scientists have researched the disease epidemic of the 1930's and 1940's, yet the scientific process of sampling seagrass, isolating the protist, confirming infection, determining a level of infection and assessing the potential risk for catastrophic disease outbreak remains a tedious and imperfect science. A closer examination of the history of research on mass-wasting events reveals the possibility that a complex set of interacting forces ultimately share responsibility for catastrophic losses to seagrasses around the world. I will present a series of pilot experiments developed to improving efficiency and accuracy of identifying, isolating and monitoring for disease outbreaks. As global climate change persists and escalates in our nearshore environment it is imperative we increase our ability to assess the causes and risks of the so-called 'wasting disease' in seagrass communities.



Alex Adams

**Planning for Resilience in Coastal Communities: A practical approach to managing cruise ship tourism.**

awadams@u.washington.edu

Advisor: Marc L. Miller (School of Marine and Environmental Affairs)

Resilience theory has management implications useful when planning for cruise ship tourism. In small coastal communities, cruise ships often provide welcomed economic incentives that can bolster a waning economy. However, in some coastal communities, the magnitude and intensity of passenger visits can reduce social resilience and induce an economic regime shift that leads to rapid socioeconomic reorganization. The implications of such a regime shift are a loss of economic diversity, reduced social resilience, and a loss of social capital. Planning for cruise ship resilience increases the likelihood of successful coping strategies and addresses the socio-ecological changes inherent to a cruise ship destination. Both Holling's adaptive cycle and the four principals for building resilience established by Berkes and Seixas are fundamental to a successful management plan.

## Session IV

Jeff Richardson

### **Vegetation Sampling at the Speed of Light**

jeffjr@u.washington.edu

Advisor: L. Monika Moskal

Field based methods of assessing plant communities has changed little in the past century, relying on traditional methods of assessing species composition and abundance. An important additional component of plant communities, their three dimensional structure, is very difficult to assess using traditional techniques. Terrestrial LiDAR is a technology that can be used to address this limitation, providing highly detailed three-dimensional measurements of plant communities. In this study, two new structural indices based on terrestrial LiDAR methods are developed to assess vegetation density and patchiness. An example using experimental manipulations of forest structure with fire and grazing demonstrates the power of these indices in describing complex structural variability.



Mohit Rastogi, Richard Gustafson

### **Life Cycle Assessment of Producing Biofuels from Plantation Grown Willow**

mohitr@u.washington.edu

Advisor: Richard Gustafson

We are engaged in a comprehensive Life Cycle Assessment (LCA) of producing biofuels from woody biomass. Currently, we are investigating producing fuel using sugar platform technology from plantation grown willow. In this paper we will present details of an LCA for production of ethanol from plantation grown willow. Operations data for production of Willow biomass are combined with **ASPEN-Plus®** process models and life cycle data bases to perform a cradle to grave impact analysis of producing ethanol from plantation grown willow. LCA models were developed using **SimaPro® 7** software. The impacts of producing fuel from willow in terms of global warming potential, abiotic depletion, toxicity, acidification, and photochemical-oxidants formation are assessed relative to the impact using conventional petroleum. The relative effect of each segment of the lifecycle is also assessed to provide guidance on where to reduce overall environmental impact.

Graduate Student Symposium 2011 \_\_\_\_\_

Karyn Boenker

## **Communicating Climate Change: Shifting Frameworks in Online U.S. New Sources**

kboenker@uw.edu

Advisor: Stanley Asah

In recent years, belief in climate change has been declining in the U.S., leaving researchers to answer the question, “Why?” For more than 60 years media coverage has been shown to effect public perception. Accepting that body of research, headlines from major U.S. news sources will be analyzed in order to create a historical record of issue framing within climate change journalism. In addition, Google search data will be investigated to quantify public engagement in the debate. Preliminary results indicate that 2007 and 2009 are notable years for successful climate change communication campaigns. In 2007, search data was highest in the months surrounding the Noble Peace Prize nomination and subsequent to awarding Al Gore and the International Panel on Climate Change for their contribution to the film *An Inconvenient Truth*. In 2009, search data was highest during the months leading up to the United Nations Climate Change Conference in Copenhagen, Denmark; a time period that also included the “Climate-gate” scandal.



Rebecca Singer, Sally Brown

## **Technical investigation of environmental benefits of using reclaimed water for watershed enhancement: A preliminary report**

singer1@u.washington.edu

Advisor: Sally Brown

Ecological and agricultural use of reclaimed water would reduce direct discharge into Puget Sound and replenish flows in compromised watersheds. Current state requirements for groundwater recharge using reclaimed water are in excess of Class A requirements for irrigation. It is likely that indirect recharge by using irrigation areas as surface-spreading basins will effectively treat water to meet State groundwater requirements. This study will test the potential for soils in impacted watersheds to serve as a tertiary treatment system. Two types of reclaimed water will be added to representative soils. Intact soil cores will be collected from a forest system and an agricultural system, measuring 15cm deep. Soils will be watered at three rates using MBR reclaimed water, Sand filter reclaimed water and tap water as a control. Impact on soils and water quality will be measured.

## Poster Session

Alina Cansler

### **Climatic and topographical influences on fire regime attributes in the northern Cascade Range, Washington, USA.**

acansler@uw.edu

Advisor: Donald McKenzie

I examined the influence of annual climate and topography on fire occurrence, size, severity, and within-fire severity pattern in the northern Cascade Range of Washington, USA. Landsat Thematic Mapper (LTM) data were used to quantify fire severity for all fires greater than 10 ha ( $n = 125$ ) that occurred during a 25 year period (1984-2008). Categorical burn severity images were developed from an index of burn severity (Relative differenced Normalized Burn Ratio) derived from LTM data and parameterized with data from 639 field plots.

Spring snowpack and summer temperature were negatively and positively correlated, respectively, with fire occurrence, annual area burned, and proportion of landscape burned at high severity. As the proportion of high severity within individual fires increased high severity patches became larger and increasingly spatially aggregated. Fires in areas with greater topographical complexity had lower proportional area burned at high severity, decreased spatial aggregation of individual burn severity classes, and more complex overall patch structure.

These results show that the fire regime of the northern Cascade Range responds to annual climatic variation. Nevertheless, within-fire severity mosaic reflects the underlying topographic complexity, even under climatic conditions conducive to the development of large fires. Several recent studies in the western United States have documented a positive relationship between warm and dry climate conditions and annual area burned. The relationship between climate drivers and fire regime attributes identified in this study—a positive relationship between warm and dry conditions and both proportion of area burned at high severity and greater spatial aggregation of high severity patches—add nuance the climate-area burned relationship documented in previous studies.



E. Natasha Stavros, Jessica Hudec, Joe Restaino, Alina Cransler, Whitney Albright, Kailey Marcinkowski, Christina Lyons-Tinsley, and Karen Kopper

## **Fire and Mountain Ecology Lab**

enstavros@gmail.com

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 eight research topics currently being studied in the lab: 1) how fire severity affects post-burn fire hazard in mixed-severity fire regimes; 2) the effects of fuel treatments on carbon storage across the life cycle of forest fuels; 3) the expected changes in the severity of disturbance, specifically wildfire, under a changing climate, and the consequent effects on ecosystem processes; 4) the expected changes in radial tree growth under a changing climate; 5) changes in glacier mass balance compared to the historical range of variability; 6) the effects of climate change on wildfire smoke emissions; 7) examination of climate-growth interactions along the North American range of *Pseudotsuga menziesii*; and 8) characterization of fire effects and fire frequencies in mixed-severity fire.



Jessica Hudec

### **Post-burn fire hazard in mixed severity fire regimes in the Cascade Range**

jhudec@u.washington.edu

Advisor: David Petersen

Fire severity influences the post-burn structure and species composition of a site and the potential for future disturbance. This study focuses on post-burn site characteristics in mixed severity fire regime forests. Fires in mixed severity fire regime forests vary widely in frequency and severity. Three fires that burned on the near east side of the Cascade Range between 2007 and 2008 were stratified by fire severity, and vegetation and fuels were sampled at 0.04-hectare plots within the fire perimeter. The Fuels Characteristic Classification System (FCCS) (Sandberg et al. 2007) was used to convert those structure and composition characteristics into estimates of potential surface fire behavior, crowing potential, and fire hazard.

Understanding the variability in post-burn fuels and vegetation in mixed severity fire regimes is important for management practices including the classification of high-risk areas, the assessment of re-burn potential, and the identification of fuel breaks. Knowledge of post-burn fire hazard will help guide fire managers to meet fire and fuels management objectives.



Aaron Ruesch, Carrie Schloss, Christina Galitsky, Tristan Nunez and Josh Lawler

**Conserving biodiversity in the face of global change: forecasting impacts and modeling solutions – highlights from the Landscape Ecology and Conservation Lab**

asruesch@gmail.com

The Landscape Ecology and Conservation Lab focuses on applied environmental problems. We provide solutions, tools, and knowledge to manage and conserve natural resources and systems. Models are one method we use to assess threats to species and ecosystems and to design potential conservation solutions. Here we present ongoing conservation-modeling efforts covering a broad range species and spatial and temporal scales. These include: (1) determining how changes in air temperature and precipitation are affecting the fish communities in the John Day hydrological system, (2) exploring the utility of existing reserves for protecting mammals in a changing climate, (3) modeling landscape patterns and vegetation effects on avian diversity in the Willamette Valley, Oregon, and (4) designing landscapes that facilitate climate-driven range shifts.



Nóra Könnýú and Sándor F. Tóth

**Economic and Ecological Analysis of Maximum Clearcut Size Policies with the Cutting Plane Method**

nk6@u.washington.edu

Advisor: Sándor F. Tóth

Spatially explicit harvest-scheduling models provide a rigorous framework for quantifying the economic and ecological effects of maximum clearcut size policies. These models, a.k.a. area restriction models, are typically formulated as mixed integer programs and are hard to solve, especially if

the maximum clearcut size is large. We show how a Cutting Plane Method that the authors previously proposed can be used to attain high levels of computational efficiency even for problems with large clearcut size restrictions. We illustrate the utility of the technique by deriving a tradeoff curve between timber revenues and a series of different clearcut size restrictions for a real forest planning problem, and by performing sensitivity analyses with respect to a set of exogenous forest planning parameters such as minimum average ending age and harvest flow constraints. We find that lower maximum clearcut sizes result in reduced timber revenues and that the shape of the tradeoff is insensitive to the exogenous planning parameters. Further research is necessary to calculate landscape metrics in order to compare the economic and ecological effects of different maximum clearcut size policies.



Liam M. Stacey

### **Landscape Analysis of Factors that Foster an Invasive Ant in Chile**

liams@u.washington.edu

Advisor: Robert Gara

Previous studies have proposed several biotic and abiotic factors that might influence the spread of invasive Argentine ant, (*Linepithema humile*). Each of these factors is either a physiological constraint, or a resource. In order to elucidate how the factor, vegetation type, might foster the spread of the ant, I compared the geographic spread of the ant with position of each vegetation type in landscapes in which there is little co-variation among the factors: a mixed agro-ecosystems and coastal scrub-step of central Chile.

I mapped the invasion front of the ant in isolated mixed cover landscapes using a GPS, iterative ground searches, and Google Earth aerial photos. To compare the importance of each vegetation type, I compared distances of invasion into adjacent vegetation types.

Key findings: 1. Hedgerows of native shrub vegetation, and of mixed plantation species foster the invasion of argentine ants more than do grazed fields. 2. Mixed pine plantations, disturbed native cover, and grazed fields foster the invasion of the ant more than do intact native forests, which appear to possess biotic resistance, despite being resource rich.



Jon Klacik

### **Stand reconstructions using USGS historical records**

jklacik@uw.edu

Advisor: Lisa Nordland

My work consists of two components. The primary of these is to convert 1920's USGS forest survey records to modern day spreadsheet format, which can be used by the researchers I work for. The data site is located in southern Oregon on the historic Klamath Reservation. The other component of my project is run statistics on the duplicate transect records. These are surveys of the same transect by different surveyors. This will enable us to evaluate surveyor percent error.

To convert the data into modern software, I take scanned copies of the survey records and manually enter records into MS Access spreadsheets. Information recorded includes transect coordinates, acreage of transect, tree counts by species and diameter, dead tree counts, shrub species present and more. The trees, which have been recorded in dot tally format, are the core component of forest stand reconstruction.

For the duplicate records, my statistical work will be done by running the data through SPSS software.



Anna Clark

### **Captive Breeding as a Conservation Tool**

aclark7@u.washington.edu

Advisor: John Marzluff

Endangered species can be bred in captivity to rebuild declining wild populations. Captive breeding is often used in conservation efforts in conjunction with reintroduction. Knowledge of reproductive biology is crucial to successful captive breeding and a studbook is necessary to manage genetic data and preserve allele diversity within captive populations. Although captive breeding has limits as a conservation tool, it has been successfully used to save several species on the brink of extinction. Breeding techniques must vary between species in order to meet various reproductive requirements. However, captive breeding programs all have certain goals in common: establishing healthy and self-sustaining

captive populations, maintaining genetic diversity, protecting against inbreeding and disease, and guaranteeing consistent reproductive success.



Kim Littke

## **Effects of Soil Water and Nitrogen Availability on Douglas-fir Growth**

[littkek@gmail.com](mailto:littkek@gmail.com)

Advisor: Rob Harrison

Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) is the dominant forest plantation species in the Pacific Northwest. One reason for the dominance of Douglas-fir is that it can grow in nearly all of the varied climates and soil types of the region. Three major soil parent materials cover the western Pacific Northwest: glacial, sedimentary, and igneous. These parent materials formed over different geologic time periods and experience distinct climates over the range of Douglas-fir, which may affect soil water and nitrogen availabilities. An understanding of how these different parent materials might affect Douglas-fir growth is important to determine how productivity might differ throughout the region. At each installation, PRISM climate data was used to determine monthly precipitation and temperatures. At the center of each installation, total soil nitrogen was estimated from a one-meter deep pit. Soil water availability at each installation was estimated by particle percentages of sand and clay using the hydrometer method. Six tree cores at each installation were sampled and measured to determine earlywood, latewood, and total growth each year. Site index was estimated from King's site index equation using average tree height and breast height age. This study will determine if soil parent materials can differentiate soil water and nitrogen availability and Douglas-fir productivity in the Pacific Northwest.

## **GSS Organizing Committee**

Alina Cansler

Andrea Watts

Brook Cassell

Catherine Carter

Dave Hays

Diana Pietri

Eva Dettweiler-Robinson

Gabrielle Roesch

Jenny Knoth

Laurel James

## **This event was made possible with generous support from:**

Tom Hinckley and the School of Forest Resources

Bob Edmonds

Michelle Trudeau and Amanda Davis

Xi Sigma Pi Honor Society



## **Thank you for coming today!**

We hope you enjoyed the eighth annual School of Forest Resources Graduate Student Symposium. Please take a moment to fill out an 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!**

Visit our Website...

**[www.cfr.washington.edu/cfrgss](http://www.cfr.washington.edu/cfrgss)**

...where we will post videos of all presentations

# GRADUATE STUDENT SYMPOSIUM VISION

**“A forum for graduate students to share their research with fellow School of Forest Resources 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 Forest Resources.**

**A time for graduate students to share ideas.**

**A place for the School of Forest Resources to gather and show others the wealth of knowledge housed in these buildings.”**

