SCIENCE COMMUNICATION FOR SOCIETY

2017
PROGRAM

WESTERN FORESTRY GRADUATE RESEARCH SYMPOSIUM

WELCOME TO THE 2017 WESTERN FORESTRY GRADUATE RESEARCH SYMPOSIUM

The annual Western Forestry Graduate Research Symposium (WFGRS), hosted by Oregon State University's College of Forestry, showcases current graduate student research. The purpose of this symposium is to foster educational opportunities, community building, and academic excellence by providing a space for students to present their work to their university community. This event offers graduate students a forum to receive feedback on their proposed and current research, fostering student engagement, enthusiasm, and interdisciplinary collaboration.

In addition to featuring cultural geographer Teresa Cavazos Cohn as this year's keynote speaker, we are delighted to share oral and poster presentations by graduate student researchers on a variety of interesting subjects. Topics stretch across the realm of forest management, products, ecology and human dimensions. This year's participants communicate an array of research spanning all three departments of the College of Forestry: Forest Ecosystems and Society (FES), Forest Engineering, Resources and Management (FERM), and Wood Science and Engineering (WSE).

While WFGRS is a student-organized event, it would not be possible without generous support from the College of Forestry. The organizing committee would like to thank Dr. Thomas Maness (Dean of the College of Forestry), Dr. Anthony Davis (Associate Dean of Research), Dr. Lisa Ganio (Graduate Program Director), and the department heads of FERM, FES and WSE. Additionally, this year's symposium was preceded by a series of workshops on science communication designed and led by Francisco Guerrero, Marion Rossi, and Nick Houtman. We would also like to thank this year's keynote speaker, Teresa Cavazos Cohn, and the many other students, staff, faculty and research associates who volunteered their time to make this event possible.

We welcome you to enjoy the symposium and invite you to share in the success of the graduate students' research efforts, as well as this year's theme: science communication for society.

Student Organizers

Alexander Rose
Allison Swartz
Emily Heaston
Gretchen Engbring
Julia Olszewski
Karla Jarecke
Kayla Johnston
Karin Kralicek
Pipiet Larasatie
Preston Green

SYMPOSIUM SCHEDULE

Friday, April 21st, 2017 | Oregon State university, Memorial Union

	Allworth Conference Rm 207		**Asian Pacific American Rm 206**
8:30	Coffee, Tea & Pastries		Registration for Presenters
	La Raza Rm 208		
9:00	Opening Remarks & Keynote Speaker - Teresa Cavazos Cohn		
10:00	Workshop - The Future of Forestry: Challenges and Opportunities		
	La Raza Rm 208		**Asian Pacific American Rm 206**
11:30	1. Topographic influences on soil moisture availability in the Western Cascades | Karla Jarecke		2. Moderate changes in light influence biota in forested headwater streams | Emily Heaston
11:45	Transition		Transition
11:50	3. Restoration with bluebunch wheatgrass: seed production phenology | Kathryn Alexander		4. Public perceptions of tall wood buildings | Pipiet Larasatie, Jose Guerrero, Kendall Conroy
12:05	Transition		Transition
12:10	5. Douglas-fir seedlings in the Pacific Northwest: The genetics of drought hardiness | Erda Celer		6. The role of strategy in exceptional small forest management | Julian Geisel
12:25	Transition		Transition
	American Indian Rm 211	**MLK Jr. Rm 212**	**Pan-Afrikan Sankofa Rm 213**
12:30	Poster Session	Lunch	Poster Session
	La Raza Rm 208		**Asian Pacific American Rm 206**
1:30	7. Simulation of Douglas-fir realized gain trials using genetic multipliers in ORGANON | Sukhyun Joo		8. Discovering the historical culture of spalted wood in Spain | Patricia Vega Gutiérrez
1:45	Transition		Transition
1:50	9. Long term effects of vegetation management in the PNW: Assessment of biomass stock and net primary productivity responses of four coniferous species | Herman Flamenco		10. A comparative analysis of stream water nitrogen and phosphorus responses to precipitation events in a forested Oregon Coast Range watershed | Casey L. Steadman
2:05	Transition		Transition
2:10	11. Exploring the constraints of the use and management of school forests in South Korea | Hyun Jung Hong		12. Abundance of three specialist predators of the hemlock woolly adelgid in the Pacific Northwest | Alexander Rose
2:25	Transition		Transition
2:30	13. Assessing the effect of pacific marten habitat reserves on wildfire exposure in the Northern Sierra Nevada | Kevin Credo		14. Drawing inferences on the effect of price, income, population and internet use on global demand of forest products | Rafal Chudy
2:45	Transition		Transition
2:50	15. Continuing professional education in green infrastructure: A constructivist approach to interdisciplinary trainings | Christine M. Johnson		16. Too cold to eat! How do abiotic factors affect black-capped chickadee's daily feeder visitation? | Janel Lajoie
3:05	Transition		Transition
3:10	17. Dead forest burning: The influence of beetle outbreaks on fire severity in lodgepole pine forest of British Columbia | Anna Talucci		18. Equitable engagement?: Constraints and place attachment of diverse groups in Portland parks | Jaclyn R. Rushing
3:25	Transition		Transition
3:30	19. Modeling alternatives for the conservation of large wood in riparian and aquatic ecosystems of the Oregon Coast Range | Deanne Carlson		20. Comparison of nocturnal and diurnal summer rest structures used by Pacific martens in Lassen National Forest, California | Patrick J. Tweedy
3:45	Transition		Transition
3:50	21. The economics of biomass logistics and conversion facility mobility | Michael Berry		
	American Indian Rm 211		
4:10	World Café Discussion - Refreshments provided		
5:10	Closing Remarks		
	McMenamins at 2001 NW Monroe Avenue		
6:00	Mixer & Awards (top oral and poster presentations to be announced at 6:30 pm)		

KEYNOTE SPEAKER: TERESA CAVZOS COHN

9:00 am in the Memorial Union La Raza Room 208

Teresa Cavazos Cohn is a cultural geographer and professor of Science Communication at the University of Idaho's McCall Field Campus. If not an anti-disciplinarian, Teresa is an interdisciplinarian, who has taught in both Earth Sciences and Environmental Humanities programs, and draws from techniques used in both. Her research includes hydrosocial relationships (with emphasis on Indigenous water issues), culturally-relevant STEM education, and science communication.

Within the field of science communication, Teresa is particularly interested in the role of storytelling in science communication and the environment, and the diversity of its audiences and voices. She explores collaborations between disciplines–such as poets and chemists, or musicians and remote sensors–but also the ways in which science communication supports the creative core of scientists. This creative engagement in the critical issues of our time may be, in physicist David Bohm's words on creativity, "the most important thing to be done in the circumstances in which humanity now finds itself."

In addition to building the science communication program at the UI McCall Outdoor Science School, Teresa works with NASA's Earth to Sky/ABoVE climate change communication program in Canada's Northwest Territories; the USGS Northwest Climate Science Center-MOSS climate fellows program; and with Northern Arapaho educators on digital storytelling and science initiatives.

THE FUTURE OF FORESTRY: CHALLENGES & OPPORTUNITIES

10:00 am in the Memorial Union La Raza Room 208

Join the College of Forestry International Programs Office and many of the College's international students in this globally-oriented workshop on challenges and opportunities facing forestry.

WORLD CAFÉ DISCUSSION

4:10 pm in the Memorial Union American Indian Room 211

The 'World Café' discussion method is a unique way to host large, group dialogue. Attendees at WFGRS this year will have the opportunity to participate in a world café-style discussion hour centered on this year's theme: science communication for society. Divided into smaller groups and offered questions to facilitate conversation over a series of rounds, participants will have a unique opportunity to engage with students, staff and faculty at the college. We encourage attendance at this event designed to build community, facilitate networking, and share ideas and experiences.

ORAL PRESENTATIONS

1. Topographic influences on soil moisture availability in the Western Cascades

Karla M. Jarecke[1], Kevin D. Bladon[2], and Steven M. Wondzell[3]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Department of Forest Engineering and Resource Management, Oregon State University
3 Pacific Northwest Research Station

Hillslope ecohydrological processes, including subsurface water flow and plant water uptake, are strongly influenced by soil moisture. However, the factors controlling the spatial and temporal variability of soil moisture in steep, mountainous terrain are poorly understood. We asked: How does topographic position control soil moisture availability and variability in steep, highly dissected terrain of the Western Cascades? We hypothesized that soil moisture availability would differ on convergent (concave) versus divergent (convex) hillslopes due to topographically-induced differences in soil properties and upslope water subsidies. Additionally, we expected that topographic position would play a lesser role in driving soil moisture dynamics during seasonally dry periods compared to seasonally wet periods. To address our question, we established 54 soil moisture monitoring sites on alternating convergent and divergent hillslopes within a 0.1 km2 sub-catchment area of the H.J. Andrews Experimental Forest in western Oregon. We used a Topographic Position Index (TPI) to identify convergent and divergent hillslopes restricted to north-facing aspects and 25-55 degree slopes. TPI was calculated from a one meter digital elevation model as the difference between the elevation of each grid cell and the average elevation within a 30 m radius of that cell. We positioned soil moisture monitoring sites in low, mid, and upper hillslope locations. We returned to the site every 2-4 weeks from July to November, 2016 to measure volumetric water content at 0-30 and 30-60 cm depth. Preliminary results suggested similar soil moisture availability on convergent and divergent hillslopes for shallow (0-30 cm) soil, but greater soil moisture availability on divergent hillslopes for deep (30-60 cm) soil. By comparing the spatiotemporal variability of hillslope soil moisture across topographic positions, our research will inform additional hypotheses regarding subsurface water flow processes and plant-available soil-water in forests with steep, highly dissected terrain.

2. Moderate changes in light influence biota in forested headwater streams

Emily Heaston[1] and Dana Warren[1]
1 Department of Forest, Ecosystems and Society, Oregon State University

Light availability is an important factor controlling autotrophic productivity, and in turn food web dynamics and nutrient processing in many ecosystems. The amount of light reaching a forested headwater stream is directly influenced by the structure of the riparian vegetation and riparian canopy. Riparian cover can therefore have direct effects on ecosystem functions and trophic interactions. Experimental studies removing all riparian vegetation have clearly demonstrated the importance of riparian shading and light availability on stream primary production, with implications for bottom-up drivers of fish abundance in the stream. However, these experimental manipulations do not necessarily reflect the natural light environment of streams or the kinds of changes in stream light that are expected in the future. This study explores how a moderate decrease in stream light affects biomass in the stream food web. We experimentally manipulated stream channel light in three replicate streams in the HJ Andrews Experimental Forest, in the western Cascade Mountains by creating patches of shade along a

reach and evaluated how periphyton, invertebrates, and fish responded in the manipulated reach relative to the reference reach in a BACI (Before-After Control-Impact) study design. We compared ecosystem sampling data from before (2014) and during (2016) the shading treatment in these streams to explore the direct changes in in-stream biota while moderately decreasing light availability. Shading manipulations in 2016 resulted in an average decrease of in-stream algae, invertebrate, and trout biomass from before shading, in 2014, in manipulation reaches with respect to reference reaches. Even with moderate, patchy decreases in light we saw a decrease in stream biota that transferred throughout all trophic levels. With further analysis of primary productivity and macroinvertebrates in progress, this research continues to develop our understanding of how light availability can directly shape ecosystems.

3. Restoration with Bluebunch Wheatgrass: Seed Production Phenology

Kathryn Alexander[1], Matt Orr[2], and Holly Prendeville[3]
1 Department of Forest Ecosystems & Society, Oregon State University
2 Department of Biology, Oregon State University-Cascades
3 USDA Forest Service, Pacific Northwest Research Station

In the Great Basin, shifts away from native-perennial to invasive annual-grass dominated systems have reduced biodiversity, increased wildfires, and expedited desertification. In an effort to enhance restoration success, seed transfer zones have been designed to assure that populations sourced for restoration are locally adapted to conditions at the restored site. Once seed zones are identified, plants are sourced for restoration within the seed zone that corresponds the restored site. Although seed zone delineation provides guidance on where to source propagules for restoration, it often does not provide growers with crucial information about the timing or duration of anthesis, dispersal, and seed ripening. Bluebunch wheatgrass (Pseudoroegneria spicata) is a commonly used native species in restoration for which seed transfer zones have been empirically delineated. In order to supply the volume of zone-specific seed needed to restore bunchgrass communities in the Great Basin, a better understanding of the seed production phenology of bluebunch wheatgrass is needed. In our study, anthesis through seed-dispersal stages were monitored at a common garden near the Crooked River Grasslands containing as many as 20 adult individuals from 39 populations (depending on survival) sourced from seed zones 1, 3A, 4, 5, 6A, 6B, 7A, and 7B. Every four days, each plant in the common garden was scored on its progression from flowering through seed dispersal stages. The data were analyzed using non-parametric time to event analysis. Our results indicate that the temporal pattern of anthesis, ripening, and dispersal stages differ significantly among zones and that in some cases, significant differences in the timing of seed ripening and dispersal occurred among populations within zones. This knowledge will enable growers to cater their production systems to zone-specific seed production dynamics thereby meeting restoration goals.

4. Public perceptions of tall wood buildings

Pipiet Larasatie[1], Jose Guerrero[1], Kendall Conroy[1], Troy Hall[2], and Eric Hansen[1]
1 Department of Wood Science and Engineering, Oregon State University
2 Department of Forest Ecosystems and Society, Oregon State University

The built environment accounts for much of the United States' resource consumption. Being able to build with a renewable resource, such as wood beams, columns, and panels, has the potential to increase the sustainability of tall buildings, and the overall built environment. The purpose of this 2-phase study is to understand public perceptions of tall wood buildings (TWBs). The first phase (reported here) entailed 27 qualitative interviews with a convenience sample of Corvallis, OR, residents, to better understand people's opinions and main concerns

regarding TWBs. The second phase will use an online panel to survey people who currently live or work in US Pacific Northwest metropolitan areas about various dimensions of their perceptions of buildings made from wood. Overall most of respondents had a positive perception of the use of wood as the main material in tall buildings and to the adoption of TWBs in the United States. Respondents argued that having TWBs will be valuable because they look nice, are environmentally friendly, have fewer emissions, and wood is a renewable material. While no one expressed an overall negative perception of TWBs, they did express negative perceptions of aspects of TWBs, such as hesitation on safety, the amount of wood that will be required, possible deforestation, unsustainable management of forest resources, fire performance, structural strength, durability, stability, and safety of the tall wood buildings. A limitation this phase of our research is that we only interviewed people in Corvallis, OR. Understanding the public's perception of tall wood buildings in the Pacific Northwest is the first step to creating a wood-based construction culture, development of a TWB market, and a more sustainable and environmentally friendly built environment in the United States.

5. Douglas-fir seedlings in the Pacific Northwest: The genetics of drought hardiness

Erda Celer[1] and Glenn T. Howe[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Douglas-fir (*Pseudotsuga menziesii*) is a widely distributed, ecologically important, and commercially valuable tree species in North America. Recent studies indicate that climate change is likely to adversely impact the adaptability of Douglas-fir, and consequently, assisted migration may become a necessary tool to mitigate the impacts of climate change. This work seeks to understand the genetics of drought hardiness so that forest resources can be better managed to deal with the potential effects of global climate change. Over 10,000 Douglas-fir seedlings from 429 families were considered in an experiment conducted in southern Oregon. A number of variables including growth traits (height), second flushing, spring bud flush, foliage damage, stem damage, leader damage, and mortality were measured, and a genecological approach was used to explore the evolution of genetic variation in drought adaptation traits in Douglas-fir. Mixed effects and regressions models were used to predict breeding values and create selection indices that may help to increase genetic gain. Climate characteristics at the seed sources were obtained using ClimateNA. The results of this study indicate that seedlings grown in hotter and drier site grew less, were more damaged, and had greater mortality than the trees grown in wetter and colder site. Furthermore, we found clear evidence of adaptive genetic variation for drought adaptation traits, and therefore, genetic variation should be carefully considered for reforestation. Although drought adaptation traits were correlated as expected, the results show that these associations differed between plantations. This form of genotype-by-environment interaction can be partially explained due to the highly contrasting temperature and moisture conditions at the two sites.

6. The role of strategy in exceptional small forest management

Julian Geisel[12], Ethan Stroup[2], Eric Hansen[2], and Klaus Puettmann[1]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Department of Wood Science and Engineering, Oregon State University

Most owners of small forests do not consider their 20-200ac forest as source for a significant and continuous contribution to their livelihoods, and ownership goals vary from a focus on conservation to high commodity production. Small private forests make up a sizeable share of total forests in Oregon and potential contributions to habitat and marketable products are significant. To find out why generating income while maintaining diverse forests on a

continuous basis works only in exceptional cases, we conducted 6 case studies and drew on established and novel qualitative and quantitative sources of data. After comparing words to numbers (interviews to field measurements) through the lens of strategy, we identified the following factors as common among our cases: a diverse mix of income streams (portfolios), supported by affluence, personal skill and labor, lifelong learning, and the ability to think many decades ahead. The latter two factors suggested that while younger managers are physically capable managers, they lack the crucial experience to realize their forest's potential. A problem that could be remedied through dedicated mentoring. We concluded that the management of income-generating and diverse forests requires constant and ongoing voluntary, personal physical and mental dedication of the owner. The more completely the owner is able to embrace the non-monetary benefits of this commitment, the more suitable she will be for small forest management. While not all cases were strategic in their management, the theoretical framework associated with strategy was very applicable.

7. Simulation of Douglas-fir realized gain trials using genetic multipliers in ORGANON

Sukhyun Joo[1], Doug Maguire[1], and Keith Jayawickrama[2]
1 Department of Forest Engineering, Resources and Management, Oregon State University
2 Department of Forest Ecosystems and Society, Oregon State University

Realized gain trials test how well gains predicted from individual-tree growth in progeny tests translate into stand yield gains at rotation age. Estimating volume gains in improved stands at rotation age is challenging because first-generation progeny tests in Douglas-fir were typically established to measure relative growth performance of individual trees from open-pollinated parent trees. The objectives of our study are: 1) to simulate genetic gain in volume at rotation age from genetically-selected Douglas-fir trees using ORGANON genetic gain multipliers; and 2) compare these simulated genetic gains to volume growth on realized gain trials. The realized gain trials were established at five sites in 1997 using three-year-old seedlings representing three genetic improvement levels (elite, intermediate, and woods-run). At each site, six whole-plots planted on a 3.6 × 3.6-m spacing were further divided into three split-plots receiving one of the three genetic improvement levels. Realized gain trials were simulated with ORGANON from age 8 to 50 and age 15 to 50 under the three levels of genetic improvement: elite (7.8% and 11.2% genetic gain in height and diameter, respectively, from age 8 to 50 years; 5.7% and 5.2 % genetic gain in height and diameter, respectively, from age 15 to 50 years), intermediate (6.1% and 8.4% genetic gain in height and diameter, respectively, from age 8 to 50; 4.1% and 5.2% genetic gain in height and diameter, respectively, from age 15 to 50 years), and woods-run (0% genetic gain in height and diameter from ages 8 to 50 and 15 to 50 years). Projecting growth of Douglas-fir realized gain trials with genetic multipliers in ORGANON provides a first approximation to volume yield gains at rotation age until realized gain trials mature.

8. Discovering the historical culture of spalted wood in Spain

Patricia Vega Gutiérrez[1] and Sara C. Robinson[1]
1 Department of Wood Science and Engineering, College of Forestry, Oregon State University

This study looks for the presence of spalted wood in pieces belonging to the Habsburg era in Spain during the 16th century during the period of the apogee of *Gesägte intarsia* in Europe. In order to determine the possible exposure of South American crafters to *intarsia* and the use of two types of spalted wood: zone lines and wood pigmented by *Chlorociboria sp.*, pieces belonging to the Habsburg era were located in diverse historical sites in Spain and identified using macroscopic characteristics. South American collections showed the presence of spalted

wood in pieces produced after the 18th century. The connection between both eras is explained in terms of material availability and guilds organization.

9. Long term effects of vegetation management in the PNW: Assessment of biomass stock and net primary productivity responses of four coniferous species

Herman Flamenco[1], Maxwell Wightman[1], and Carlos Gonzalez-Benecke[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Currently the Vegetation Management Research Cooperative (VMRC) at Oregon State University has two CTP (Critical Period Threshold) studies with 15-16 years of monitoring data on different conifer species (Douglas-fir, western redcedar, western hemlock, and grand fir), in sites located in Coastal range and Piedmont of Cascade Mountains. These studies provide a unique opportunity to evaluate long-term responses to intensive vegetation management treatments, assessing differences across species as well as differences across sites. Even though responses in basal area and volume per acre are well documented for these studies, we do not know the long-term impact of these treatments on total ecosystem productivity and stand sustainability. An effective way to estimate that response is by evaluating aboveground net primary productivity (ANPP, Mg ha-1 year-1) or total biomass stock (including soil, forest floor and competing vegetation biomass). On both sites we measured litterfall, tree biomass, understory biomass, forest floor and soil organic matter in two contrasting VM treatments.

10. A comparative analysis of stream water nitrogen and phosphorus responses to precipitation events in a forested Oregon Coast Range watershed

Casey L. Steadman[1], Kevin D. Bladon[1], Alba Argerich[1], and Sherri L. Johnson[2]
1 Department of Forest Engineering, Resources, and Management, Oregon State University
2 Pacific Northwest Research Station, United States Forest Service, Corvallis, OR

Headwater streams play a pivotal role in the ecological state of rivers downstream yet we lack data pertaining to the natural variability of nutrients in these streams. Considering the critical environmental issue of increasing nitrogen (N) and phosphorus (P) fluxes through river systems, it is essential to improve understanding of the primary drivers of these limiting nutrients. Precipitation events serve to mobilize large proportions of nutrients in watersheds and studies show that the responses of N and P to precipitation and hydrologic activity can differ dramatically. Furthermore, whether a precipitation event is preceded by wet or dry conditions can influence hydrologic activity and whether solutes are transported to the stream. In this study, we analyzed the response of stream water nutrients to storm events to assess the influence of precipitation, antecedent conditions, and hydrologic activity. In 2010 we collected climate and hydrology data as well as water chemistry samples during storm events across four catchments in the Trask Paired Watershed Study (coastal Oregon). Preliminary data analysis reveal that dissolved inorganic nitrogen (DIN) shows the strongest seasonal variation when the catchment is wetting up following the dry season. It is also during this season that DIN shows the strongest correlation to cumulative 28-day antecedent precipitation index across three of the four sites (Pothole Ck r^2= .49; Gus Cr r^2= .57; and Rock Ck r^2= .51). Soluble reactive phosphorus (SRP) exhibits less seasonal variation compared to DIN. However, in one of the four sites (Pothole Ck), correlations between SRP and 28-day antecedent precipitation index (r^2= .52) as well as SRP and discharge (r^2 = .46) are strongest and distinct when the catchment is wetting up.

11. Exploring the constraints of the use and management of school forests in South Korea

Hyun Jung Hong[1]
1 Forest Ecosystems and Society, Oregon State University

In general, school forests in South Korea provide natural environments for schools and neighborhoods, and they promote experience in nature for students and residents. The Korea Forest Service (KFS) manages school forest policy. After the KFS and local governments create school forests, the management of school forests transfers to the host schools. For this reason, schools are responsible for school forest management with the assistance of local governments. Some studies suggest that experiences in school forests positively affect student temperament. However, little is known about how schoolteachers use school forests or how school forests are managed. This study addressed the knowledge gap by exploring schoolteachers' opinions on school forests. Data were obtained from an online survey of schoolteachers in South Korea (n = 149). This survey found that schoolteachers frequently visit school forests, which means their problems with the use of school forests, such as lack of planning time, do not prevent them from visiting school forests. Furthermore, the results indicated that school forests are well managed. However, schools experienced a lack of maintenance funding and a lack of expert advice in management. The KFS and local governments can use these results to support school forests for management.

12. Abundance of three specialist predators of the hemlock woolly adelgid in the Pacific Northwest

Alexander Rose[1], Darrell Ross[1], and Kimberly Wallin[2]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Rubenstein School of Environment and Natural Resources, University of Vermont,

The hemlock woolly adelgid (Hemiptera: Adelgidae: *Adelges tsugae*; HWA) is an invasive and damaging pest on hemlock in eastern North America, but is native to the Pacific Northwest. In support of classical biological control of HWA, abundances of native predators on HWA in the Pacific Northwest were assessed in an observational study. HWA and its predators were counted and identified on branch samples from western hemlock (Pinaceae: *Tsuga heterophylla*) in the Puget Sound area. Species densities were calculated on a per-centimeter basis. Two species of cryptic congeners, silver flies (Diptera: Chamaemyiidae: *Leucopis argenticollis* and *Le. piniperda*), were innovatively identified using DNA sequencing. More individuals of the two *Leucopis* spp. were found than the next most abundant predator, a beetle (Coleoptera: Derodontidae: *Laricobius nigrinus*). *Leucopis argenticollis* was more abundant than *Le. piniperda*. Since site was found to be non-significant as a factor in explaining mean cumulative species densities (one-way ANOVAs: F-values < 3; d.f. = 3,21, p-values > 0.07), densities were related across sites in further analysis. Pearson's product-moment correlations of HWA and *La. nigrinus* densities were non-significant, while HWA and *Leucopis* spp. densities were positively correlated (e.g., for combined *Leucopis* densities, t-value = 2.29; d.f. = 23; p-value = 0.016; 95% CI= 0.11 to 1; estimated correlation = 0.43). Combined *Leucopis* spp. and *La. nigrinus* densities were weakly negatively correlated (t-value = -1.93; d.f. = 23; p-value = 0.033; 95% CI = -1 to -0.042; estimated correlation = -0.37). *Leucopis argenticollis* and *Le. piniperda* densities were negatively correlated (Spearman's rank correlation coefficient: rho = -0.34; d.f. = 23; p-value = 0.049). These results recommend further study of the *Leucopis* spp. for potential introduction as biocontrols of HWA in eastern North America, with the possible precaution of only using *Le. argenticollis* so as to avoid hypothetical competition between the two congeners.

13. Assessing the effect of pacific marten habitat reserves on wildfire exposure in the Northern Sierra Nevada

Kevin Credo[1] and John Bailey[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Forest managers are challenged to restore resilience in forests with an elevated risk of stand-replacing fire by using mechanical treatments and prescribed fire. However, implementation of such treatments can be constrained by mandates to conserve sensitive wildlife species like the Pacific marten, a small forest carnivore whose distribution in the Sierra Nevada is fragmented due to management history and land use changes. Martens avoid open and simplified stands created by some management activities, but the long-term comparative risk to this species of increased wildfire versus fuel reduction treatments is not clear. This research will examine the trajectories of crown fire potential and Pacific marten habitat over a 30-year period following fuel treatment in Lassen National Forest. We will simulate the effects of treatments at two scales: on representative stands selected by vegetation type and management history, and on two planning units (~75 km^2) with documented marten presence. Four treatment scenarios will be implemented at each scale: no treatment; prescribed underburn only; light thinning from below with underburn; and heavy thinning from below with underburn. Additionally, at the planning unit level 0 to 70% treatment of each unit will be simulated at 10% increments, and growth will be simulated with and without a large fire after 5 years. We hypothesize that enduring changes in crown fire potential following treatment correspond to an extended period of marten exclusion, because removing intermediate canopy fuels also removes cover required by martens for foraging and reproduction. At the planning unit scale, we expect that the overall effect of fuel treatments on marten habitat quality hinges on the presence/absence of stand-replacing wildfire. This study will provide a scientific basis for comparing the costs and benefits to Pacific martens of specific fuel treatment projects, and inform the design of management plans to conserve martens across the landscape.

14. Drawing inferences on the effect of price, income, population and internet use on global demand of forest products

Rafal Chudy[1], Gregory Latta[2], and Greyson Nyamoga[1]
1 Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences
2 Department of Natural Resources and Society, University of Idaho

Projections of future forest products demand are key components in forest sector outlook studies. Income elasticities based on gross domestic product (GDP) have long been the primary mechanism for determining shifts in this demand. Studies estimating income elasticities date back to the late 1970's yet limitations in both data availability and computing capacity elasticities for individual countries have been never reported comprehensively. Moreover, some studies divide what time series is available into multiple periods, thus lowering the number of observations and statistical strength of their findings. Other studies have grouped countries either by region or income level and reported disaggregated elasticity estimates for selected individual countries. In some cases, forest products have been either highly aggregated or omitted altogether. Among those omissions is typically fuelwood or charcoal which is a particularly important global forest product in developing economies. The objective of this study is to examine price, income (per capita GDP) and internet use elasticities for countries separately, and compare them to elasticities based on grouped countries. We group countries either based on income level, geographical location, or as provided by IPCC or FAO. We also examine different options for categorizing related forest products. We estimate the elasticities using seemingly unrelated regression, taking into account the correlation error between countries and products. We also utilize macroeconomic indicators for the IPCC shared

socioeconomic pathways to highlight how projections of future forest products demand based on our elasticities differ from prior estimates for selected country and product combinations.

15. Continuing professional education in green infrastructure: A constructivist approach to interdisciplinary trainings

Christine M. Johnson[1], Paul D. Ries[1], Jenna H. Tilt[1], & Bruce Shindler[2]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Department of Geography, Environmental Sciences, and Marine Resource Management, Oregon State University

The practice of Green Infrastructure is synonymous with collaborative partnerships. Expertise from engineers, landscape architects, planners, and natural resource consultants are often required for successful implementation. Traditionally, these professionals perform their responsibilities in their disciplinary "silos," but this evolving area of sustainable development is creating a demand for continuing professional education (CPE) trainings that address the challenges and opportunities associated with collaboration. Yet an interdisciplinary audience with mixed motivations, backgrounds, and experiences creates a challenging balancing act between professional development skills and technical training. Herein lies the dilemma - *how to deliver curricula valuable to all practitioners of green infrastructure?* This study aims to answer that question by using a qualitative approach to gain insight into the motivations, instructional design processes, and evaluation mechanisms utilized for interdisciplinary CPE trainings. A variety of green infrastructure CPE providers in the Pacific Northwest United States participated in the study, offering perspectives from agencies, non-profits, consulting firms, and academic institutions. Qualitative software was used to code patterns and themes. Preliminary results support the theory of Social Constructivism - a learning theory that argues that learning is an active process, whereby adults learn when they actively converse with their peers and negotiate new knowledge, constructing their own meaning through the process. For green infrastructure professionals, this interaction is ideal because it fosters a communal environment to share knowledge. This theory lends itself to collaborative hands-on learning activities such as anonymous site reviews, demonstration site tours, and simulations. A discussion of successful instructional design and program development strategies for interdisciplinary audiences will be presented to summarize research results.

16. Too cold to eat! How do abiotic factors affect black-capped chickadee's *(Poecile atricapillus)* daily feeder visitation?

Janel L. Lajoie[1], Lisa Ganio[1], and James Rivers[1]
1 Department of Forest Ecosystems and Society, Oregon State University

In the U.S., 53 million people spend over five billion dollars every year on bird food and accessories; however, little data exist on how individual birds use supplemental feeding stations. Most supplemental feeding studies on wintering birds are conducted in continental climates, where temperature either has no effect on the use of feeders (Wisconsin), or prompts black-capped chickadees *(Poecile atricapillus*) to increase overall feeder visitation (New York) as temperatures decrease or precipitation increases. There is a knowledge gap regarding wintering bird feeding studies in warmer, Mediterranean climates. Recent technological advances have made continuous monitoring of bird feeding activity more feasible, while simultaneously enhancing data quality. The use of radio frequency identification provides an opportunity to monitor feeder visitation by individual birds fitted with passive integrated transponder tags on a continuous temporal scale. We quantified the feeding activity of 110 black-capped chickadees in the Willamette Valley, Oregon from 551,454 records of individual feeder visits. Here, we examine the relationship between daily bird feeder visitation and

minimum daily ambient temperature, daily precipitation, and daily photoperiod. We found that the mean number of daily feeder visits increases with increasing minimum daily ambient temperature after accounting for the varying number of hours in daily photoperiod ($F_{1, 91}$ 30.24, $p < 0.001$). Our results are contrary to published literature. This unexpected result could be because nearly all previous studies have been conducted in continental climates. Continental climates generally have longer sustained periods of cold weather, and more ice and snow than Mediterranean climates.

17. Dead forest burning: The influence of beetle outbreaks on fire severity in lodgepole pine forest of British Columbia

Anna Talucci[1] and Dr. Meg Krawchuk[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Central interior British Columbia lodgepole pine (*Pinus contorta* var. *latifolia*) forests have been the epicenter of a recent regional outbreak of mountain pine beetle (*Dendroctonous ponderosae*), which has resulted in widespread tree mortality and potentially increased forest vulnerability to wildfire. While lodgepole pine landscapes are accustomed to large-scale singular disturbances of beetle outbreaks and wildfire, beetle outbreaks followed by wildfires are less familiar. Warm winters and an abundance of mature lodgepole pine have facilitated the unprecedented scale of beetle activity in the region. The resulting tree mortality alters fuel structure, fire behavior, and subsequent fire severity. Previous studies have investigated interactions of short-interval beetle-fire disturbances with variable levels of lodgepole pine and tree mortality in montane regions of the western United States. Our objective was to determine how beetle outbreak severity influenced fire severity in dominant lodgepole pine stands with high proportions of beetle-killed trees for the central interior plateau region of British Columbia, Canada. We inventoried 63 plots across three wildfire events spanning gradients of outbreak severity, fire severity, and fire weather conditions. We examined fire severity in beetle-killed, gray-phase lodgepole pine forest from three fire events (10-12 years post-outbreak) in Provincial Parks, which are managed as wilderness with minimal to no fire suppression. Preliminary findings show that, after accounting for fire weather, key fire severity metrics (e.g. scorch height, duff depth) varied in relation to the proportion of beetle-killed trees. Whereas scorch height was negatively associated with beetle severity, remaining duff showed the opposite response. Initial finding are surprising, because we had anticipated dry, dead fuels from the outbreak to increase fire severity. These findings may suggest a dampening of fire severity for short-interval beetle-fire disturbances. Further analysis will investigate additional fire severity metrics to synthesize the story of short-interval disturbances in central interior lodgepole pine forests.

18. Equitable engagement?: Constraints and place attachment of diverse groups in Portland parks

Jaclyn R. Rushing[1], Mark D. Needham[1], Ashley D'Antonio[1], and Elizabeth Metcalf[2]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Department of Society & Conservation, University of Montana

This study focuses on urban parks in the Portland, Oregon metropolitan area and examines relationships between perceived constraints to park visitation, park visitation frequency, and attachment to parks. Data were obtained from: (a) a mixed-mode survey (i.e., internet, mail) of a representative sample of mostly ethnic and racial minority residents in Clackamas, Multnomah, and Washington counties; and (b) an internet survey of a convenience sample of Opt-In panel members (Portland area residents interested in park management who signed on to this panel). This study: (a) identifies primary constraints that inhibit visitation to urban

parks in this area, (b) determines if there are differences in constraints between traditionally underserved (e.g., racial and ethnic minorities) and traditionally well-served residents (white majority), and (c) examines relationships among constraints to visitation, visitation frequency, and attachment to urban parks and determines if these relationships differ between traditionally underserved and well-served residents. Findings will expand on theoretical foundations and inform local management objectives associated with reaching underserved communities and engaging them in urban parks.

19. Modeling alternatives for the conservation of large wood in riparian and aquatic ecosystems of the Oregon Coast Range

Deanne Carlson[1] and Norm Johnson[1]
1 Department of Forest Ecosystems and Society, Oregon State University

A large body of scientific work recognizes the critical role large wood plays in the functioning of riparian and aquatic ecosystems, watershed processes, and disturbance regimes. In the Oregon Coast Range (OCR), human activity has significantly altered the quantity, form, and distribution of large wood. These changes have altered the watershed processes and disturbance regimes that create and maintain habitat for aquatic- and riparian-dependent species. These habitats, species, and processes provide instrumental value to human society, and possess intrinsic value in their own right. A primary assumption of the research proposed here is that large wood is a form of critical natural capital, and its continued presence will be necessary to sustain these values. The intent of this research is to evaluate the effectiveness of public policy alternatives for the conservation of large wood necessary for the functioning of watershed processes, and to thereby inform the policy-making process. The primary hypothesis of this research is that different policy alternatives will produce different policy outcomes. Using a case study approach, contrasting policy scenarios will be applied to a selection of OCR watersheds. One- and two-dimensional hydraulic models will be used to estimate the influence of large wood on: (1) the connectivity of active stream channels to off-channel aquatic habitat; (2) the areal extent of off-channel aquatic habitat and; (3) the transport and storage regimes of stream sediments. LiDAR-derived terrain models will be used to represent stream geometry, USGS regressions will be used to estimate stream discharges at ecologically-relevant return periods, and large-wood-related policy regimes will be represented by changes to the value of Manning's roughness coefficient and the manipulation of modeled stream geometry.

20. Comparison of nocturnal and diurnal summer rest structures used by Pacific martens in Lassen National Forest, California

Patrick J. Tweedy[1], Katie M. Moriarty[2], John D. Bailey[1], and Clint W. Epps[3]
1 Department of Forest Engineering, Resources and Management, Oregon State University
2 US Forest Service, Pacific Northwest Research Station
3 Department of Fisheries and Wildlife, Oregon State University

Pacific martens (*Martes caurina*) in the Sierra Nevada Mountains have been reported to be primarily nocturnal during winter and diurnal during summer. Martens use structures (e.g., live trees, logs, snags, stumps) to avoid predation and adverse weather (cold precipitation). Diurnal rest structures have been described, but nocturnal rest structures have not. We hypothesized that resting structures used by martens would be specialized (e.g., larger, older) compared to available structures; we predicted that difference would be greatest for nocturnal structures due to lower temperatures at night. We collected diurnal radio telemetry data from 2009 - 2012 and 2015 - 2016 (n=110 resting structures, 33 martens) and nocturnal telemetry data during summer 2016 (n= 36 structures, 13 martens). Used resting structures averaged 94 cm in diameter and were significantly larger than available structures ($\bar{x}$ = 52 cm,

$p < 0.05$). Martens selected snags more than any other structure type during nocturnal (58%, n=21) and diurnal (54%, n=59) periods. The size of snags, live trees, and logs used as rest structures did not differ between nocturnal and diurnal periods. Martens used larger stumps at night than during the day, and used a diversity of structure types regardless of diel period. The predominant use of snags as resting structures may be due to their high abundance in Lassen National Forest, protection from predation, or thermoregulatory benefits. Our research emphasizes the importance of conserving a diversity of structure types and sizes on the landscape, including larger dead wood.

21. The economics of biomass logistics and conversion facility mobility

Michael Berry[1] and John Sessions[1]
1 Department of Forest Engineering, Resources & Management, Oregon State University

This paper presents an analysis of transportable biomass conversion facility design to evaluate the conceptual and economic viability of a highly mobile and modular biomass conversion supply chain in the Pacific Northwest, USA. The goal of this work is to support a broader effort to more effectively and sustainably use residual biomass from commercial harvesting operations that are currently piled and burned as part of site preparation. A structural representation is first developed to include sources of biomass feedstock, distributed preprocessing hubs (centralized landings), and centralized processing facilities (biomass to product conversion sites) to produce desired products and byproducts. A facility costing model was developed to evaluate potential economics of scale which then informed the optimization study. A mixed integer linear programming model was developed to characterize, evaluate and optimize biomass collection, extraction, logistics and facility placement over a landscape from a strategic level to evaluate the mobility concept. The objective is to minimize operational costs in order to quantify financial advantages and identify challenges of the proposed system modularity and mobility. A case study is evaluated with an assumed modular biochar facility servicing the region. In particular, we review economies of scale, mobility, energy costs and biomass availability tradeoffs.

POSTER PRESENTATIONS
Research Proposals

1. The potential for community-based ecotourism to address human wellbeing constraints endangering the Bornean Orangutan population in the Sabah Region of Borneo, Malaysia

Molly Arnold[1] and Ian Munanura[1]
1 Department of Forest Ecosystems and Society, Oregon State University

The goal of this study is to identify the human wellbeing constraints that increase Malaysian families' demand for wildlife-based livelihoods, thus endangering Bornean orangutans in the Sabah region. Additionally, we seek to explore the potential of community-based ecotourism to address the identified human wellbeing constraints. Our research questions are as follows: (1) Do increases in family stressor events negatively affect forest-adjacent families' wellbeing? (2) How are families' resources and coping capabilities correlated with the impacts of family stressor events on household wellbeing and demand for wildlife-based livelihoods? (3) Do economic and social benefits from community-based ecotourism have potential to increase family resources, coping capabilities, and wellbeing? The following corresponding hypotheses were developed: (H1) Increases in family stressor events negatively affect forest-adjacent families' wellbeing, (H2) Diminished stock of family resources and coping capabilities increases the impact of family stressor events on a) families' wellbeing, and b) families' demands for wildlife-based livelihoods, (H3) The social, cultural, and economic benefits from community-based ecotourism have potential to increase families' resources and coping capabilities; these increases will, in turn, reduce the negative impact of family stressor events on families' wellbeing, thereby reducing families' demands for wildlife-based livelihoods that endanger Bornean orangutans. This research utilizes a sequential mixed methods study design to examine the relationships between stressor events, family wellbeing, and wildlife-based livelihoods. Focus groups with Malaysian OSU students will help us refine our survey questions, and delete items that are culturally irrelevant. Quantitative survey data will then be collected at the household level in Sabah. Our scope of inference is limited to Sabah, Malaysian Borneo, but the survey measures our research will generate will be applicable throughout Malaysia and Indonesia. This will fill a social and academic gap by providing reliable and valid measures for quantifying wellbeing in developing nations.

2. Do I belong? Answering questions of inclusion using the HJ Andrews Long-Term Ecological Site as a model of diversity

Sativa Cruz[1], Michael Paul Nelson[1], Ana Spalding[2], and Ivan Arismendi[3]
1 Department of Forest Ecosystems and Society, Oregon State University
2 School of Public Policy, Oregon State University
3 Department of Fisheries and Wildlife, Oregon State University

Given the importance of ecological sciences in a rapidly changing environment, the goal of this project is to understand the environmental worldviews of students who have decided to pursue degrees in this field. Initiatives to increase representation of people from diverse backgrounds and increase cultural competency on university campuses and workplaces is a movement toward equity and ideally creating a sense of belonging within these spaces. In natural resource fields, however, there is a sense of dissatisfaction with the rate of diversity and inclusion enhancement. By connecting with students in natural resource-related

disciplines, this research will attempt to acknowledge environmental worldviews as a measure of diversity. Using the HJ Andrews Long Term Ecological Research Program as a model of a research community, a visual portrayal focusing on disciplinary and environmental worldview diversity will be developed in collaboration with Oregon State University's Flux Design Studio. From there we will attempt to answer the following questions: 1) How do environmental worldviews influence decisions to pursue higher education in natural resource fields? 2) How does a portrayal of research program send a message of belonging, and ultimately translate into enhancement of representation in natural resource disciplines? The protocol will include a survey and facilitated group activity to delve deeper into student experiences. Hopefully, results will provide insight into how a portrayal of a program can encourage people from different backgrounds to participate. The design will include a ranking component of three portrayals of a research program which will be distributed to students in introductory natural resource courses, as well as a facilitated group interview to gather qualitative responses. These portrayals will emphasize varying degrees of disciplinary inclusion and environmental worldviews. Our hypothesis is that students will have varying environmental worldviews which will influence their preference for a research program, and ultimately their retention.

3. Effects of nitrogen fertilizer application and pre-chilling on C. *leichtlinii* growth and development

Matthew Davis[1] and Anthony S. Davis[1]
1 Department of Forest Engineering, Resources, and Management, Oregon State University

To restore wet prairies in the Pacific Northwest, nursery managers will need to supply many high quality plants to restoration specialists. One species, *Camassia leichtlinii* (camas), is challenging because it takes many years to produce mature bulbs. My objective is to develop strategies for producing high quality camas quickly. My research question is, "how can growers use temperature manipulation and fertilization to get camas from seed to flowering bulb more quickly?" I hypothesize that: Camas takes up nitrogen over the winter. Camas prioritizes growth over storage in nitrogen allocation at emergence. Camas allocates nitrogen to storage once demands by growth have been met. Towards the end of the growing season, camas prioritizes storage over growth in nitrogen allocation regardless of leaf nitrogen concentration. Camas has a maximum nitrogen concentration. Camas requires pre-chilling prior to chilling. The number of cells in the daughter bulb is determined by the length of the pre-chilling period. Camas dormancy is initiated once the daughter bulb has met its carbon maximum. To test fertilizer use, I aim to produce multiple 2-factorial time series, with bulb nitrogen (mg) as one factor and nitrogen applied (mg) as the other. The multiple time series will be constructed within each treatment tray by inoculating subsamples of bulbs with 15N. I expect that nitrogen allocation will be influenced by nitrogen concentration and time. I will test how pre-chilling affects camas with a 2-factorial experiment. My factors will be time spent pre-chilling at 15oC (weeks) and the amount of subsequent time spent chilling at 5oC (weeks). I expect that bulbs that receive pre-chilling will be more vigorous. Trends in the data will likely be applicable to many more bulb species

4. The potential of Sumatran orangutan ecotourism to improve household wellbeing and reduce illegal forest use in Bukit Lawang community, Gunung Leuser National Park, Indonesia

Rika Dewi[1] and Ian Munanura[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Sumatran orangutan ecotourism is a famous tourism destination in Gunung Leuser national park, and has potential benefits such as provide alternative livelihoods for the local

community, and incentives for Orangutan conservation. Loss of Orangutan species and habitat is attributed to supplemental forest-based livelihoods of adjacent communities, such as illegal hunting. Attempts to address such anthropogenic threats have not been successful, and require a deeper understanding of human livelihood constraints, with the most influence on Orangutans, and targeted ecotourism solutions. This research has two objectives. First, to determine the household livelihood constraints, with most influence on illegal forest use. Second, to identify the ecotourism benefits (economic, social, political and psychological), with potential to address livelihood constraints influencing illegal forest use. The research questions are: (1) what are the livelihood stressors diminishing the wellbeing? The hypothesis is the wellbeing diminishes when a household experiences stress, (2) Does the diminished wellbeing increase illegal forest use? The hypothesis is that illegal forest use increases when the household wellbeing is diminished by livelihood stress. The research question for the second objective is: (3) Do ecotourism benefits strengthen the household resources, and stress coping capabilities? It is hypothesized that when households economically, socially, politically and psychologically empowered, their stock of resources improves, and stress coping capabilities are strengthened, which improves their wellbeing, and reduces illegal forest use. The data will be collected at the household level using a survey. The existing scales in literature will guide the survey construction. These scales will be validated using structural equation modeling. Inferences are limited only to Bukit Lawang community. However, the research will provide household wellbeing, ecotourism benefits and illegal forest use indices that may be applied in other locations. This research will contribute toward deeper understanding of drivers of anthropogenic threats to Sumatran Orangutans, and ecotourism based solutions.

5. Living legacies: Fire refugia, seedling response, and forest resilience in Pacific Northwest dry mixed-conifer forests

Will Downing[1] and Meg Krawchuk[1]
1 Department of Forest Ecosystems and Society, Oregon State University

The combined effects of over a century of grazing, timber harvest, and fire suppression have resulted in significant changes to the structure and composition of dry mixed-conifer forests in the Pacific Northwest. Increases in tree density, structural homogeneity, and fuel loading appear to be supporting increasingly large and severe fires which may be outside the historical range of variability. Contemporary large fires have contributed to uncertainties about dry mixed-conifer forest resilience and concerns that high-severity fire effects and climate change may be creating the conditions for vegetation type shifts. Fire refugia, unburned or low-severity patches inside wildfire perimeters, are proposed to be important ecological anchors that facilitate the return to a forested condition and buffer plant and animal species from deleterious impacts of changing fire regimes. These living legacies provide essential propagule sources for seed obligate tree species and they may be critical for maintaining dry mixed-conifer forest ecosystems in a safe operating space. This study seeks to quantify the effect of fire refugia density on post-fire seedling response in eight large fires that burned between 2000 and 2003 in the Blue Mountains and North Cascades. We hypothesize that (1) seedling density increases with proximity to fire refugia, and that (2) seedling density is highest in areas with intermediate fire refugia density, where both seed sources and suitable areas for seedling establishment are abundant. Fires will be randomly sampled across a fire refugia density gradient, calculated from maps of surviving overstory trees derived from 1 meter aerial imagery. This study will contribute to an understanding of how patterns of surviving disturbance legacies influence succession and forest resilience.

6. Conflicts between core purposes: Decision-making and trade-offs in Oaxacan Community Forest Enterprises

Gretchen Engbring[1], Dr. Troy Hall[1], and Dr. Reem Hajjar[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Fostered by scholars like political economist Elinor Ostrom, the communal ownership and management of natural resources has been proposed as a means by which to address both human development and environmental goals. However, while scholarship in the field has frequently promoted the theoretical 'win-win' nature of communal tenure, the potential trade-offs and associated decision-making processes related to the communal management of natural resources are less understood. The proposed study thus seeks to determine the strategies that Community Forest Enterprises (CFEs) adopt to maintain financial viability or pursue financial growth, how CFEs perceive these strategies as counter to non-financial goals, and subsequently how they balance financial goals with other core purposes. This study proposes to draw on case studies of CFEs in varying stages of development in the Mexican state of Oaxaca to ultimately explain the decisions that CFEs make to increase, maintain, or sacrifice profits given conflicting financial and non-financial purposes. Data will be collected through semi-structured interviews with individuals in decision-making positions within CFE's and with focus groups composed of community members. Analysis will include transcribing and coding interviews using a grounded theory approach. In addition to providing CFEs, governing bodies and non-governmental organizations with information on prospective conflicts between core purposes and potential management strategies, the results from this study will contribute to the body of literature on common property governance, furthering the discourse around trade-offs in particular.

7. Lithology and tributary controls on transport capacity

Mulugetta Fratkin[1] and Catalina Segura[2]
1 Water Resources Graduate Program, Forest Engineering and Resource Management, Oregon State University
2 Forest Engineering and Resource Management, Oregon State University

Tributaries are an important link in understanding landscape evolution as they can influence longitudinal patterns of grain size, channel geometry, and slope. Numerical methods suggest that tributaries can cause upstream and downstream aggradation of the bed when discharge and sediment load are at least 10% of those in the mainstem. Aggradation of coarse material is associated with an increase in grain size and a decrease in slope causing an overall decrease in transport capacity. As a result there is a need to understand which tributaries have the potential to alter main-stem channel form and the frequency of those tributaries. In low-gradient river systems with large floodplains, tributaries often have little impact on mainstem sediment size, slope, and geometry. However, in headwater systems hill-slopes and channels are typically coupled. In these systems the character and amount of sediment entering channels often depends directly on hill-slope processes. In these environments, lithology has been identified as a key variable in controlling sediment supply to channels. The initial grain size and resistance of coarse sediment to abrasion have been shown to strongly depend on lithology. As a result, lithology and the connectivity of hill-slopes and channels may control the number of tributaries capable of influencing channel form and transport capacity. We hypothesize that a balance between tributary frequency and the caliber of sediment supplied results in similar tributary effects between hard and soft lithologies. River networks in soft lithology have a higher drainage density than networks in hard lithology, resulting in stronger downstream fining of coarse bed material due to abrasion processes. However, the high drainage density also increases the frequency of tributaries, resulting in more opportunities for coarse material to be introduced.

8. Root characterization and physiology of *Acacia koa* seedlings grown under limited phosphorus and moisture conditions.

Kaitlin Gerber[1] and Anthony S. Davis[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Hawaii has a high rate of endemic and endangered avian species relative to the rest of the United States. These species often rely on remnant and restored forests as critical habitat. Endemic *Acacia koa* (koa) forests are of particular importance for species such as ʻakiapōlāʻau and ʻĀkepa. The need to expand beyond present forest cover levels has generated a demand for quality nursery seedling stock for use in restoration projects. High quality seedlings can be critical to overcome low soil water and phosphorus availability, both of which are common limiting factors to koa seedling establishment. This research will examine how seedlings adapt their root architecture and water use efficiency under optimal and suboptimal water conditions; the same level of physiological and morphological response to ideal and P-limited conditions will be observed. It is hypothesized that 1) the aerial axis of the root will extend to capture water from deeper soil profiles if subject to water limited conditions and that water use efficiency will increase with decreasing water availability 2) the root width to root depth ratio to will develop to prioritize phosphorus uptake when growing in P-limited conditions 3) insufficient water and phosphorus will result in poorer seedling growth. By identifying seedling response to these common limiting factors, koa seedling growers will be better equipped to propagate seedlings that can overcome these challenging site conditions and meet restoration planting objectives.

9. Community attitudes and tradeoffs associated with intensive forest management and herbicide use on private forests in Oregon

Janet Gorman[1], Mark Needham[1], and Matthew Betts[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Intensive forest management (IFM) is used for successfully growing and harvesting timber, especially on private forestlands. In the Pacific Northwest, IFM has started including aerial herbicide application to reduce species competition, allow replanted seedlings to grow, and help maximize timber production. This practice, however, involves tradeoffs among timber production, biodiversity, and ecosystem services (e.g., human health, recreation, water.) Another challenge involves how to effectively communicate information about these management practices. Places in Oregon have received negative media attention about aerial herbicide application, but little is known about how communities perceive these practices and whether communication efforts can influence these cognitions. We address the following research questions: (a) what are public attitudes and tradeoffs associated with herbicide application on privately managed lands, and (b) how could scientific information influence these cognitions? We hypothesize that: (a) the public will tradeoff timber maximization via herbicide application in favor of other ecosystems services, and these tradeoffs will be related to previous experiences with IFM and environmentally oriented values and (b) receiving scientific information about herbicide use on managed lands will influence these attitudes and tradeoffs. A random and representative survey of community members stratified by location in Oregon's Coast Range will measure value orientations, experiences with herbicides and IFM, and perceived tradeoffs among ecosystem services. After some participants receive scientific information about IFM (via scenarios in questionnaires, field tours, and potentially virtual reality), we will measure how this communication influences responses. If value orientations and experiences are statistically related to tradeoffs, our first hypothesis will be supported. If the second wave of respondents (i.e., those who receive information) have different tradeoffs than respondents who did not receive information, our second hypothesis will be supported.

Findings will augment research about public attitudes toward IFM and provide direction for effective communication among managers, scientists, and communities.

10. Group selection silviculture in second growth Douglas-fir forests in the Oregon Coast Range foothills

Alexis Gunsolus[1], Matt Powers[1], and Stephen Fitzgerald[1]
1 Department of Forest Engineering, Resources, and Management, Oregon State University

Uneven-aged management in Douglas-fir (*Pseudotsuga menziesii*) has often been difficult to implement and maintain, particularly in the Pacific Northwest due to tree physiology and regional variation in stand structure and dynamics. A general lack of experience with uneven-aged management in this region also contributes to this difficulty. The creation and preservation of uneven-aged stand structure using a group selection silvicultural system could offer greater flexibility in achieving multiple-use management objectives. The purpose of the proposed research is to maintain and enhance uneven-aged treatments in a 40 acre stand within the Dunn forest while preserving the integrity and usefulness of the stand for research and teaching purposes. An inventory cruise will be conducted using a nested plot design to gather estimates of volume and value of standing timber and existing regeneration. Existing group openings and permanent skid trails used during harvest will be recorded using a global positioning system (GPS). To create gaps in the overstory canopy to promote the establishment of a new cohort and to release existing regeneration, groups of trees will be selected for removal and flagged appropriately. The central location of the groups will be similarly recorded. Future growth and development of the stand will be modeled using a series of alternative treatments with varying gap sizes and levels of residual stands density to assess the relative success of the proposed treatments. Subsequently, it is expected that the outlined methods will produce an assessment of the current regeneration and overstory growth, and potential damage to remaining trees. The implementation of a group selection harvest within the Dunn forest will serve as a case study in western Douglas-fir forests. Uneven-aged treatments, particularly in Douglas-fir may allow for more flexibility in timing and intensity of harvest and may give small landowners more silvicultural options for achieving their management objectives.

11. Early seral habitat longevity in actively managed forests: a retrospective study

Scott Harris[1], Matt Betts[1], Jake Verschuyl[2], AJ Kroll[3], and Urs Kormann[1]
1 Department of Forest Ecosystems and Society, Oregon State University
2 National Council for Air and Stream Improvement
3 Weyerhauser Co.

We propose to conduct a retrospective assessment of the response of songbirds to active forest management practices over the first 28 years of stand development. Our goals are to assess the species and community level responses of birds to intensive forest management and to characterize the timing of canopy closure in production forest stands in the Oregon Coast Range. We hypothesize that birds will have species-specific responses to changing vegetation composition (for example, hardwood cover) and structure, and that species turnover will occur throughout stand development. We also hypothesize that the timing of canopy closure will be depend upon a suite of stand-level environmental conditions. By resurveying stands that were studied 10 years ago, we will compile a dataset of the abundance of birds, vegetation cover, and tree growth that spans stand ages from 2 to 28 years. Data collection will include avian point counts, vegetation canopy cover estimates, and forest stand metrics. We will test for thresholds in species occupancy and abundance in relation to vegetation and stand metrics. Models will account for imperfect detection, and assess patterns of biotic homogenization among sites. To our knowledge, there are no studies that have assessed avian response to plantation succession over the full critical period from stand establishment past canopy closure. Our study will fill this information gap and provide a

foundation for forest managers to both incorporate biodiversity conservation targets in management and to quantitatively assess the contribution of actively managed forests to the conservation of songbirds.

12. Vegetation management research cooperative: COSINE- COmpetition and Site INteractions Experiment

Chris Hubbard[1] and Carlos Gonzalez[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Forest vegetation management (FVM) is a common reforestation practice throughout the Pacific Northwest (PNW). The reduction of unwanted competing vegetation allows for crop trees to better acquire resources. The Vegetation Management Research Cooperative (VMRC) at Oregon State University has already installed a series of studies across the PNW. These studies have shown that FVM promotes seedling growth and survival however, responses were variable among sites. A new research project with a focus on how site conditions and FVM treatments interact to effect seedling survival and growth its being installed by the VMRC. The project is called COSINE which stands for **CO**mpetition and **S**ite **IN**teractions **E**xperiment, and seeks to gain a better understanding on the interactions between site resources, FVM treatments and conifer seedling growing across a range of sites in the PNW. On each study site, six different vegetation control treatments will be tested using four replicates. Each plot consists of 120 trees planted at a 10x 10 ft spacing. During the first 3 years, data collection will include tree inventory and vegetation surveys, tree biomass, vegetation biomass, soil moisture, xylem water potential, stomatal conductance and weather monitoring. All collected data will be used to develop a hybrid model to estimate growth of young western hemlock (*Tsuga heterophylla*) trees under changing soil, weather and vegetation management conditions.

13. Characterizing the Germination and Growth Requirements of Two Native Plants

Christina St John[1] and Dr. Anthony S. Davis[1]
1 Department of Forest Engineering, Resources, and Management, Oregon State University

Native plant species are increasing in importance for restoration projects around the world, but information about germination and growth requirements for many species is sparse. Snowberry (*Symphoricarpos albus var. laevigatus*), native to the western United States, is difficult to propagate from seeds because of its long pre-sowing (stratification) treatment. Hispaniola pine (*Pinus occidentalis*), endemic to Hispaniola, has variable germination rates and slow growth, making it difficult to grow a healthy tree within a feasible time frame in resource-limited countries. The objective of this research is to characterize germination rates at different stratification lengths in snowberry and Hispaniola pine and to determine nursery practices that lead to higher Hispaniola pine seedling quality. This research will address the following research questions: 1) How does seed water content affect the stratification requirements and germination of snowberry and Hispaniola pine? 2) How do nursery cultural practices influence germination and growth rates of Hispaniola pine? 3) What variability exists in open-pollinated, wild-sourced, snowberry? We hypothesize that imbibition decreases the length of stratification and increases germination rate and speed. Furthermore, we hypothesize that the growth rate of Hispaniola pine is responsive to irrigation and nutrient levels, and less sensitive to summer light and temperature. Finally, snowberry seedlings will exhibit greater variability than those from nurseries that use cuttings as the source of plant material. Seeds from each species will be tested for water uptake, will be imbibed or not imbibed and placed in stratification for differing lengths and germinated. In addition, Hispaniola pine will be grown in different media and fertilization rates. The protocols developed will provide guidance for nurseries to grow these species successfully by

characterizing stratification, germination rates, and best growing practices. This knowledge is crucial to increasing the use of native plants in the restoration of ecosystems in the United States and Hispaniola.

14. Effects of spatial diversity on forest ecology and fire behavior

Christal Johnson[1] and John Bailey[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Fire shapes the spatial arrangement of trees across landscapes. In the West, fire suppression has led to a more homogenous forest conditions at multiple scales. Managing for a mixture of individual trees, clumps, and openings can help restore spatial diversity. However, ecological benefits of spatial diversity are not well-studied. This research aims to quantify how spatial diversity affects: 1) tree responses to climate, 2) plant diversity, and 3) fuel arrangements and modeled fire behavior. I will compare climate responses between trees that are solitary and trees that are in clumps, using weather records and tree cores. I will conduct vegetation surveys in forest openings, beneath clumps of trees, and beneath solitary trees, and will quantify differences in species occurrence and diversity between these three microenvironments. I will measure fuel loads in both clumps and openings, by counting downed woody debris in different size classes along a transect and use estimated fuel loads and types to model fire and tree mortality from fire across the landscape. I will quantify how fire behaves differently in clumps versus openings, how spatial arrangements impact tree mortality from fire, and how mortality from fire impacts tree spatial arrangements post-fire. I will conduct this research in Malheur National Forest, which is a ponderosa pine-dominated mixed-conifer forest. Results of this research will be applicable to management in Malheur, and potentially in other similar ponderosa pine mixed-conifer forests of the West. Restoring forests after a century of fire suppression is a priority for fire ecologists, and promoting forest resilience should be a priority for all foresters as climate change increases stress and unpredictability in our forests. This research will explore possible benefits of spatial diversity so that foresters can better decide whether restoring spatial diversity will benefit forest resilience to climate and resistance to fire.

15. Risk management of stakeholders and forest collaborative processes: A case study of the Lower Joseph Creek Restoration

Gabe Kohler[1] and Emily Jane Davis[1]
1 Department of Forest Ecosystems and Society Department, Oregon State University

In Wallowa County, there are three processes for collaboration; The Forest Service public involvement period, the Natural Resource Advisory Council, and the Wallowa-Whitman Forest Collaborative. Collaboration attempts to engage stakeholders and increase public participation in resource management decisions. The way that stakeholders perceive the risk of wildfire, and their willingness to participate in tradeoffs involved in risk mitigation, creates the social context of restoration projects. My research question is: Within the context of the Lower Joseph Creek Restoration Project, in Wallowa County, how is risk managed by stakeholders and forest collaboratives? This study looks at two scales of risk management: 1) stakeholder risk perceptions of wildfire and risk mitigation preferences, and 2) the values at risk emphasized in documents of the three collaborative processes. At the stakeholder level, I will evaluate the relationship between a stakeholder's perceived risk of wildfire and their ratings of certain risk mitigation treatments through key informant interviews. At the collaborative level, I will use document review to analyze the variation in values at risk across the three processes of collaboration. I hypothesize that 1) Stakeholder perceptions of wildfire risk are related to values at risk, mitigation preferences and ratings of hazard characteristics, and 2) Each of the three processes of collaboration in Wallowa County frames or mediates risk to certain values

differently. Research that accounts for the social dimensions of natural resource management has the potential to identify "barriers and bridges" to management of dynamic landscapes in times of change. This research will produce a durable social analysis that will enrich future implementation of collaborative management projects, and in so doing, accelerate the pace and scale of forest restoration on public land.

16. C4 grass primary production: assessing variation along climate gradients and at multiple scales

Lila S.T. Leatherman[1], Christopher J. Still[1], and Daniel M. Griffith[1]
1 Department of Forest Ecosystems and Society, Oregon State University

The response of grasses to climate change is relatively understudied in comparison to that of woody plants, especially in tropical regions. Globally, grasslands and savannas are estimated to comprise 30 percent of non-glacial land cover and include many important crop species. Grasses that use the C4 photosynthetic pathway, in contrast to the more common C3 photosynthesis, are estimated to comprise 25 percent of gross primary productivity (GPP). Thus, understanding how C4 range and production may change in response to climate change will be critical in predicting future land cover and carbon dynamics. GPP can be measured using physiological assessments of carbon flux, and can also be estimated from spectral indices, such as the photochemical reflectance index (PRI) and solar-induced chlorophyll fluorescence (SIF), that are linked to photosynthetic rates. For my dissertation research, I propose to integrate field measurements with imagery at the leaf, canopy, and satellite levels to study how the GPP of C4 grasses varies along climate gradients in Hawaiian grasslands. I will study the environmental controls on GPP, as estimated from flux, leaf spectra, canopy spectra, and satellite spectra; clarify the relationship between spectral indices collected at the leaf, canopy, and satellite level to assess the accuracy of satellite-derived estimates of GPP; and use my refined understanding of variation in C4 production to parameterize a global carbon cycle model. This research will clarify the relationship between C4 production and climate, help refine PRI- and SIF-based estimates of GPP for grasses at multiple scales, and help hone predictions of how C4 grass range and production may change under future climate change.

17. Effects of keystone species loss on the structure of a tropical pollination network

Kara G. Leimberger[1], Adam S. Hadley[1], and Matthew G. Betts[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Plants and pollinators are experiencing parallel declines worldwide. Some theoretical studies of plant-pollinator interaction networks suggest that extinction of highly connected species can cause secondary extinctions and, ultimately, network collapse. Other theoretical research suggests that networks are robust to disturbance due the redundancy of pollinators, rarity of interactions between specialists, and flexibility of pollinator foraging behavior. However, experimental removals of a highly connected species from a plant-pollinator network are uncommon. In this project, we will experimentally simulate the local extinction of a tropical flowering plant (*Heliconia tortuosa*), a keystone nectar resource for many species of hummingbirds. We hypothesize that temporarily removing *Heliconia tortuosa* from premontane forest patches in southern Costa Rica will either result in (1) network collapse, in which all hummingbirds vacate the patch or visit floral resources rarely, thereby compromising the reproductive success of other flowering plants, or (2) network robustness, indicated by hummingbirds remaining in the patch but feeding on alternate resources ('rewiring'). Additionally, only the highly *Heliconia*-dependent pollinators may vacate, preserving most network links. Before and after *Heliconia* extinction, hummingbird home ranges, floral visitation rates, and plant-pollinator interactions will be determined concurrently in control and treatment patches using radio telemetry, camera observations,

and pollen samples from hummingbirds' bills. To determine how *Heliconia* extinction affects the pollination success other flowering plants, we will quantify the number of pollen tubes present in flower styles. This research will broaden the understanding of how interaction networks respond to environmental disturbance as well as the mechanisms (e.g. pollinator behavior) underlying robustness or collapse.

18. The uneven-aged management project - creating heterogeneous forests

Sean Marcum[1] and Matt Powers[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Historically, Oregon was filled with large amounts of old growth forests, that have since been transformed into monoculture Douglas-fir plantations. There is a growing need to find a method to create old growth structures from these Douglas-fir plantations. Twenty years ago, the Uneven-Aged Management Project in the H.J. Andrews Experimental Forest implemented several treatments to convert even-aged Douglas-fir plantations into mixed-species, uneven-aged structures. These treatments include: (1) a Light Overstory Removal where 100% of the stand is thinned from below to a relative density (RD) of 30, (2) a Group Selection where 90% of the stand is thinned from below to a RD of 30 and the remaining 10% is cut in circular gaps of 80 feet in diameter, (3) a Heavy Overstory Removal where 100% of stand is thinned from below to a RD of 20, and (4) a no action control treatment. All treatments were underplanted with a mixture of tree species. I will gather data from this long term project to quantify the growth response of the overstory trees and characterize the regeneration of the new cohort of young trees in the understory. I hypothesize that overstory trees in the Heavy Overstory removal will have the highest individual tree growth response due to a longer time of decreased competition. I hypothesize that the Group Selection cut will have the highest rate of saplings height growth and survival due to the gaps allowing the saplings more light to grow. The scope of this research is monoculture Douglas-fir stands of the western Cascades, but the ecological scope could be larger. This research explores the trade-offs between the economic and environmental outcomes associated with converting Douglas-fir plantations into uneven-aged, mixed-species stands which forest managers could use to create future management plans.

19. Intraspecific variation in allometric characteristics of *Pinus ponderosa* and *Abies concolor* across climatic gradients in eastern Oregon and eastern Washington

Al Pancoast[1] and Temesgen Hailemariam[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Forests provide important environmental, social, and economic resources. Forest managers need information about the amount and quality of a resource to manage it appropriately for a given set of objectives and desired resource outcomes. Three commonly desired characteristics are: taper, volume, and total above ground biomass (AGB). The objectives of this study are to (1) quantify variation in taper, volume, and biomass estimates exhibited within the same tree species across climatic gradients and (2) to identify potential explanatory variables of this variation. I hypothesize that localized site conditions across climatic gradients in eastern Oregon and eastern Washington will introduce intraspecific variability in allometric models of individual tree stems of *Pinus ponderosa* and *Abies concolor*. Research questions include: (1) which model forms and fitting techniques produce the most precise and least biased predictions of upper stem diameter, total volume and total ABG? (2) Is there consistent and significant differences in the prediction of allometric characteristics using the same equation form and fitting technique, fitted to the same species, using datasets collected at locations along climatic gradients? I will use different modeling approaches to investigate intraspecific variation in allometric characteristics by fitting taper, volume and biomass

equations for trees sampled across the gradient and compare the difference in prediction efficiency between locations in terms of mean squared error and bias. Different cross-validation techniques will be used to validate the findings of this study. Decisions made using models of allometric relationships in forestry applications significantly impact forest management activities, environmental policy, and economic development. These models need to be continuously evaluated and improved to ensure the best possible information in formulating important decisions for *Abies concolor* and *Pinus ponderosa* management within the range of conditions found in the study area.

20. Method of stabilizing heavily spalted *Acer macrophyllum* for flooring applications

Diego Rodrigues de Oliveira[1], A. Godinez[1], M. Miner[1], and F. Kamke[1]
1 Department of Wood Science and Engineering, Oregon State University

Spalted wood, wood colored by fungi, has been popular in woodcraft for centuries. Most found spalted wood is in an advanced state of decay and cannot be readily utilized by landowners. This very soft spalted wood is of interest because it is still visually appealing, but has no current market value, as it cannot be worked. This project used the Viscoelastic Thermal Compression (VTC) machine to increase the decayed woods' strength and stiffness. The main objective of this research was to find a method to turn rotted wood into commercial flooring. In addition, this work involves gaining a chemical understanding of the extracted fungal pigments used for dyeing the wood, opening up new fields of use, such as in pharmacy, energy production, and biological marking. Spalted bigleaf maple logs were collected from the MacDonald-Dunn Forest and cut into veneers in three different sizes: 15 in x 4 in x 0.22 mm, 15 in x 2 in x 0.22 mm, and 12 in x 6 in x 0.22 mm, and sanded (grits: 100 and 150). The pigments were extracted from the known spalting fungi *Scytalidium cuboideum*, *Scytalidium ganodermophthorum*, and *Chlorociboria aeruginosa*, collected from the school forest and grown on malt agar amended with wood chips. The fungal material was chopped and transferred to a round-bottom flask and mixed with dichloromethane (DCM). The samples were shared basically in 3 groups based on the pigments and each group was composed by 9 specimen. Additionally, there were more two groups: control and zone line (heavily spalted). The samples were stained with the pigments using a soft brush. The pressure and temperature used in the VTC process was 60 psi and 350°C, respectively, for 10 minutes. Preliminary work has shown that decayed wood can be cut into thin veneer and pressed into panel flooring.

21. Using LiDAR to Detect Changes in Forest Fuel Structure Following Restoration Treatment

Julia Olszewski[1] and Dr. John Bailey[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

The policy of wildland fire suppression in the United States has led to greater fuel loads than has been typical of historical fire regimes. In response to the increased wildland fire threat, "restoration" has emerged as a forest management goal. Restoration involves removal of fuels by prescribed fire or mechanical thinning with the goal of reducing the destructive potential of wildland fire. While the practice of fuel reduction is widespread in forest management, there has been little research on assessing the effectiveness of fuel reduction projects. Most of the existing research has involved opportunistic case studies of fire severity in treated areas following a large fire. There has been little focus on quantifying changes in vegetation structure following restoration treatment. It is important to know whether these practices are successful, so that ineffective practices may be improved. This study investigates whether LiDAR (a form of remote sensing) can be used to quantify changes in fuel metrics following restoration treatment. The hypothesis is that LiDAR is capable of assessing changes in forest fuel structure following fuel reduction treatments. The prediction is that LiDAR data from the

Damon Fuel Reduction Project area in the Malheur National Forest will detect changes in one or more fuel metrics following restoration treatment. Some of these metrics can be calculated using FUSION, a computer program developed by the US Forest Service to analyze LiDAR data. Other metrics will require a more detailed interpretation of LiDAR returns and calibration with field data. The scope of inference includes the Malheur National Forest and could extend to similar forest types in the surrounding region.

22. Quantifying tree selection criteria across municipalities of Oregon and Washington

Joshua Petter[1] and Paul Ries[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Trees in urban areas provide a wide array of benefits to people; these trees help make cities more beautiful and sustainable. They provide an array of social, ecological and economic benefits for the residents of cities and those benefits are increased when appropriate tree species are selected. There are many reasons to select a tree, but too often the incorrect tree species is planted. Trees that outgrow their location become hazardous and don't provide the desired benefits. This study will attempt to quantify the criteria used in selecting tree species in municipalities of the pacific northwest. An online survey will be developed using Qualtrics and sent to city staff members responsible for planting trees on public land. If there is time pilot interviews will be conducted to help structure the survey and a nonresponse bias check will be conducted after the survey. The following questions will be addressed by this survey. What criteria are most important in tree species selection for municipalities in Oregon and Washington? Are municipalities in Oregon prioritizing different tree species selection criteria than municipalities in Washington? Are there differences in tree species selection criteria between occupation, (i.e. between private contractors and urban foresters)? There is probably not a lot of difference in tree species selection between municipalities geographically, and the trees planted across the Pacific Northwest are probably relatively homogenous. Because most municipalities are likely prioritizing tree selection based on aesthetic qualities, this study could help influence changes in tree species selection for urban areas. It is important to have a wide diversity of trees that are selected based on site suitability.

23. Assessing mechanisms of Douglas-fir growth response to thinning

Jacob Putney[1] and Dr. Douglas A. Maguire[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

Thinning is a widely used intermediate silvicultural treatment for intensively managed Douglas-fir (*Pseudotsuga menziesii*) plantations. Understanding physiological responses to thinning can be useful for understanding and predicting tree growth over time. The goal of this proposed research is to assess mechanisms of Douglas-fir growth response to thinning, and to synthesize this information into a mechanistic model for simulating tree-level net primary productivity (NPP). Specific research questions are: (1) do residual trees in thinned stands absorb more photosynthetic active radiation (PAR)? (2) how quickly do residual trees build additional leaf area, and how much additional PAR does that leaf area absorb? (3) does thinning increase the amount of available soil water, and how quickly do the trees utilize this additional water? (4) does this additional water uptake lead to greater growth? To answer these questions, I will test the following hypotheses: (1) total leaf area of residual trees increases after thinning and this additional leaf area allows the tree to absorb more PAR; (2) soil water available to individual residual trees and hence total water use per tree increases after thinning; (3) tree growth per unit transpired water (water use efficiency) decreases immediately after thinning because transpiration rates increase more than CO_2 fixation rates; (4) net water use efficiency increases with time since thinning because decreasing efficiency of the additional leaf area is offset by increased PAR absorption. The proposed research will

utilize recently thinned Stand Management Cooperative (SMC) plots by comparing soil water content in comparable thinned and unthinned stands, analysis of tree-level growth data, and predictions from the process-based 3-PG model (stand-level) and MAESTRA model (individual tree-level). Results from this proposed research will be incorporated into individual-tree growth models and contribute improved predictions of site-specific growth responses to thinning in intensively managed Douglas-fir plantations in the Pacific Northwest.

24. Ponderosa pine in the Willamette Valley

Audrey Riddell[1] and Dr. Stephen Fitzgerald[1]
1 Department of Forest Engineering, Resources, and Management, Oregon State University

My primary objectives in this study are to quantify the total acreage of ponderosa pine plantations in the Willamette Valley, and to assess the relationship between canopy cover and understory species richness and cover in these stands. The current extent of ponderosa pine in the Willamette Valley is unknown, and there is little published data about its ecology, especially regarding the associated understory species. I hypothesize that the understory vegetation associated with Willamette Valley ponderosa pine forests is adapted to open canopies with abundant light availability. If this hypothesis is correct, then the understory species association that is most similar to that of a mature ponderosa pine stand will be present in low-cover plantations, and not in high-cover plantations. I will accomplish my first objective by performing a supervised classification of very high resolution satellite data in ENVI, a digital image processing software. This classification will discern between coniferous species in the Valley. I will accomplish my second objective by sampling understory vegetation richness and percent cover in three different canopy treatments, comparing the differences across the three treatments. The scope of inference is limited to the Willamette Valley, as this subspecies of ponderosa pine is endemic to the Valley. By quantifying the extent of ponderosa pine plantations, this study will provide valuable information to land managers and mills in the area regarding the potential future market value of pine in the Valley. The understory assessment will inform forest managers about the impact canopy closure has upon the understories of their plantations, providing opportunities to increase the ecological value of their forests.

25. Evaluation of public private partnership in management of protected areas: A collaborative management partnership in Akagera National Park

Louis Rugerinyange[1] and Ian Munanura[1]
1 Department of Forest Ecosystems and Society, Oregon State University

In recent decades, protected area governance regimes have moved from strictly government agencies, to community conservation, and more recently, to public private partnership management for achieving biodiversity conservation. The purpose of this research is to (1) explore the effectiveness and efficiency of private-public management as a means of integrating divergent needs of wildlife conservation and family wellbeing, (2) investigate family resilience mechanisms in relation to human-elephant conflict, and (3) generate guiding principles for effective governance of protected areas and biodiversity conservation in Rwanda. The research questions are: (1) Does proximity to elephant home-range increase family's stressor conditions responsible for diminished wellbeing of families neighboring Akagera National Park? (2) Do family resources have a mediating effect in the hypothesized relationship between family stressors, family wellbeing and human-elephant conflicts? (3) To what extent has the new public-private partnership management reduced the human-elephant conflicts and family wellbeing constraints associated with families' proximity to elephant home-range? The hypotheses are: (1) Families living close to elephant home-ranges will experience increased stress and diminished wellbeing, (2) When families have sufficient

stock of resources and strong coping capabilities, the negative effect of family stressor events on family well-being is minimized, which is likely to reduce the human-elephant conflict, and (3) The social and economic benefits from the public-private partnership management have potential to improve the stock of family resources, strengthen coping capabilities, improve family well-being, and reduce human-elephant conflict. Data will be collected at the household-level using survey and a structured questionnaire will be administered to families living in proximity to elephant home range. A systematic sampling approach will be used to select households to participate in the survey study and this research seeks to provide information in response to existing challenges and dynamic adaptive management of protected areas.

26. Aquatic ecosystem responses to riparian forest canopy gaps

Allison Swartz[1] and Dana Warren[1]
1 Department of Forest Ecosystems and Society, Oregon State University

Canopy structure in riparian zones is important because riparian forest canopies control stream light availability in headwater ecosystems, and stream light availability is a key factor controlling aquatic primary production and in-stream nutrient cycling. The goal of this study is to understand how the development of complex canopy structure in riparian forests impacts these two fundamental ecosystem processes. Due to the legacies of anthropogenic land use, mid-succession forests with uniform closed canopies dominate headwater ecosystems across much of temperate North America, creating low-light stream environments. In contrast to these mid-succession forests, old-growth riparian forests contain complex multi-level canopies with streams that have patches of both high and low light. The transition of mid-succession forests to late-succession forests will include an increase in structural complexity and in particular an increase in canopy gaps that will alter the light environment of associated headwater streams. In my study, I will implement six replicate experimental manipulations that create canopy gaps in mid-succession riparian forests to evaluate how this transition will influence stream ecosystem processes in the coming century. I will use a Before-After Control-Impact study design to quantify the influence of riparian canopy gaps on primary production and nutrient uptake at both the patch and reach scales. I expect the increases in localized light from riparian canopy gaps to cause increases in primary production and nutrient uptake. Dramatic increases in light to the stream from riparian forest clearing have been shown to increase stream primary production and nutrient cycling, but also stream temperature, which has potentially detrimental impacts to biota. Because light is highly limiting to primary production in these systems, I expect to influence primary production and nutrient dynamics with the creation of a canopy gap, but unlike in clear-cut studies, I do not expect increases in stream temperature.

27. Large wood impacts on stream geomorphology and fish habitat: Does stream size matter?

Amelia Yeager[1,2] and Catalina Segura[1,2]
1 Department of Forest Engineering, Resources, and Management, Oregon State University
2 Water Resources Engineering Program, Oregon State University

Engineered large wood (LW) jams have long been implemented as a stream restoration strategy to create fish habitat. However, their relative effectiveness in streams of different sizes is rarely studied. The goal of this study is to assess the effectiveness of LW introduction over a range of stream sizes in an Oregon Coast Range basin. As part of a salmon habitat restoration project, 35 LW jams have been placed throughout the Mill Creek watershed. The basin will serve as a natural laboratory to quantify scale-dependent effects on stream geomorphic change and grain size distribution after the addition of LW and correlate stream

geomorphic change with biological salmon habitat indicators. Seven sites draining 3.9-22 km^2 and with similar LW jams were selected. Indicators to be examined include grain size distribution, stream topography and width, frequency of pools, and LW movement. We will assess the relative change among sites of different sizes to determine which size of site experiences the most geomorphic change. We expect that this will be primarily influenced by the upstream drainage area of the site and the amount of contact between LW and the channel. We hypothesize that the most geomorphic change will occur in sites of intermediate drainage area and bankfull width, where the equilibrium between LW-channel contact and discharge (driven by drainage area) is maximized. By identifying which size category experiences the most change after the introduction of LW, and clarifying the relationship between this change and salmon habitat metrics, we will provide information to optimize LW stream restoration efforts that focuses on stream reaches likely to experience the most geomorphic change and create the most habitat.

28. Quantifying Ratios of Suspended Sediment Sources in Forested Headwater Streams Following Timber Harvesting Operations

Aaron A. Rachels[1], Kevin D. Bladon[1], and Sharon Bywater-Reyes[1]
1 Department of Forest Engineering, Resources, and Management, Oregon State University

Historically, it is understood that timber-harvesting can increase fine sediment inputs to streams due to increased hillslope and streambank erosion and mass wasting along roads. However, under modern best management practices (BMPs), the relative importance and variability of these sources is poorly understood. We will present the design of an ongoing study investigating the primary sources of suspended sediment in Oregon Coast Range streams influenced by timber harvesting. This investigation could contribute to more effective BMPs for forest harvesting in the future. Two catchments, Enos Creek (harvested 2016) and Scheele Creek (reference), were instrumented in fall 2016. Phillips samplers (5-6 per catchment) have been deployed longitudinally down the streams to enable robust characterization of suspended sediments– the collected samples integrate the chemical signatures of upstream sediment exports over relatively long time scales (e.g., months). Samples will be collected from the Phillips samplers at regular intervals (every 1 month over ~2 wet seasons) and returned to the laboratory for sediment source fingerprinting analysis. The fingerprinting technique compares the chemical properties of stream sediment samples with the chemical properties of potential source areas, such as 1) roads, 2) stream banks, or 3) general harvest areas or forest soils. After establishing a fingerprint for each source, suspended sediment samples are then analyzed for all relevant chemical parameters, and an un-mixing model will be developed to quantify the proportions of the suspended sediment in each stream from each of the sources. To design a robust model for sediment-source identification, different types of physical or chemical data are required–we will analyze sediment samples using a combination of: a) stable isotopes and C/N ratios (i.e., δ15N, δ13C, and C/N), and b) radiogenic isotopes (137Cs and 210Pb). This approach will enable robust analysis of the primary fine sediment sources both longitudinally and through time.

29. PyFor - Open source software for forest LiDAR data processing

Bryce Frank[1]
1 Department of Forest Engineering, Resources and Management, Oregon State University

LiDAR as a tool for measuring forest structure has become increasingly popular since the 1990s.

The data sets produced with LiDAR scanning are large and require specialized software to extract useful information. LiDAR data processing applications are few and far between, with even slimmer open source options. PyFor, a software package I am currently developing, is an open source Python-based package for LiDAR data processing in the context of forest resources. The aim of PyFor is to create a flexible and modifiable way to examine and extract useful information from LiDAR data over forested areas that can be used and developed by Python users. Some of these functions include height normalization, canopy height model generation, and field plot extraction. These functions are demonstrated by processing a sample LiDAR data set from the coast of Washington state using a workflow model common in forest LiDAR analysis. This workflow inspires a discussion of the development process, limitations and opportunities for PyFor as the package enters a new stage of development.

30. Stories from small forests: Innovative practices and planning for future markets in Willamette Valley forests under 200 acres

Ethan Stroup[1], Julian Geisel[2], and Eric Hansen[2]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Department of Wood Science and Engineering, Oregon State University

Product planning - the anticipation of desire for specific products in future markets - is a defining facet of marketing. Anticipating the demand for products and producing those products accordingly offsets the uncertainty of future markets. Novel and innovative practices can help small forest owners to develop and produce products with increased desirability, which may improve access to future markets. Novel practices for producing innovative and desirable products are common in Willamette Valley forests under 200 acres. A case study detailing several of these practices may be of interest to small forest owners, and may influence them to adopt similar practices or to develop their own innovative and novel practices, which may also increase their access to future forest products markets.

POSTER PRESENTATIONS
Non-student Presentations

31. The College of Forestry Diversity, Equity and Inclusion Initiative: Where we've been, where we're at, and where we're going

Heather Roberts[1], Sarah Kelly[2], Troy Hall[1], Michael Collins[1], Lisa Ganio[1], Michele Justice[1] and Dana Warren[1]
1 Department of Forest Ecosystems and Society, Oregon State University
2 Environmental Arts and Humanities, Oregon State University

The College of Forestry aspires to create an environment in which all members of the community feel safe, respected, and free to participate in various undertakings of the college, including learning, teaching, administration, and research. We are asking for all College of Forestry members–representing various departments, roles, ages, genders, ethnicities, races, religions, abilities and worldviews–to provide feedback, ensuring the creation of an inclusive plan that accounts for everyone's priorities and concerns regarding diversity, equity, and inclusion within the College. In 2016, we heard from many students, faculty, and staff via open meetings early in the year, the survey distributed in Spring, and the retreat in July. The valuable ideas and insightful opinions shared were drafted into a list of the goals, strategies, and actions for the Diversity, Equity and Inclusion (DEI) Strategic Plan. Faculty, staff and graduate students provided feedback on the draft planning document via peer focus groups in Fall and Winter 2017. Undergraduate students provided feedback on their priorities via in-class sessions in each of the College's three departments. Faculty, staff and students were given the alternative option to provide feedback in an online questionnaire. The DEI strategic planning team is currently in the process of developing recommendations on how to enhance DEI in CoF based on the input received from members of the College. We invite everyone from the CoF community to continue to engage in the planning process by providing feedback on the proposed recommendations, which will be submitted to the Forestry Executive Committee in May 2017. Once the strategic plan is finalized by Summer 2017, there will be additional opportunities for community involvement to help implement the plan.

College of Forestry