University of Washington
School of Environmental and Forest Sciences
Graduate Student Symposium

Friday March 2\textsuperscript{nd} 2018
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Acknowledgments

Dr. L. Monika Moskal

Dr. L. Monika Moskal is an Associate Professor of Remote Sensing in the School of Environmental and Forest Sciences (SEFS), within the College of the Environment. She serves as the Associate Director of SEFS, Director of the Precision Forestry Cooperative (PFC), and Director of the Remote Sensing and Geospatial Analysis Laboratory (RSGAL). She is affiliated with the UW BioEnergy IGERT, the UW Interdisciplinary PhD Program and the UW Department of Geography. She is also a Visiting Associate Professor at Keio University, Global Environmental System Leader Program, Graduate School of Science and Technology and Graduate School of Media and Governance, Japan. Dr. Moskal earned her PhD in Remote Sensing and GIS from the University of Kansas, her M.S. in Remote Sensing from the University of Calgary and her B.S. in Environmental Sciences from the University of Waterloo.

This event was made possible with the generous help and support from:

- David Campbell, Michelle Trudeau, Dr. L Monika Moskal, The Directors Office, and the various donors who have given to The Directors Office.
- Moderators: Michelle Agne, Jake Betzen, Caitlin Littlefield, Laura Nelson, and Saba Saberi.
- Previous SEFS GSS organizing committees.

GSS Organizing Committee

Michelle Agne  Laura Nelson
Jake Betzen    Alex Pane
Vivian Griffey Saba Saberi
Norah Kates   Smita Stepanova-Pednekar
Caitlin Littlefield  Lila Westreich
Schedule of Events

9:30 – 10:00 a.m. Breakfast Meet and Greet
10:00 – 10:15 a.m. Welcome by SEFS Associate Director L. Monika Moskal
10:15 – 11:00 a.m. Session I (Moderator: Saba Saber)
   10:15 Vivian Griffey
   10:30 Jacob Betzen
   10:45 Michelle Agne
   11:00 Break

11:15 – 12:15 p.m. Session II (Moderator: Michelle Agne)
   11:15 Emilio Vilanova
   11:30 Alexa Schreier
   11:45 Daniel Feinberg
   12:00 Sarah Bassing

12:15 – 1:00 p.m. Lunch
1:15 – 2:15 p.m. Session III (Moderator: Laura Nelson)
   1:15 Saba Saberi
   1:30 Oliva Sanderfoot
   1:45 Roxana Rautu
   2:00 Robbie Emmett
   2:15 Break

2:30 – 3:30 p.m. Session IV (Moderated: Jake Betzen)
   2:30 Caitlin Littlefield
   2:45 Sally Landefeld
   3:00 Ryan Garrison
   3:15 Jasna Hodzic
   3:30 Break

3:45 – 4:45 p.m. Session IV (Moderated: Caitlin Littlefield)
   3:45 Norah Kates
   4:00 Hannah A. Sipe
   4:15 Mitchell Parsons
   4:30 Mira Sytsma

4:45 – 5:00 p.m. Awards Presentation
5:30 p.m. Reception hosted by Dead Elk Society
Session I

Vivian Griffey, MS Student (Advisor: Kristiina Vogt)

Assessing forest structure and function across different land ownerships in Washington and Oregon

Ecosystem borders and socio-political borders rarely align, resulting in a mosaic of land ownerships across a given ecosystem. Forest management practices differ across ownerships and their effects may extend beyond their socio-political borders. However, little research has been done to assess the effects of management practices across an ecosystem and little foundational data exist to assess these effects. This study seeks to fill this gap by quantifying forest structure and function in Washington and Oregon and comparing these measurements across land ownerships. Forest structure will be divided into structure classes using processed airborne LiDAR data and forest function will be assessed using NDVI, an index of greenness used as a measure of forest function, derived from Landsat imagery. Land ownership classification data has been collected by previous studies. The findings of this study will improve our knowledge of the effects of land management on forests and will serve further investigation into how management and ownership differences affect carbon sequestration, habitat, and other crucial conservation goals.

Jacob Betzen, MS Student (Advisor: Patrick Tobin)

Bigleaf maple decline in Western Washington

In collaboration with the Washington State Department of Natural Resources, I am investigating the extent and severity of a recently reported decline in bigleaf maple (Acer macrophyllum). In 2010 reports from the general public, land owners, and forest land management began to reach the Washington State DNR. This prompted an exploratory survey throughout the range of bigleaf maple in Washington State, which revealed widespread decline. Symptoms of this decline include yellow flagging of large branches, small leaf size, partial or entire crown dieback, and mortality. No pathogens commonly responsible for bigleaf mortality have been found present in sufficient numbers of affected trees to indicate a main causative agent. I surveyed tenth-acre plots at a subset of the original DNR survey sites, randomized plots on public land in Western Washington. In these plots, I recorded basic forest measurements, and collected soil samples and leaf samples from healthy and declining bigleaf maple, and tree cores from a subset of bigleaf maple and douglas-fir. I will also be collecting weather, soil, and land use information from online databases. I am currently conducting elemental analysis on the leaf and soil samples, and dendrochronological analysis on the tree cores. I will attempt to statistically test whether any of the possible biotic or abiotic factors are correlated with presence and severity of bigleaf maple decline. Additionally, the temporal and spatial record of the decline’s spread and establishment, garnered from the dendrochronological analysis of the trees cores, could indicate the presence or absence of a pathological agent.
Michelle Agne, PhD Student (Advisor: Brian Harvey)

Post-fire propagule availability and regeneration following short interval fires in California closed-cone conifer forests

Evidence from terrestrial ecosystems globally indicates that climate change is eroding resilience – defined as an ecosystem’s capacity to experience a disturbance without transitioning to an alternative state. Further changes in ecosystem resilience are predicted to result from increased temperature, decreased moisture availability, and altered disturbance regimes. Warming and drying conditions are predicted to decrease propagule availability, decrease post-fire seedling recruitment, and shorten fire intervals, leading to constrained woody plant populations, particularly in ecosystems that rely on the presence of a canopy seed bank for regeneration following stand-replacing fire. However, these hypotheses have rarely been tested simultaneously with empirical data. Furthermore, how these effects are mediated by biotic factors is not well understood. I plan to investigate the following research questions using California closed-cone conifer forests as a model system for canopy seed-banking forests adapted to stand-replacing fires: 1. Do warmer, drier post-fire conditions interact with biotic factors to dampen propagule availability at multiple spatial scales? 2. Do warm, dry post-fire conditions decrease seedling establishment after accounting for pre-fire seed source? 3. Do shortened fire intervals decrease post-fire propagule availability? I will collect data on stand structure, cone abundance, and tree health from previously burned plots, spanning a range of landscape positions across varying times since last fire, within three forest types (Pinus muricata, Pinus attenuata, and Hesperocyparis sargentii) to address these research questions. The results of this research will result in a refined conceptual model of canopy seed-banking woody plant species persistence in the face of climate change.

Session II

Emilio Vilanova, PhD Student (Advisor: Greg Ettl)

A multi-decadal analysis of tree turnover and woody productivity in Venezuelan tropical forests: Insights from permanent sample plots

In this study we use data from 43 permanent plots ranging from 0.25 – 1 ha monitored from 8 to 55 years across contrasting ecological conditions of tropical forests of Venezuela, South America to: 1) investigate tree dynamics (mortality and recruitment); and 2) analyze patterns of aboveground wood productivity (AGWP). Turnover rates were significantly different (p < 0.001) among regions, with an average turnover of 1.91 ± 0.10 (SEM) % year-1, and close to average rates for other mature tropical forests. We found a weak positive relationship between Aboveground Biomass (AGB) and AWGP with Guiana Shield forests having the highest values for both variables (204.8 ± 14.3 Mg C ha-1 and 3.27 ± 0.27 Mg C ha-1 year-1), but AGB was much more strongly and negatively related to stem turnover. When grouped together, a consistent positive trend in both mortality (+ 1.26 % year-1) and recruitment
(+ 1.04 % year-1) rates were found across all plots, seasonality and soil fertility classes, but not when plots were classified into six ecological regions. A test for slope effect reveals that 78% of the plots had an increase in tree turnover, mostly influenced by a positive slope (>0) in tree mortality (80% of the plots). AGWP remained relatively constant over time (average value of 2.73 ± 0.11 – SEM - Mg C ha-1 year-1), but biomass loss from mortality has increased, mirroring the positive slope in mortality rates, causing a decline in the ‘sink’ effect affecting the positive balance in biomass change across all plots. Using Mixed Effect modelling, the analysis of the factors driving these results is currently in progress to tease apart between forest development causes and potential climatic effects.

Alexa Schreier, MS Student (Advisor: Kristiina Vogt)

The Wilderness Act in the United States: A review of designation trends, political support, and the evolution of the wilderness standard

In the 52 years since the Wilderness Act of 1964 was enacted in the United States, the National Wilderness Preservation System (NWPS) has become a cornerstone of U.S. land conservation, designating over 109 million acres of federally protected Wilderness across 44 states. This article explores the changes in legislative trends and politics that have shaped U.S. Wilderness designations from 1964-2016 through assessing the spatial patterns of Wilderness legislation relevant to biodiversity conservation, the frequency and nature of Congressional exceptions that reduce restrictions on Wilderness lands, and the role of political partisanship in American Wilderness politics. Results of this analysis show that Wilderness area designations have declined over time, seen through Wilderness designating bills, the average size of designated Wilderness areas, and the frequency of designated Wilderness areas. Additionally, the number of Congressional exceptions written into Wilderness designations have increased, including “anti-wilderness” exceptions that authorize development and resource use. Political partisanship in Wilderness politics has also grown as measured by Wilderness bill introductions and co-sponsorship. These findings highlight how Wilderness politics in the U.S. have evolved over the history of the Wilderness Act; how Wilderness politics are tightly linked to domestic political, economic, and cultural conditions; and how the federal Wilderness standard has declined with the increase of Congressional exemptions. This study concludes that while Wilderness politics have been generally successful in the U.S., there is room for improvements, such reducing political partisanship, using alternative policy approaches, increasing Wilderness designations, and harnessing broader public support to develop an ecologically representative NWPS.

Daniel Feinberg, PhD Student (Advisor: Clare Ryan)

What factors influence the quality of hazard mitigation plans in Washington State?

Hazard mitigation plans (HMPs) enable communities to prepare for natural hazards, such as earthquakes and floods, and to qualify for federal funding if a disaster occurs. These plans are particularly important as climate change increases the risk of some types of hazards, including floods. Counties in Washington
State (WA) have begun preparing for disasters through a combination of HMPs and elements of comprehensive plans. However, literature is scarce regarding the quality of these plans, and the little research that does exist suggests opportunities for improvement. The proposed study will help to fill this gap by investigating factors that may lead to higher- or lower-quality plans. Units of analysis will be county-level HMPs and planning processes in WA. Content analysis of 36 counties yielded plan quality scores, which will be examined through principal component analysis and a multilevel model of statistical relationships with predictor variables, such as indicators of collaboration, which will be collected through an online survey. Semi-structured interviews with a purposive subsample of survey respondents will qualitatively explore collaboration dynamics, as well as potential diffusion processes. Anticipated results include that counties with more collaborative planning processes will have high-quality plans and that planning strategies diffuse horizontally and vertically. This study has implications for contributing to the literature on collaborative governance and policy diffusion and for increasing decision makers' understanding of the processes that lead to high-quality plans.

Sarah Bassing, PhD Student (Advisor: Beth Gardner)

Spatiotemporal dynamics of predator-prey interactions as wolves recolonize Washington

Gray wolves (Canis lupus) began naturally recolonizing eastern Washington in 2008. As the population grows, wolf distribution is likely to expand and continue to overlap with other large predator and ungulate species. Critical to evaluating the effects of wolves on the larger ecological community, is the need to understand how prey and competing predators respond to wolf presence across the landscape. We plan to examine the spatial and temporal interactions of multiple predator and prey species across several scales to assess processes that influence co-occurrence, activity, and habitat-use patterns. We plan to deploy approximately 50 remote-sensing cameras in each study area and use photo-captures of animals to address how environmental factors and interspecific interactions influence species co-occurrence. In addition, we hope to evaluate how temporal overlap, attraction, and avoidance behaviors are influenced by the occurrence of wolves. Results from our research will hopefully improve our understanding of how recolonization of wolves influences the broader ecological community in eastern Washington and may help inform a monitoring program for wolves across the state.

Saba Saberi, MS Student (Advisor: Brian Harvey)

Do you CBI what I see? Relationships among multiple field measures of burn severity in the interior PNW and US Northern Rockies

Increasing wildfire activity across western North America raises questions about how fire regimes are changing and how forests are responding to changes. Potential alterations to fire regimes necessitate measuring and monitoring components of burn severity, and accurate quantification integral to understanding ecological effects of fires. Many studies use the Composite Burn Index (CBI) protocol,
developed primarily for calibrating satellite indices of burn severity. In CBI, burn severity is assessed in the field by averaging ordinal ocular estimates of fire effects across five vertical strata. Estimates depend on user familiarity with the forest ecosystem, creating variation in consistent CBI application. Directly quantified field measures (e.g., char cover on the forest floor, charring/scorching of vegetation, and tree mortality) have also been used in burn severity studies, but their relationships with CBI have not been widely tested. We assessed relationships between CBI and quantitative field measures of burn severity in recently burned forests across the Interior Pacific Northwest and the Greater Yellowstone Ecosystem. In summer 2017, we collected data in 87 field plots (~700 m2) that burned in 2016. Spearman Rank correlations between CBI and direct measurements ranged from r=0.48 to r=0.99. The highest correlations were between CBI and measures of canopy-tree burn severity, such as crown scorch height (r=0.99) and char height (r=0.94). Correlations between CBI were lower for variables measuring surface burn-severity, such as surface char cover (r = 0.88). Further analyses will assess relationships between remotely sensed indices of burn severity (e.g., dNBR, RdNBR, and RBR) and quantitative field measures.

Olivia Sanderfoot, PhD Student (Advisor: Beth Gardner)

*Canary in the coal mine: Quantifying the impact of exposure to health-damaging air pollutants on avian communities*

Exposure to health-damaging air pollutants is a leading contributor to the global burden of disease and leads to millions of premature deaths each year. The National Ambient Air Quality Standards (NAAQS) set by the Environmental Protection Agency (EPA) are a key component of the regulatory framework established to reduce air pollution and improve air quality in the United States. Primary NAAQS are designed to protect public health by limiting ambient concentrations of health-damaging air pollutants that have been linked to cardiovascular disease, respiratory disease, and other adverse health impacts. Secondary NAAQS are intended to protect public welfare by improving visibility and reducing damage to infrastructure, vegetation, crops, and animals. Given the limited number of studies regarding the impacts of air pollution on wildlife, it is unclear if the secondary NAAQS are sufficient to protect our nation’s rich biodiversity. Birds are likely more susceptible to the negative health effects associated with exposure to air pollutants because they respire more efficiently than any other type of terrestrial vertebrate. Surprisingly, few studies have examined the impacts of inhalation exposure to atmospheric contaminants in wild bird populations. Additional research is evidently needed to assess the sufficiency of the secondary NAAQS in protecting birds as a valued component of public welfare. To determine how exposure to reactive gases and aerosols may affect avian abundance, species richness, or species diversity, we will need to rely on methodologies from quantitative ecology, atmospheric chemistry, and epidemiology.
Roxana Rautu, MS Student (Advisor: Bernard Bormann)

**Temporal variation of stream carbon in selected reaches of the Olympic Experimental State Forest**

The wet forests of the Olympic Peninsula are highly productive, carbon-rich areas that have been extensively managed for timber production. In the wake of climate change, an accurate carbon budget is critical to guiding timber harvest planning and restoration efforts. Though extensive efforts have been made to quantify carbon in Pacific Northwest forests, little is known about the carbon in freshwater systems. The transport of dissolved organic and inorganic carbon represents a carbon loss for terrestrial systems, affecting the estimated carbon budget of a landscape. These solutes also play an important role in carbon cycling and microbial loops both in freshwater and marine ecosystems. The dissolved carbon makeup of a water system is affected on multiple temporal and spatial scales by landscape components, in-stream processing, and hydrologic connectivity, all of which are affected by management decisions. This study resolves to quantify stream carbon export of 14 reaches on the Olympic Peninsula during varying flow conditions. These reaches were chosen by the WADNR to be representative of the 50 designated watersheds in the Olympic Experimental State Forest. Samples for the calculation of total organic carbon (TOC), CO2, CH4, Gran-alkalinity, and pH will be taken for analysis during the specified “low-flow” and “high-flow” windows of time of each basin reach. The results will then be used to test the accuracy of the EPA’s VELMA hydrological model, a tool that links management scenarios and watershed characteristics.

Robbie Emmett, MS Student (Advisors: Beth Gardner and Robert Long)

**Developing an occupancy model for wide-ranging species**

Wolverines are recolonizing formerly occupied range in the continental U.S., including the Cascade Mountains. Their reliance on spring snow cover, however, makes them vulnerable to climate change, making an effective and efficient monitoring framework necessary. Given wolverines’ inherently low population density and difficulty obtaining “recaptures”, an occupancy-based monitoring method is likely to be more successful than abundance-based methods. Unfortunately, wolverines’ large home ranges violate standard occupancy model assumptions, and may result in inaccurate and imprecise occupancy estimates. Therefore, we propose a novel continuous-time dynamic occupancy model that can account for the long-distance movements and low densities of wolverines and similar species. We used simulations to test our model against competing occupancy models, and found that our model had several advantages, being generally more accurate, more precise, or faster than similar models. This model will be applied to wolverines in the Cascades and used to develop a monitoring framework, but it is also suitable for any wide-ranging species.
Session IV

Caitlin Littlefield, PhD Student (Advisor: Josh Lawler)

Connecting today’s climates to future analogs to facilitate species movement under climate change

Increasing connectivity is an important strategy for facilitating species range shifts and maintaining biodiversity in the face of climate change. To date, however, few studies have included future climate projections in efforts to prioritize areas for increasing connectivity. Here, we identify key areas likely to facilitate climate-induced species movement across western North America. Using historical climate datasets and future climate projections, we mapped potential routes between current climates and their future analogs using a novel moving-window analysis based on electrical circuit theory. In addition to tracing shifting climates, the approach accounts for landscape permeability and empirically-derived species dispersal capacities. We compared connectivity maps generated with our climate-change informed approach to maps of connectivity based solely upon the degree of human modification of the landscape. We show that including future climate projections in connectivity models substantially shifts and constrains priority areas for movement to a smaller proportion of the landscape than when climate projections are not considered. Predicted movement decreases in all ecoregions when climate projections are included, particularly when dispersal capacities are highly constrained, making climate analogs inaccessible. In addition, many areas emerge as important for connectivity only when climate change is modeled in two time steps rather than in a single time step. Our results illustrate that movement routes needed to track changing climatic conditions may differ from those that connect present-day landscapes. Incorporating future climate projections into connectivity modeling is important for conservation planners to understanding how to best facilitate successful species movement and persistence of biodiversity in a changing climate.

Sally Landefeld, PhD Student (Advisors: David Butman and Sally Brown)

Broccoli: The link between soil health and human health

Phytochemicals are vitamins and minerals produced by plants. Many phytochemicals have well-characterized health benefits such as antioxidant and anti-inflammatory activity. Many nutrients such as protein, calcium, phosphorus, iron, riboflavin, and ascorbic acid are reduced in many crops as soil quality has dwindled throughout the 20th century, in the "great nutrient collapse." Sulforaphane, a phytochemical produced by broccoli and other cruciferous vegetables, is known to prevent cancer and other chronic disease. While our understanding of its medical potential and mechanisms is an area of active and promising research, there is a knowledge gap regarding broccoli's ability to produce sulforaphane in depleted soil. My research aims to link environmental health with human health by characterizing the relationship between soil health and sulforaphane content in broccoli.
Ryan Garrison, MS Student (Advisor: Patrick Tobin)

*Optimizing management guidelines for the non-native azalea lace bug on Rhododendron species in Western Washington*

The invasive azalea lace bug, *Stephanitis pyrioides* (Scott), is the most serious insect pests of *Rhododendron* species, and especially azalea (subgenus *Azaleastrum*). Although introduced into the United States in 1915, its presence in Washington was not confirmed until 2008. Azalea lace bug causes significant decreases in plant vitality of *Rhododendron* species, reduces the aesthetic qualities of the plant, and in severe infestations can cause plant death. Past research on this insect has been largely conducted in the eastern United States, which has only limited applicability to Western Washington. To date, there is virtually no research on how this insect will behave in Western Washington and how it will affect *Rhododendron* species that are available in the Pacific Northwest. This research addresses these information gaps by studying azalea lace bug seasonality in Western Washington, allowing for field verification of laboratory models. To date very few of the hundreds of *Rhododendron* species and cultivars have been tested for susceptibility. This research will address this gap by measuring the susceptibility of several *Rhododendron* species, when growing in Western Washington, to azalea lace bug attack.

Jasna Hodzic, MS Student (Advisor: Jon Bakker)

*Bridging ecology and physiology to examine host plant preference in root hemiparasites*

Parasitic angiosperms are ubiquitous but understudied, representing nearly 3,000 species across 200 genera. Parasitic plants form haustoria, structures that attach to the vascular root tissue of their hosts. Hemiparasites, parasitic plants that are photosynthetically active, are unique in that they simultaneously parasitize and compete with co-occurring plants. *Castilleja levisecta* (golden paintbrush) and *Castilleja hispida* (harsh paintbrush) are facultative hemiparasites; while *Castilleja levisecta* is endemic to prairies of the Pacific Northwest and has been federally listed as threatened since 1997, *Castilleja hispida* is widespread throughout North America. *Castilleja* can parasitize many different hosts, and host identity directly influences its survival, growth, and fitness. After evaluating more than a dozen hosts, we have found *Achillea millefolium* (yarrow) to be one of the best. Active research is focusing on the physiological mechanisms that underlie differences in host preference in both *Castilleja* species. In a series of greenhouse studies, we are currently analyzing differences in root and haustoria development of *Castilleja* while it is parasitizing different host species. Haustoria connections with different host plants has been analyzed anatomically to determine whether some hosts are able to resist haustoria formation. Stable isotope tracing has shown that nitrogen amount does not vary with host identity, suggesting it is not as important in influencing host plant quality as has been suggested previously. A similar project will be conducted to trace the movement of host-derived carbon. Finally, I am currently researching whether bacterial endophytes can be transferred from the host to the hemiparasite.
Session V

Norah Kates, MS Student (Advisor: Sally Brown)

Combining water treatment residuals and organic compost to improve bioretention soil mixtures’ ability to hold phosphorus

Bioretention soil mixtures (BSMs) incorporate components with varying properties beneficial for treating stormwater: good drainage, adsorption of contaminants, and often the ability to support plant life. These properties may be in opposition to each other and need to be balanced in a successful overall system. We matched the phosphorus-leaching capacity of organic composts used in bioretention soil mixtures (BSMs) with the phosphorus-adsorption capacity of water treatment residuals. By incorporating this readily-available waste product from drinking water treatment, we hope to offer a way to effectively bind environmentally relevant phosphorus in bioretention systems, reducing the amount of phosphorus that makes its way into local waterways. We tested different water treatment residuals and composts in the lab to determine their individual contributions to dissolved phosphorus in BSM leachate, and will scale up proposed combinations in a greenhouse column study using both components in the BSM, which will also be tested in their ability to support plant growth. Initial findings suggest that a phosphorus saturation ratio (PSR), previously found to be a good predictor of environmentally relevant phosphorus in solution, may hold for these mixes as well. As municipalities increasingly look to bioretention systems to help handle excess stormwater, we strongly encourage prescriptive calculations be used to ensure high functioning BSMs.

Hannah A. Sipe, MS Student (Advisor: Sarah Converse)

Common loons in Washington: Understanding their distribution and improving survey design

The common loon (Gavia immer) is a migratory diving bird, spending summers breeding on secluded lakes and winters in marine waters. Washington state has listed the common loon as a State Sensitive species, although little is known about the distribution within the state or the factors affecting distribution. Multi-state occupancy models offer a flexible framework for estimating the occupancy probabilities of breeding and non-breeding common loons in the state while also accounting for missing observations, multiple seasons, and variability in detection over space and time. Factors influencing occupancy and detection are identified by allowing occupancy and detection parameters to be functions of covariate information. Lake morphology (e.g. size and perimeter) and fish assemblage data (e.g. stocking size and presence of naturally reproducing populations) are covariates hypothesized to influence occupancy of breeding and non-breeding common loons. State survey data provide breeding, non-breeding, and non-detection observations, whereas opportunistic eBird observations provide a large quantity of detection and non-detection observations covering a larger spatial and temporal scale than state survey data. The two data types will be integrated, and a Bayesian hierarchical occupancy model will be fit to the data. The results will allow predictions of where breeding common loons are likely to occur but have previously not been detected by monitoring efforts. In addition, the results from the multi-state occupancy model will be utilized to optimize a state survey design using resources available.
Mitchell Parsons, MS Student (Advisor: Laura Prugh)

Effects of species interactions on habitat use of reintroduced fishers in the South Cascades

Habitat use patterns are affected by both resource requirements and species interactions. Two common species interactions that influence habitat use are competition and predation. Mesopredators exist in a unique situation where their competitors and predators are often the same species. This is the case for fishers (Pekania pennanti), a medium member of the weasel family and a species of conservation concern in Washington. Fishers require structurally diverse forest, but also compete with and can be preyed on by coyotes (Canis latrans) and bobcats (Lynx rufa). We examined the habitat use of a reintroduced population of fishers in the South Cascades of Washington, assessing how habitat use decisions are affected by landscape features and species interactions. Using occupancy models and resource selection functions, we found that fishers select habitats based on forest conditions, prey availability, and competitor/predator presence. Fishers had higher probability of habitat use in locations with larger trees, higher predicted probability of snowshoe hare (Lepus americanus) presence, and lower probability of bobcat habitat use. Bobcat and coyote habitat use probabilities were negatively correlated, suggesting that fishers must make tradeoffs regarding species interactions. Our findings can be used to understand habitat use of an endangered species in Washington, manage landscapes to accelerate their recovery, and to plan future reintroduction efforts in the state.

Mira Sytsma, MS Student (Advisor: Laura Prugh)

Wildlife response to tourism in Glacier Bay National Park, AK

Visitation to Glacier Bay National Park (GLBA) has nearly doubled in the past 20 years, and many visitors are especially interested in activities that allow them to explore the shorelines of the park, potentially leading to undocumented impacts on wildlife activity patterns and space use. We used 40 remote cameras installed at 10 study sites that were categorized as either areas where tour vessels drop off tourists on the shore (treatment), or areas where the vessels do not drop off tourists (control). The sites were paired based on similar habitat and successional age, and treatment/control sites were switched halfway through the summer to determine whether wildlife occupancy patterns changed. There were 81,428 photos of wildlife and humans taken during the summer of 2017 that were incorporated as presence absence data into an occupancy model that includes human use/non-human use and shore/inland covariates to understand how tourist visitation to the shorelines of GLBA impacts wildlife. Preliminary photo analysis showed fewer wildlife photos were taken in the west arm of the park than the east arm, including zero detections of wolves or coyotes in the west arm compared to an average of 32 wolf photos per site and 83 coyote photos per site in the east arm. Additionally, statistical analysis of photos provided evidence to suggest that the number of photos of humans taken is negatively correlated with the number of brown bear, black bear, wolf, and coyote photos taken. Preliminary results of the occupancy modeling will be presented.
Thank you for attending the 15th annual School of Environmental and Forest Sciences Graduate Student Symposium. Please take a moment to fill out an evaluation form (located on the table near the entrance) for each student presentation. Your constructive feedback and insights will help presenters refine their research approaches and hone their presentation skills.