COLLEGE OF FORESTRY
WESTERN FORESTRY GRADUATE RESEARCH SYMPOSIUM

Canopies to Construction: The Ecology, Management, & Use of Tomorrow's Forests

Photo by René Zamora

April 22-23, 2013

Oregon State
UNIVERSITY

Keynote Speakers

Michael Nelson

Dr. Nelson is an environmental scholar and professor of environmental ethics and philosophy. His works include teachings and writings on the concept of wilderness, the philosophy of ecology, and the role of science and advocacy. At Oregon State University, he holds the Ruth H. Spaniol Chair in Natural Resources and is the Lead Principle Investigator for the HJ Andrews Forest Long-Term Ecological Research program. Dr. Nelson co-founded and co-directs the Conservation Ethics Group. He also serves as a Senior Fellow with the Spring Creek Project for Ideas, Nature, and the Written Word and as the philosopher in residence of the Isle Royale Wolf-Moose Project (the world's longest continuous study of a predator-prey system). With his rich depth of questioning traditional research divides and moral considerations impacting the social-ecological environment, Dr. Nelson's keynote address will focus on interdisciplinary collaborations inherently necessary in environmental research and how we can progress the environmental ethics discussion across boundaries.For more information: ***http://fes.forestry.oregonstate.edu/faculty/nelson-michael-p***

J. Renée Brooks

Dr. Brooks is a Plant Physiologist at the Western Ecology Division of the Environmental Protection Agency. She is also a courtesy professor at Oregon State University in the Department of Forest Ecosystems and Society. Her research interests include whole plant ecology, forest biology and canopy structure, biological systems within watersheds, and stable isotope ecology. She has an extensive publication history related to these topics and has been contributing to science and research for over twenty years. From her depth of experience in the field with agencies and universities, she will draw her keynote address along the themes of the power of collaboration and research flexibility to meet the research challenges of the future.For more information:
http://www.epa.gov/wed/pages/staff/brooks.htm

Patricia Muir

Dr. Muir is a Professor in the Department of Botany and Plant Pathology at Oregon State University. Her research interests focus on the effects of human activities on plants, with emphasis on detailing the effects that alternative logging methods have on the productivity and diversity of forests. She also studies the relationship between air pollutants and plants, historical vegetation and fire history investigations, and commercial moss harvesting practices. Her broader research interests in the effects of land management practices on plant populations and community ecology. Having partnered with many agencies and groups, Dr. Muir has a wealth of experiences in not only conducting research on human-plant relationships, but also in finding avenues and mediums through which to successfully communicate findings, emphasizing the role of science and engaging audiences as fellow stewards. Dr. Muir's keynote address will focus on the role and importance of conducting and communicating applied ecological research, conveying their relevance to diverse audiences.For more information: ***http://bpp.oregonstate.edu/muir***

John C. Gordon

Dr. John Gordon is Pinchot Professor Emeritus of Forestry and Environmental Studies at the Yale School of Forestry and Environmental Studies. He has served as dean of Yale Forestry, department head and professor at Oregon State University's Department of Forest Science professor at Iowa State University, principal plant physiologist with the US Forest Service, and as a consultant for numerous international, federal, and private entities. He currently leads the national review of forest and forestry on Native American lands and is a consultant for Interforest LLC. He has authored hundreds of publications, including books such as "Planning research: A concise guide for the environmental and natural resource sciences," "Environmental Leadership Equal Essential Leadership: Redefining who Leads and How," and "Forests to Fight Poverty, Creating National Strategies." He has extensive international experience and awards to his name. Dr. Gordon's keynote address will focus on the leadership needed in the international world of forestry. For more information:
http://www.iforest.com/gordon.htm

Welcome to the Western Forestry Research Symposium!

CANOPIES TO CONSTRUCTION: THE ECOLOGY, MANAGEMENT, AND USE OF TOMORROW'S FORESTS

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 promote academic excellence by challenging students to present their work to their academic and professional peers. This event offers graduate students a forum to receive feedback on their proposed and current research from a diverse audience, fostering student engagement, enthusiasm, and interdisciplinary collaboration.

We are delighted to share over 70 oral and poster presentations by graduate student researchers on a variety of interesting subjects. Topics stretch across the realm of forests, forestry, and forest products, examining ecology, human uses, and interconnections between the two in forest settings. This year's participants communicate an array of research projects spanning all three departments of Oregon State University's College of Forestry (Forest Ecosystems & Society [FES]; Forest Engineering, Resources & Management [FERM]; and Wood Science & Engineering [WSE]), as well as the University of Idaho, University of Montana, and University of Washington.

The symposium also features four invited keynote speakers bringing research and academic knowledge from a wealth of experiences and varying fields of expertise. These distinguished speakers and the range of student work presented emphasize the collaborative and interdisciplinary nature of forestry today, as well as broader implications of forestry into the future. WFGRS is an entirely student-organized event, though it would not be possible without generous support from the OSU College of Forestry and the departments within the college. The organizing committee would like to thank Dr. Thomas Manness (Dean of the College of Forestry), Dr. John Bliss (Associate Dean for Graduate and International Programs), Dr. Paul Doescher (FES Department Head), Dr. Claire Montgomery (FERM Department Head), Dr. Laurie Schimleck (WSE Department Head), and the numerous staff and faculty who provided invaluable planning support. We would also like to thank this year's keynote speakers, Dr. Michael Nelson, Dr. Renee Brooks, Dr. Patricia Muir, and Dr. John Gordon, and the faculty and research associates who participated on student presentation award panels for their time and support.

We welcome you to enjoy the symposium and invite you to share in the success of the graduate students' research efforts.

Sincerely,

The 2013 Western Forestry Graduate Research Symposium Planning Committee

2013 Symposium Planning Committee

Michelle Agne
Kate Halstead
Joey Hulbert
Kate Marcille
Elizabeth (Bess) Perry
Josh Petit
Eli Weisgerber
René Zamora

Symposium website: ***http://gradsymp.forestry.oregonstate.edu/***

MONDAY APRIL 22			TUESDAY APRIL 23	
8:40	Welcome - Dr. Thomas Maness		8:40	Welcome - Dr. Claire Montgomery
9:00	Why? Dr. Michael Nelson		9:00	Delivering the Message: Beyond the Peer Review Journal Article Dr. Pat Muir
	Concurrent Sessions			Sessions
	RH 107	RH 115		RH 107
9:45	The use of LiDAR to identify the forest transportation network - Storm Beck	Long-term controls on ecosystem calcium: Nitrogen accumulation versus bedrock weathering - Justin Hynicka	9:45	The value of knowing: A study of public lands monitoring by non-agency entities - Aaron Olsen
10:05	Aggregate degradation in NW forest roads - Austin DeWitt	Do cutthroat trout go with the flow? Relationships between discharge and cutthroat trout abundance at multiple scales in managed headwater basins - Hazel Owens	10:05	Reliability of the generalized inference: Assessing the generalizability of small woodland owner social research - Deanne Carlson
10:25	Break			
10:45	Perceptions of protection: Oregon coastal residents' awareness and understanding of state marine reserves - Elizabeth Perry	Development of new/novel materials for use in advanced composites (Polymer/Cellulose nano Crystalline (CNC)) - Meisam Mohammadi	10:45	Landscape-level reference conditions for ponderosa pine and mixed conifer forests of eastern Oregon - Keala Hagmann
11:05	What will they do? Visitor sanctions in response to crowding at coastal parks in Oregon - Wesley Mouw	Synthesis and characterization of industrial lignins thermoplastic elastomeric systems - Hui Li	11:05	Fire management and restoration decisions of federal land managers - Emily Platt
11:25	Public acceptance of smoke from wild, prescribed, and private-use fire - Stacey Frederick	Characterization of Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) produced by mixed microbial consortia on agricultural waste by NMR spectroscopy and electrospray ionization mass spectrometry - Liqing Wei	11:25	An evaluation of U.S. Forest Service planning standards and guidelines - Emily Schembra
11:45	RH 313—Poster Session and Lunch			
1:00	Collaboration and Flexibility: Tools for Addressing Tomorrow's Research Challenges Dr. Renée Brooks		1:00	Research Leadership: An Oxymoron? Dr. John Gordon
1:45	Assessing bird diversity and land ownership implications for management prioritization in oak ecosystems of the Rogue Basin, Oregon - Kate Halstead	Micro analysis of wood-composite bondlines in 3D - Jesse Paris	1:45	Oregon's timber towns: What can forest management do to improve community health? - Mindy Crandall
2:05	Impacts of dwarf mistletoe on the physiology of host Tsuga heterophylla trees as recorded in tree ring stable carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotopes - Danielle Marias	Quantifying the availability of woody biomass from fuel reduction and forest restoration thinning in the PNW - Kevin Vogler	2:05	Evaluation of social preferences for woody biomass bioenergy - Robert Campbell
2:25	Impacts of dwarf mistletoe on canopy structure of lodgepole pine-dominated forests 21-28 years post-mountain pine beetle epidemic in central Oregon - Michelle Agne	Douglas-fir biomass and nutrient model of varying harvest intensities and silvicultural treatments in regards to liquid biofuel production - Kristin Coons	2:25	The Portland-Vancouver metropolitan regional urban forestry strategy - Abbey Driscoll
2:45	Break			
3:05	Insects and wildfires across Pacific Northwest forests: A photographic journey through space and time - Garrett Meigs	Moisture management model for optimal forest biomass delivery in the Pacific Northwest - Francisca Belart	3:05	A description of Masters International program at OSU - Peace Corps staff
3:25	Impact of Swiss Needle Cast infection on tree carbohydrate reserves - Brandy Saffell	RENO: A computerized decision support system for the economic optimization of forest biomass processing and transport - René Zamora	3:25	Estimation of leaf area index and simulation of evapotranspiration for intensively managed Douglas-fir forests - Nicole Rogers
3:45	Red alder inoculations with Phytophthora species from Oregon streams: Testing pathogenicity of the "tree-killer" genus - Sarah Navarro	Lactic acid production by novel one-step fermentation of potato processing waste - Shaobo Liang	3:45	Upslope thinning impacts on trees in riparian buffers - Kenneth Ruzicka
4:05	Chemical treatments to sanitize Phytophthora ramorum colonized timber material and mitigate the risk of artificial Sudden Oak Death dissemination - Joey Hulbert	Characterization of bio-oil produced from woody biomass fast pyrolysis - Yinglei Han	4:05	Tradeoffs between intensive forest management, plant diversity and cervid foraging: herbicides and herbivores - Thomas Stokely
4:25	The effects of prolonged weather exposure on wood I-joists - David King	Factors of thermal bioenergy adoption in Grant County Oregon: A model for the rural West? - Meagan Nuss	4:25	Redefining recruitment strategies: the role of traits, demography, and origin in identifying seed and seedling functional types - Julie Larson
4:45	Closing Notes - Dr. Laurie Schimleck		4:45	Closing Notes - Dr. John Bliss

Tuesday, April 23, 2013

Giustina Gallery, LaSells Stewart Center

Oregon State University

Student Presentations
Awards Banquet

7:00 pm
Dinner

7:30pm
Keynote Address, Dr. Lisa Ganio
Graduate Program Coordinator
Forest Ecosystems and Society, College of Forestry

8:00 pm
Awards Presentation, Dr. Steven Tesch
Director of Research, College of Forestry

9:00 pm
Banquet concludes

Impacts of dwarf mistletoe on canopy structure of lodgepole pine-dominated forests 21-28 years post-mountain pine beetle epidemic in central Oregon

Michelle C. Agne, Travis J. Woolley, and David C. Shaw
Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University

Dwarf mistletoe (Arceuthobium americanum) is a native parasitic plant that is pathogenic on lodgepole pine and is present throughout most of the host's geographical range. The symptom of witches' brooming associated with dwarf mistletoe infection is known to cause deformities in individual tree crown structure. We were interested in whether this effect also occurs at larger spatial scales in stands with various levels of dwarf mistletoe infection in central Oregon lodgepole pine forests. Mountain pine beetle (Dendroctonous ponderosae) is a native bark beetle that is understood to occur at both endemic and epidemic levels in all lodgepole pine dominated forests. Therefore to accurately characterize canopy structure impacts of dwarf mistletoe on lodgepole pine forests, time since mountain pine beetle outbreak was held constant over all sites.

We investigated the effect of dwarf mistletoe infection and associated witches' brooming on the canopy structure of 39 randomly located sites grouped within 13 stands on Deschutes National Forest land which had experienced a mountain pine beetle outbreak 21-28 years prior, and had no evidence of recent fire or management. The sites ranged from no dwarf mistletoe to severe dwarf mistletoe infection. Canopy base height, crown volume, and diameter distribution trends of the sites were compared using general linear models to determine the effect of dwarf mistletoe infection on the canopy structure attributes mentioned above. Dwarf mistletoe's effect on canopy structure of lodgepole pine forests may influence fire behavior, particularly with respect to the transition from surface fire to crown fire. However, this relationship may behave differently at various spatial scales and times since mountain pine beetle, having complex implications for managing fire on a heterogeneous landscape.

The use of LiDAR to identify the forest transportation network

Storm Beck and John Sessions
Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University

To meet the needs of the future, the forestry industry will need to acquire more information about their lands and existing infrastructure. Currently, few engineering records are available to forest managers and engineers to assess the transportation of non-conventional products such as poles, chips, or hogfuel. One potential technology that could be used to provide as-is engineering records of the forest transportation network is Light Detection and Ranging, LiDAR. Along with the X, Y, and Z coordinates, an intensity value is provided for each return. The intensity value is defined as the amount of energy backscattered from the study area. Many factors affect the intensity value including material properties, range, angle of incidence, and atmospheric dispersion. We examine the possibility and accuracy of using aerial LiDAR data to extract the forest transportation network to better meet the transportation needs of the future forest industry.

Moisture management model for optimal forest biomass delivery in the Pacific Northwest

Francisca Belart[a], John Sessions[a], Glen Murphy[a], Matthew Jolly[b], Lisa Madsen[c], and Lech Muszynski[d]

[a]Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University, [b]USDA Forest Service Fire Sciences Laboratory, Rocky Mountain Research Station, Missoula, MT, [c]Department of Statistics, Oregon State University, [d]Department of Wood Science and Engineering, College of Forestry, Oregon State University

The objective of this project is to design, build and validate a model to estimate the optimal storage time for forest biomass residues given different Pacific Northwest harvest locations, species and storage form.

Biomass residues are an available resource currently seen as a green alternative for energy production. However, one of the biggest challenges for this material to be economically competitive with traditional fuel sources in the U.S. is high transportation cost.

There are components of transportation cost we cannot control. However, we can be more efficient on what we transport. Our hypothesis is that transportation cost is affected by residue moisture content. As forest biomass moisture increases, transportation becomes more inefficient and expensive.

Wood moisture can be reduced in the forest by transpirational or air drying. It has already been shown that drying rates, and therefore storage time, will depend on climate conditions, species, and storage form. However, preparing biomass residues for storage and storage time itself will incur capital costs, interest and risk. Storage costs must be weighed against savings associated with transportation and customer premiums for dryer material.

Moisture content measurements will be carried out in Oregon to determine moisture content for different forms of storage and times since harvest. A pre-trial has already been performed and field measuring protocols are being evaluated.

The model will be developed as a mixed integer mathematical optimization problem. It will consider multiple logging residue units to supply an energy plant on a determined period of time (to be defined). The objective will be to maximize discounted net revenue over the planning horizon where costs and price will depend on residue moisture content at delivery time.

Model validation could be performed with a current cogeneration plant database or a biomass residue buyer (or owner) who supplies a plant.

Evaluation of social preferences for woody biomass bioenergy

Robert Campbell and Tyron Venn

College of Forestry and Conservation, University of Montana

The utilization of residues from forest thinning operations for energy generation offers potential climate change mitigation benefits compared to an alternative of pilling and burning the residues on-site. Additionally, the treatment of more acres may become financially feasible when a profitable use for residues exists. Increased levels of thinning treatments provides benefits in the form of reduced risk of catastrophic wildfire and pest outbreaks.

However as with other forms of renewable energy, potential drawbacks also exist. Biomass energy is more expensive than fossil fuel energy, and potential environmental impacts exist. Negative impacts of increased woody biomass energy generation may include: reduced local air quality and changes in forest structure and productivity which may in turn impact the ability of forests to provide other valuable ecosystem services.

Demand for increased renewable energy generation is evident from the renewable energy targets set by multiple countries and U.S. states. However, how much and from what sources will be influenced by specific preferences and the willingness that exists to make tradeoffs between the various benefits and costs of each type of energy. Because climate change mitigation, air quality and many ecosystem services are public goods without market prices, nonmarket valuation techniques must be used to elicit social preferences for these goods.

A choice experiment will be used to quantify the public's preferences for woody biomass energy generation. Preferences will be derived in the form of willingness to pay to receive alternative levels of electricity from biomass, while trading off potential associated benefits and costs. Surveying residents of three U.S. states will allow heterogeneity in preferences to be compared between populations from regions with distinct geographic, demographic and economic characteristics.

Reliability of the generalized inference: Assessing the generalizability of small woodland owner social research

Lisa Deanne Carlson and Jeanean Creighton
Department of Forest Ecosystems and Society, College of Forestry, Oregon State University

Natural resource education and extension is at the intersection of diverse disciplines, where effective practice and policy decisions rely on the impartial evaluation of multiple sources of information. As the body of literature informing natural resource and education topics becomes more diverse, complex, and voluminous, our means and ability to synthesize the knowledge represented in these literatures must adapt. An important step in the systematic analysis of multiple sources of information is the evaluation of the validity and generalizability of the source material. Often these sources represent different target populations and measured constructs, and comprise both qualitative and quantitative forms of data that are difficult to evaluate for validity and generalizability by unified standards. In the absence of such standards, circumstances may nevertheless require that disparate information sources be evaluated implicitly with little theoretical basis for evaluation. A framework for the evaluation of validity and generalizability is proposed that makes express those factors that contribute to the validity and generalizability of source materials used in the systematic evidence review process. Validity criteria for quantitative research follow generally-accepted survey and experimental standards. Validity criteria for qualitative research are grounded in critical realist epistemology. Generalizability criteria include factors associated with Fisherian, Bayesian, deductive, and abductive forms of inference. A model is described for the Reliability of the Generalized Inference (RGI), an index based on the internal validity of the source literature and the strength of inference between the source material and the target of generalization.

Douglas-fir biomass and nutrient model of varying harvest intensities and silvicultural treatments in regards to liquid biofuel production

Kristin Coons and Doug Maguire
Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University

The type and intensity of biomass harvest and associated nutrient removal that are sustainable has not been accurately quantified or defined for actively managed stands on a scale applicable to biofuel production. The current equations available for biomass were developed from relatively uniform unmanaged stands with invariant height-diameter relationships. These biomass volume estimates have typically been derived from only tree diameter, which leads to extreme bias in estimates of biomass component distribution due to variation in height for a given diameter in unmanaged stands. Nutrient (N, P, K, Su, Ca, and Mg) allocation in aboveground and belowground tree components also has not been well defined in actively managed stands of Douglas-fir in the Pacific Northwest. In this study biomass sampling and nutrient analysis of coastal Douglas-fir in the Pacific Northwest are being performed across a wide variety of tree diameter, height, and crown length (D/H/CL) combinations on fertilized, thinned and herbicide treated plots. Soil samples and competing vegetation will also be identified and sampled at each site. An improved model of biomass and nutrient balance will be developed across as wide of a range of stand management regimes as possible to identify the levels and intensity of harvest that will prevent long term site degradation.

Oregon's timber towns: What can forest management do to improve community health?

Mindy Crandall and Claire Montgomery
Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University

Forestry in the Pacific Northwest has a unique relationship to rural communities. To what extent are Oregon's communities forest dependent, and to what extent can forest management affect rural economies? Economists typically see two conflicting models for the role of natural resource use and community health, but I think there's a third model that can help us better understand the relationship. This talk will explore the history and geography that have led to our current state and discuss the potential for forestry to sustain our rural communities.

Aggregate degradation in NW forest roads

Austin De Witt, Kevin Boston, and Ben Leshchinsky
Department of Forest Engineering, Resources, and Management, College of Forestry, Oregon State University

This research project had two intended goals. The first is to develop research methodology for studying aggregate wear and breakdown in forest roads. The second is to generate some initial data which can shed some light on the process in which aggregates degrade over time from dynamic traffic loading in forest roads and relate that to standard physical and engineering index properties. This project is mostly observational and focused on developing a broad understanding which can be used for developing future studies.

Three aggregate sources were selected of high, medium, and low quality and tested using standard ASTM and AASHTO methods to measure physical and engineering properties. Samples of these aggregates were then implanted into newly constructed and unused forest road and subjected to approximately 500; 1,000; and 1,500 passes with samples being removed at each of these benchmarks. The gradations of each sample were measured before and after loading. The change in gradations shows how the structural makeup of the aggregates changes over time and with varying strength properties.

Forestry in the Pacific Northwest has a The Portland-Vancouver metropolitan regional urban forestry strategy

Abbey Driscoll, Paul Ries, and Lisa Ganio
Department of Forest Ecosystems and Society, College of Forestry, Oregon State University

Because the urban forest knows no political boundary, efforts should be taken to advance urban forestry management at a regional level. To fulfill that purpose, the *Portland-Vancouver Metropolitan Regional Urban Forestry Strategy* was created to promote healthy urban forests in the Portland-Vancouver metro area. This strategy was prompted in response to the *Vibrant Cities and Urban Forests* report published by the U.S. Forest Service, recommending the creation of regional urban natural resource plans. Working within this strategy framework, this research will assist in the development of the final strategy as well as serve as the focus of my master's thesis. Research activities are focused on the completion of a regional needs assessment survey of community leaders and urban forestry practitioners in the Portland-Vancouver area. This survey will attempt to 1) identify if barriers to implementing and advancing urban forestry program management exist in the project region and 2) define any differences in perspective among the two types of survey participants. These research questions will be answered through the process of conducting preliminary interviews to inform survey design, writing and compiling the final stakeholder survey, and analyzing collected survey data. By completing these objectives, I hope to better understand the needs and barriers to urban forestry management in the Portland-Vancouver area. The ultimate goal of this research is to help local jurisdictions achieve successful urban forestry programs that increase the health of our urban forests while reaping the ecosystem benefits trees provide.

Public acceptance of smoke from wild, prescribed, and private-use fire

Stacey S. Frederick[a], Christine Olsen[a], and Eric Toman[b]
[a]Department of Forest Ecosystems and Society, College of Forestry, Oregon State University, [b]School of Environment and Natural Resources, Ohio State University

Smoke is a growing issue for communities and land and air quality managers. It affects air quality across landscapes much larger than the originating fire and can have significant negative impacts on nearby communities. In early 2013, the U.S. Environmental Protection Agency (EPA) lowered ambient air quality standards for particulate matter which will likely result in more communities struggling to meet EPA limits as a result of smoke. At the same time, wildfires seem to grow in number and size every year, producing major smoke impacts on some communities, and underscoring the need to reduce fuels on unburned landscapes to reduce the risk of future fire events. Managers and landowners wishing to use fire as a tool for fuel reduction (i.e., prescribed fire, pile burns) could face significant barriers, both because of air quality standards and because of public concern for smoke impacts. Accordingly, it is important to understand public beliefs regarding smoke, acceptance of smoke emissions and management approaches, and influencing factors. Integrating this knowledge into management planning and implementation could provide vital information for proceeding forward with management goals. However, to date, relatively few studies have examined these topics. This presentation discusses findings from a 2012 public survey conducted in four locations across the U.S.; south-central Oregon, northern California, northwestern Montana and the central coast of South Carolina. Results provide insight into acceptance of smoke emissions and the influence of experience with smoke, perceptions of smoke impacts, origin of smoke emissions, public-agency relationships, and trust in management agencies. Results will be discussed cumulatively across all sites and comparisons will also be made between rural/urban subgroups and the four study sites.

Landscape-level reference conditions for ponderosa pine and mixed conifer forests of eastern Oregon

Keala Hagmann[a], Jerry Franklin[a], and Norm Johnson[b]
[a]School of Environmental and Forest Sciences, University of Washington, [b]Department of Forest Ecosystems and Society, College of Forestry, Oregon State University

Spatially explicit, landscape-level timber inventories conducted early in the 20th century across hundreds of thousands of hectares provide detailed records of the coniferous forests in south-central Oregon. Using this record of conifers at least 15 cm in diameter at breast height (dbh), we describe variation in the historical structure and composition of ponderosa pine and mixed-conifer forests. Dry forest systems operate now in a novel context of confounding and compounding stressors including increases in: human-generated fragmentation; loss of redundancy; pollution; connectivity of fuel; susceptibility to pests and pathogens; and climate change. Adding to the complexity of the current management and policy context is explicit recognition of a broad social range of variability – "the ecological condition acceptable to a society at a given time". In this context, reference conditions reflecting processes that shaped forests for millennia are consistent with management objectives to preserve ecosystem function given current, projected, and unexpected stressors.

The overwhelming dominance of low-density stands composed primarily of large-diameter ponderosa pine trees leads us to conclude that a disturbance regime characterized by a frequent low- to moderate-severity fire strongly influenced the structure and composition of dry forests in this landscape for at least several centuries. The structure and composition recorded 90 years ago is consistent with that of contemporary forests subject to frequent low- and moderate-severity disturbance. Basal areas were overwhelmingly dominated by large diameter trees (>53.3 cm dbh) and by ponderosa pine. Tree densities were low relative to current conditions; mean values and ranges were greater on mixed conifer than on ponderosa pine sites. Ponderosa pine dominated species composition in the ponderosa pine forests and shared dominance in mixed-conifer forests.

Assessing bird diversity and land ownership implications for management prioritization in oak ecosystems of the Rogue Basin, Oregon

Katherine Halstead[a], Matthew Betts[a], and John Alexander[b]
[a]Department of Forest Ecosystems and Society, College of Forestry, Oregon State University, [b]Klamath Bird Observatory, Ashland, Oregon

Oak ecosystems of the Pacific Northwest (PNW) support high levels of bird diversity, and are critical targets of conservation and restoration efforts. In the Rogue Basin of southwest Oregon, managers are challenged by site prioritization within structurally and compositionally diverse oak vegetation types across a complex patchwork of ownership. Although management is generally conducted at the site level, the goal of preserving a functional system depends on the number and distribution of functioning sites across entire landscapes and regions. Site selection for inherent biological value and likelihood of management success is key for effective coordination of management efforts, but is limited by accurate assessment of these parameters at landscape scales. Additionally, selection parameters may be dependent on stand- and landscape-level ownership patterns due to high correlation of land ownership with vegetation composition. Investigating avian responses to landscape-scale vegetation composition and ownership patterns may help to clarify these issues, increasing the efficacy of regional oak management coordination. In prior work, species distribution models (SDMs) using landscape-level vegetation composition to predict local species occurrence were highly accurate for a selection of oak-associated avian species of the Rogue Basin, suggesting that landscape composition within 2000m may be influential to site-level species occupancy. I use remote sensing data (Landsat TM) in landscape-based SDMs for oak-associated bird species across the Rogue Basin, with the goal of identifying potential "hot-spots" and "cold-spots" of regional avian diversity. I examine implications of local and landscape-level ownership on oak-associated bird diversity by assessing distribution of hot- and cold-spots among ownership types (e.g. private, federal, industrial forest). The results will inform selection and prioritization of oak conservation and restoration sites across ownership types in the Rogue Basin, with a focus on retaining avian diversity.

Characterization of bio-oil produced from woody biomass fast pyrolysis

Yinglei Han, Armando G. McDonald, and Daniel Mottern
Renewable Materials Program, Department of Forest, Rangeland and Fire Sciences, University of Idaho

Biomass pyrolysis products are a complex combination of the products from cellulose, hemicellulose and lignin, each of which has its own kinetic characteristics. The Fast pyrolysis products from woody biomass are char, bio-oil and non-condensable gas. As the bio-oil can be used as the transportation fuels, it has been paid more attention during recent years. Thus, characterizing and upgrading the bio-oil become very important for "drop-in" fuels production. This study reports the characterization on bio-oil produced from Douglas-fir and hybrid poplar fast pyrolysis in an Auger reactor at 500˚C. Current work is trying to maximize bio-oil yield (currently at 40%) by optimizing process variables (temperature, residence time, particle time, etc). The bio-oil fraction was characterized by a combination of (i) GC-MS for volatile/semivoltaile products, (ii) water content by Karl-Fisher titration, and (iii) electrospray ionizationmass spectroscopy (ESI-MS) for the analysis of the oligo/poly-meric species. The synthesis gas was characterized by GC-TCD. The second phase of this study is to upgrade and stabilize the bio-oil by a catalytic hydrogenation treatment. The results from this study will be discussed.

Chemical treatments to sanitize *Phytophthora ramorum* colonized timber material and mitigate the risk of artificial Sudden Oak Death dissemination

Joey Hulbert[a,b], Jeff Morrell[a], and Everett Hansen[b]
[a]Department of Wood Science and Engineering, College of Forestry, Oregon State University, [b]Botany and Plant Pathology, College of Forestry, Oregon State University

Exotic forest pathogen introductions are increasing in frequency as a result of accelerated globalization and world trade. Sudden Oak Death is a disease caused by an exotic organism, *Phytophthora ramorum*, which was introduced into the US in the mid-1990s and is evidence of the risk of trading plants and plant products. First discovered in Oregon in 2001, the pathogen has spread almost entirely throughout the US coastal distribution of tanoak (*Notholithocarpus densiflorus)* and continues to spread around the world. In response to the discovery, the state established a quarantine area to protect its agricultural industries and natural resources from the artificial spread of *P. ramorum*. Since the establishment, the quarantine has expanded several times to incorporate newly discovered infested areas and has led to a greater area with restricted and regulated timber harvest. Internationally, numerous countries have added *P. ramorum* to regulated pest lists and many have incorporated it into their legislature. This may be a concern for Oregon's export market and bolsters the need to develop realistic methods to maximize utilization within the quarantines, secure export markets, and reduce the risk of disseminating potentially invasive organisms. This presentation will discuss the history of the Sudden Oak Death in Oregon, the threats posed by *P. ramorum* economically, the preliminary findings leading to the development of methods to sanitize *P. ramorum* colonized timber material, and the potential benefits of these methods to the biosecurity of the trade of plants and plant products.

Long-term controls on ecosystem calcium: Nitrogen accumulation versus bedrock weathering

Justin Hynicka[a], Julie Pett-Ridge[b], and Steven Perakis[c]
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Ecosystem nitrogen supply strongly influences the biogeochemical cycling and availability of other essential nutrients in temperate forests, especially calcium. Short-term additions of nitrogen often increase dissolved nitrate fluxes and decrease soil pH, which can stimulate soil calcium loss. However, the long-term effect of high nitrogen availability on ecosystem calcium supply is more difficult to determine, and may depend on calcium supply and weathering from different types of bedrock. Strontium isotope ratios (87Sr/86Sr) provide a reliable method to distinguish whether long-term sources of calcium to ecosystems originate from bedrock versus atmospheric sources. We examined nutrient concentrations and 87Sr/86Sr ratios in tree needles and soil pools from 24 Douglas-fir forests growing on two distinct bedrock types across a wide natural gradient of soil nitrogen (0.16 – 0.88% N, 0-10 cm) in the Oregon Coast Range. Our goal was to evaluate the interactions between long-term nitrogen accumulation and bedrock type on calcium availability.

Our preliminary data show that calcium concentrations in tree needles decreased by a factor of 2 with increasing soil nitrogen concentration, despite an enrichment of residual soil calcium in surface soil (0-10 cm) compared to mineral soil at depth (40-50 cm). Preliminary strontium isotope data for tree needles showed differing trends based on bedrock type; specifically, the 87Sr/86Sr of tree needles from basalt sites showed an increasing trend from 0.7057 to 0.7089 toward an atmospheric source (87Sr/86Sr = 0.7092) with increasing soil nitrogen. In contrast, no trend in strontium isotope ratios was observed for tree needles from sedimentary sites (87Sr/86Sr range from 0.7081 to 0.7107). Our results suggest that bedrock type controls the relative importance of different calcium sources (i.e., weathering vs. atmospheric) to forests, but that ecosystem nitrogen status controls overall calcium availability to plants.

The effects of prolonged weather exposure on wood I-joists

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Wood I-joists are important components for floor systems. These materials are often left uncovered and exposed to the weather during construction. I-joists, an engineered wood composite consisting of two other wood composites, oriented strand board (OSB) and laminated veneer lumber (LVL), can be adversely affected by water absorption. Manufacturers typically specify that these materials be protected from wetting, but this can be difficult in wetter climates such as those in the Pacific Northwest. Determining the effects of exterior exposure on mechanical properties of I-joists could help encourage builders to better protect these materials during construction. The flexural properties (MOR) of I-joists exposed to the weather for extended periods of time were studied. Sets of I-joists were exposed on elevated racks during the rainy winter months in the Willamette Valley of Western Oregon. Sets of ten I-joists were removed from the field each month, dried, and then tested in static bending using four equally spaced point loads. I-joist strength (MOR) decreased as a function of exposure time and rainfall. Two months of external exposure was associated with a significant decrease in I-joist strength (MOR). While most I-joists never experience this degree of wetting, they can when construction is delayed. The results illustrate the detrimental effects of exposure to wetting during construction and support improved efforts to limit wetting.

Redefining recruitment strategies: the role of traits, demography, and origin in identifying seed and seedling functional types

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Plant traits serve as a currency for species comparisons and for understanding the selective forces operating in ecosystems. Extensive networks of correlated traits make it difficult to determine which traits have a direct influence on fitness under different environmental conditions, but this also suggests that suites of traits may comprise general strategies which could act as a basis for identifying functional types. Few studies focus on identifying trait strategies in and across the seed and seedling stages, even though success at these stages may have significant implications for relative abundance. Field-based trait and life stage transition data were collected for 47 varieties of semi-arid grasses found in Great Basin rangelands. With this information, I seek to explore and identify functional strategies across multiple stages of recruitment and determine whether trait strategies translate to demographic patterns. The effects of water addition on these relationships are examined, as are differences between native and introduced grasses with respect to trait strategies and recruitment success. Trait variation across grass varieties could be explained by four major axes: growth-related leaf investment, seed and seedling size, root investment, and germination requirements. Trait patterns were largely preserved under water addition, although few relationships were detectable between whole trait axes and life stage transition patterns under either treatment. Cluster analysis identified 6 functional types among semi-arid grasses which complemented and extended traditional classifications based on native/introduced and annual/perennial status. Preliminary results suggest that plant traits provide a strong, ecologically-relevant tool to understand and differentiate recruitment strategies across species. Further investigation will focus on the direct and indirect relationships between traits, life stage transitions, and their impact on first-year abundance.

Synthesis and characterization of industrial lignins thermoplastic elastomeric systems

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A series of different industrial lignins were investigated as a coreactant to produce hyperbranched lignin-co-poly(ester-amine/amide) s polymer (HBLPE) systems. The prepolymers were formed by reacting triols (B3) with diacrboxylic acids (A2) via melt polycondensation and then reacted with lignin macromolecules via melt condensation. The various lignins were characterized chemically (NMR, GCMS, FTIR) and thermally (TGA, TMA). The resultant HBLPEs were chemically characterized by FTIR spectroscopy. The polymer thermal and viscoelastic properties were characterized by a combination of TGA, DSC and dynamic mechanical analysis. The unique features of these HBLPEs were their remarkable flexibility and show shape memory effects on cyclic, thermomechanical tests with DMA. The results from this study will be discussed.

Lactic acid production by novel one-step fermentation of potato processing waste

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Potato processing waste (PPW) is a zero value byproduct generated from food processing operations. This PPW is promising suitable carbon source for the production of green chemicals, such as lactic acid. Lactic acid is an important industrial feedstock for synthesis of the bioplastic, polylactic acid (PLA). Lactic acid was produced through a simple and novel one-step fermentation process using undefined mixed cultures in a series of batch reactors. Results showed that most of the available starch in PPW was converted mainly lactic acid plus minor amounts of ethanol and acetic acid. Lactic acid yield was optimized by controlling process variables such as temperature and PPW pretreatment and details will be further discussed.

Impacts of dwarf mistletoe on the physiology of host *Tsuga heterophylla* trees as recorded in tree ring stable carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotopes

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Dwarf mistletoe is an obligate, parasitic plant that eventually induces host branch and tree death. However, physiological effects of dwarf mistletoe on its host remain unresolved. This study investigated the effect of the hemlock dwarf mistletoe (*Arceuthobium tsugense*) infection on radial growth and gas exchange of western hemlock (*T. heterophylla*) using relative basal area increment (RBAI) and $\delta^{13}C_c$ and $\delta^{18}O_c$ of tree ring cellulose in uninfected and heavily infected old-growth western hemlock in southwestern Washington. From 1876-2010, RBAI declined more rapidly in infected than uninfected trees suggesting that infected trees were growing faster in the past and declined in growth as the dwarf mistletoe infection progressed. From 1976 to 2010, RBAI of infected trees became significantly less than that of uninfected trees. The $\delta^{13}C_c$ of infected trees was not significantly different from that of uninfected trees prior to 1976 but thereafter became significantly less than that of uninfected trees, coinciding with the time at which RBAI of infected trees became less than that of uninfected trees. These trends were consistent with previous work suggesting that lower photosynthetic capacity in infected trees is not accompanied by a compensatory adjustment in stomatal conductance (g_s), resulting in lower $\delta^{13}C_c$. The $\delta^{18}O_c$ of infected trees was significantly less than that of uninfected trees between 1980 and 2010, an unexpected result given that g_s and the ambient humidity were similar for infected and uninfected trees. To explain this result, we used established leaf water oxygen isotope fractionation models and previous physiological measurements to estimate mesophyll conductance, effective path length, and leaf water turnover time. This modeling exercise suggested that infection-induced changes in leaf anatomy and increased time spent at isotopic non-steady state in infected trees were likely responsible for differences in $\delta^{18}O_c$ between infected and uninfected trees.

Insects and wildfires across Pacific Northwest forests: A photographic journey through space and time

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Fire is a pervasive force in many forest ecosystems, but it is not the only prominent disturbance in western North America. In recent decades, insect outbreaks have encompassed more area than wildfires. The apparent increase of both disturbances has sparked concerns about their potential interactions in space and time, as well as speculation about their future dynamics. However, what do these disturbed forest stands and landscapes look like, and how do they change over time? Drawing on photographs and maps covering a range of ecoregions and spatiotemporal scales, this presentation surveys the pyrodiversity and entomodiversity of Oregon and Washington forests. Looking across diverse regions like the Pacific Northwest allows us to see a wide range of ecosystem interactions and appreciate how diverse and dynamic these disturbance processes really are. From bark beetles and defoliators to suppressed fires and megafires, change is the only constant in these forests, and management for change is becoming the new paradigm. Indeed, in the coming decades, these multiple disturbance interactions are likely to present increasingly complex management challenges.

Development of new/novel materials for use in advanced composites (Polymer/Cellulose nano Crystalline(CNC))

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CNC is one of wood products (most abundant source of CNC is wood). Thus we will prepare CNCs from wood (MCC). Each will be thoroughly characterized for size, shape, surface chemistry, crystallinity, zeta potential, surface charge and the mechanical properties. Then, we will assemble a set of well characterized polymers and CNC materials. Initially we will focus on the polymers PVDF/HFP, poly(vinyl acetate) (PVAc) and poly(lactic acid) (PLA). PVDF/HFP is a commercial polymer (Kynar Flex) being considered for use as a battery separator. PVAc is a well-known polymer and has recently been shown to be "switchable" upon exposure to water. PLA is a bio-based polymer and provides the opportunity for a "bio-bio" biodegradable composite. Each polymer will be characterized in terms of mechanical and material properties, including tensile tests, Poisson's ratio, thermal properties, molecular weight and molecular weight distribution.

What will they do? Visitor sanctions in response to crowding at coastal parks in Oregon

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The United States is the largest travel and tourism economy in the world and generated $1.2 trillion toward its own Gross Domestic Product (GDP) in 2012. Tourism in Oregon generated an estimated $8.8 billion toward its own GDP and many of these tourists visited Oregon's coastal state parks. With such high levels of visitation to these parks, there have been concerns that overuse may lead to crowding, dissatisfaction, and other types of behavioral responses. Many studies have examined the concepts of visitor encounter norms and crowding in parks, as well as associated behavioral responses such as shifting to less crowded places or times. Few studies, however, have examined the behavioral responses, or sanctions, such as complaining to managers or others, associated with these variables. This study examined these issues using surveys of 9,063 visitors at 14 coastal state parks in Oregon. Overnight visitors encountered more users (M=112 people) than day visitors (M=67) and felt more crowded (67%) than day visitors (45%). Some parks had higher encounters and crowding than others. Over 70% of visitors who were able to report an encounter norm or that encounters and crowding matter would complain to group members or friends/family, visit at different times, or alter opinions of the park. More than 25% would also write negative reviews, complain to managers or other visitors, or never visit again. Management and research implications will be discussed.

Red alder inoculations with *Phytophthora* species from Oregon streams: Testing pathogenicity of the "tree-killer" genus

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Described as one of the most destructive pathogens of agricultural crops and forest trees, *Phytophthora* is a genus of microorganisms containing over 100 known species. *Phytophthora alni* has caused collar and root disease in alders throughout Europe and has recently been isolated from the interior of Alaska. Found throughout the coastal and Willamette Valley regions of Oregon, red alder, *Alnus rubra*, has been reported to be suffering from dieback, which prompted a survey of their overall health. With concern for the presence of *Phytophthora alni*, a survey of western Oregon riparian ecosystems was conducted in 2010. Through various sampling methods, over 1200 individual *Phytophthora* isolates were recovered, which are representative of 22 species and 2 taxa, including *P. alni uniformis*. Although these *Phytophthora* species were found in association with red alders experiencing dieback, pathogenicity tests have not been completed. Stem inoculation trials were conducted over the course of two seasons, summer and winter, to determine the pathogenicity of 13 different species of *Phytophthora* to red alder. Stem symptoms ranged from a slight brown discoloration to a blackening of the stem surrounding the inoculation cut. For the summer trial, *P. siskiyouensis* produced the largest average lesion area of all *Phytophthora* species tested (371 mm^2). While for the winter trial, lesions from the inoculation with *P.* taxon Pgchlamydo were the largest among the isolates used (80 mm^2). Using various pathogenicity testing methods, it will be determined whether these *Phytophthora* species are the causal agents of dieback in red alder. Three additional techniques to determine pathogenicity will be evaluated using the same isolates of *Phytophthora*. Each technique involves a different inoculation method: stem, soil, fine root, and leaf inoculations. The results of these experiments will address the role of several *Phytophthora* species within the dieback of red alder in Oregon riparian areas.

Factors of thermal bioenergy adoption in Grant County Oregon: A model for the rural West?

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Generating energy from woody biomass using modern technology is a well-established trend in much of Europe, and has recently become a targeted objective in United States policy. In Oregon, pursuing bioenergy has been strongly rooted in the forest products industry. It is commonly identified as a key component to urgently needed economic diversification, restoration in fire-prone regions, and revitalization of struggling rural communities. While bioenergy can include the generation of heat, electricity, or liquid fuels, thermal (heat) bioenergy has been notable for its successful implementation in Oregon, relative to other energy end-uses. Grant County has been at the forefront of these developments, with a recently constructed pellet plant, four biomass boiler installations, and the anticipation of more projects. The county represents a microcosm of issues that are relevant throughout much of the rural US West. With the last sawmill threatening to close down, an aging and shrinking population, and degraded forestland susceptible to altered wildfire regimes, Grant County and communities like it are seeking creative solutions to respond to these changes. Bioenergy is unique in its overlap in both the timber industry and as a renewable energy resource. As such, its implementation is embedded within the context of these larger-scale issues influencing rural communities. As Grant County is looked to as a model for bioenergy expansion in the state, there is a need to fully understand the conditions that have enabled bioenergy applications in that region. For this research, we conducted a case study analysis to explore the social, ecological, and economic factors of thermal bioenergy adoption in Grant County. By articulating these interrelated factors, we aim to contribute to a common understanding of the challenges and opportunities associated with thermal bioenergy in Oregon thus far. We collected data using participant observation, key informant interviews, and secondary data analysis.

The value of knowing: A study of public lands monitoring by non-agency entities

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While rhetoric emphasizing the importance of monitoring has increased significantly in the past decade, actual monitoring on public lands has failed to keep pace. In response to this discrepancy, non-agency entities have begun building their own monitoring programs. The resources and activities these entities are monitoring and methods used to do so have been the focus of several studies. What is less understood, however, is why non-agency entities are monitoring and what perceived value they receive from this activity. The aim of this qualitative study is to fill this gap in knowledge. I interviewed individuals from 15 groups across the Western United States involved in some type of monitoring activity. Preliminary findings suggest that monitoring has significant secondary social and organizational benefits. Advocacy groups find monitoring aids in prioritizing issues as well as leveraging support from membership and outside environmental interests. Collaboratives and Partnerships report monitoring as a significant contributor to building and maintaining trust among diverse interests as well as helping to focus limited resources. Groups with summer student intern or volunteer programs express the value of hands-on interaction with the resource. No group felt that monitoring hurt their mission and all groups report they will either continue monitoring as is or increase this activity in the future. While adaptive management surfaces as an important monitoring end goal, this is not always the case. Such findings point to patterns among non-agency entities that may aid entities looking to start their own monitoring programs or those struggling to maintain existing monitoring programs. Ultimately, monitoring appears to lead to an understanding of the resource which can be used to achieve a wide variety of goals so long as the value of that understanding is properly acknowledged.

Do cutthroat trout go with the flow? Relationships between discharge and cutthroat trout abundance at multiple scales in managed headwater basins

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Due to potential impacts of forest management on the long-term persistence of native salmonids, forest managers across the Pacific Northwest are interested in identifying environmental factors related to the inter-annual variability of cutthroat trout abundance over time. One environmental factor potentially related to cutthroat trout abundance in managed headwater basins of the western Cascades is discharge. While many abiotic and biotic factors may influence the abundance of resident cutthroat trout, discharge is a primary control because it directly and indirectly affects streams at multiple spatiotemporal scales through numerous pathways, including effects on habitat volume, stream velocity, channel hydraulics, water quality, channel geomorphology, bed-load stability, resource availability, and biotic interactions. To better understand environmental controls on abundance over time, this study seeks to answer the question: can discharge explain variation in cutthroat trout abundance in experimental headwater streams from the Hinkle Creek Paired Watershed Study (HCPWS)? Regression analysis was used to model the relationship between the change in Cutthroat trout abundance and hydrologic indices in two experimental sub-basins using eight years of replication to determine 1) if relationships between the change in abundance and hydrologic indices are detectable, 2) if those relationships differ between basins with and without timber harvest, and 3) if those relationships differ when analyzed at the sub-basin or reach level. This presentation will provide preliminary results and possible mechanisms to explain identified relationships.

Micro analysis of wood-composite bondlines in 3D

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Wood is a complex, bio-composite material consisting of numerous cell types designed for structural support, storage, and fluid transport in living trees. Breaking down solid wood into smaller components and reforming it into engineered-composite materials through adhesive bonding can result in randomized defects, greater strength, stiffness or toughness, increased dimensional stability, and more uniform material properties. Moreover, wood composites can utilize a greater amount of a tree's wood fiber, and can be manufactured into a variety of shapes and sizes unavailable for solid wood products. Composite structural performance is directly influenced by the adhesive penetration away from the joint interface and into the porous wood structure. Shallow penetration may result in poor stress-transfer and reduced dimensional stability; while over-penetration can yield a starved bondline. Furthermore, penetration depth is highly dependent on multiple adhesive and wood characteristics, as well as material processing and bonding conditions. The complex relationship between nature adhesive penetration and composite joint performance has thus been difficult to define quantitatively. This is, in part, because adhesive penetration is often observed with various 2D microscopy techniques, which are destructive and fail to define the full volumetric distribution in a composite joint. X-ray computed tomography (XCT), however, is a non-destructive technique capable of providing micro-scale, 3D bondline and adhesive distribution data, and is the focus of this research. Internal structural and penetration data were collected with XCT for multiple composite-specimens prepared from three wood species and three adhesive types. Mechanical joint-performance simulation modeling and testing were then subsequently performed on the same undamaged specimens, to directly account for the various roles of adhesive penetration in 3D.

Perceptions of protection: Oregon coastal residents' awareness and understanding of state marine reserves

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Marine protected areas and reserves are utilized increasingly as a means of formalized ocean conservation across the globe. Policies in these areas are often guided by an ecosystem-based approach, which considers both social and ecological indicators in the establishment, management, and evaluation of these protections. Comprehensive and systematic social science studies of marine protected areas, however, are rare, especially in the pre-establishment phase. This lack of baseline information is often cited as a cause for management misunderstandings, inability to track public perceptions over time, and varying degrees of success with education and engagement efforts. This study, therefore, examines Oregon coastal residents' knowledge, attitudes, beliefs, and potential voting behavior regarding recently approved marine reserves in this state, and how these understandings and cognitions vary depending on a resident's distance from a reserve location. Data were obtained from a mail survey of nearly 600 residents living adjacent to these reserves and along the rest of the Oregon coast. The results provide insight into the range of potential and actual impacts of these reserves on affected populations. This timely study informs implementation of grounded and place-specific ecosystem-based management strategies, educational efforts, and socially acceptable policies.

Fire management and restoration decisions of federal land managers

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The structure and pattern of central Oregon forest landscapes has been significantly impacted by management and wildfire. The size of fires in central Oregon has increased dramatically in past two decades, and the future of forestry in central Oregon will continue to be shaped by wildfire.

Much of the landscape in central Oregon is dominated by federal lands, and management decisions on these lands play a major role in influencing the response of forests to fire. Federal land managers are currently implementing activities aimed at creating more resilient landscapes, protecting communities in the wildland-urban interface, and supporting local mills and businesses that specialize in forest management work. Interviews with federal land managers in central Oregon revealed different approaches to management based on the conditions of the land, social influences, and administrative constraints.

This research explores the ability of federal land managers in central Oregon to adapt to changing forest conditions and changing social and economic opportunities and constraints. Specifically, this research assesses the Forest Service's ability to support resilient forest ecosystems in central Oregon given current budget, organizational, and administrative structures. It also explores the alignment of current organizational structures with agency ecological goals and objectives.

While "organizational structure" may not seem enticing at the first glance, a lot of exciting change is afoot within the Forest Service including new direction for the development of management plans for each national forest and pilot programs that support innovative approaches to forest management. This organizational information is directly related to how the Forest Service makes decisions about forest management.

The research presented will shed light on the Forest Service's ability to manage for resilient forests in the context of changing forest and social conditions.

Estimation of leaf area index and simulation of evapotranspiration for intensively managed Douglas-fir forests

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Understanding the tradeoff between water use and productivity is critical for modeling growth of intensively managed Douglas-fir forests in the Pacific Northwest. Evapotranspiration is closely linked to carbon dioxide intake during the process of photosynthesis. However, summer drought characterizing the growing season in this region imposes a limit on carbon dioxide intake due to plant responses to limit water loss and potential for cavitation. Therefore, understanding or predicting the rate of water use and the effect of soil water potential and vapor pressure deficits on the exchange of both H_2O and CO_2 is important for simulating the net primary production of a given forest site. This project explores methods for estimating daily and seasonal evapotranspiration and its implications for soil water drawn down and water limits on productivity.

A frequently used equation for simulation of forest evapotranspiration is the Penman-Monteith equation. Many forms of this equation can be found throughout the literature, covering a wide range of complexity. Yet, room for improvement still exists through increased accuracy in estimation of individual components of the equation. One such component is Leaf Area Index (LAI). LAI is a staple of evapotranspiration equations because this index accounts for the surface area over which evapotranspiration occurs. Three common methods of LAI estimation were compared to determine the most accurate value for simulating evapotranspiration. Estimates of evapotranspiration are then validated through comparison to soil moisture monitored at 2-hr intervals throughout the growing season. Because evapotranspiration rates are very sensitive to LAI, increased accuracy of estimating LAI and validation of simulated evapotranspiration against measured soil water loss will lead to improved predictions of Douglas-fir productivity as influenced by water limitations.

Upslope thinning impacts on trees in riparian buffers

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Thinning is a common forest management tool used to improve growing conditions for residual trees. However, forests are complex adaptive systems that will interact with the environment and management actions at multiple spatial scales from individual tree neighborhoods to ecosystems. We utilized an operation scale silviculture experiment to investigate interactions of different thinning treatments on spatial aspects of the relationship between tree growth and climate, specifically water availability. Silvicultural treatments will not just impact trees in the treated areas. Trees in downslope untreated riparian areas also may have been impacted by treatments. Our study uses the Density Management and Riparian Buffer Study (Cissell et al. 2006). Three sites (North Soup, OM Hubbard, and Keel Mountain) were chosen to establish a climate gradient. We collected increment cores from 98 trees to compare growth for the entire ring, earlywood, latewood and the proportion of latewood. We compared growth between different treatments and investigated if upslope treatments decoupled the pre-treatment relationship between drought (PDSI) and growth. Preliminary results indicate that thinning does increase growth in trees growing downslope of thinning treatments. Thinning also altered the relationship between tree growth and PDSI as well as a lower proportion of latewood in trees growing downslope of thinning treatments. Our results indicate that the spatial impacts of thinning, growth and drought tolerance are complicated and will require further analysis to determine the physiological mechanisms for growth differences.

Impact of Swiss Needle Cast infection on tree carbohydrate reserves

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Recent trends in drought-related tree mortality on a global scale have led to many questions regarding the role of non-structural carbohydrates (NSC) as an indicator of overall tree vigor and demand for photosynthate. Much of the uncertainty surrounding the role of stored NSC in maintaining tree survival pertains to the degree to which stored pools of NSC are sequestered (permanently stored and unusable) or whether they are capable of being mobilized when needed by the tree. The Douglas-fir disease called Swiss Needle Cast (SNC) provides a unique natural experiment to examine relationships between carbon storage and infection symptoms because infection involves a substantial reduction in carbon assimilation under conditions of low environmental stress in sites where SNC is prevalent. The goals of this research were: 1) to determine how SNC influences partitioning of assimilated carbon between growth and storage; 2) to evaluate the degree to which ifection severity influences relative partitioning of carbon between these two sinks over the growing season, and 3) to establish the extent to which nonstructural carbon can be mobilized under natural conditions of low environmental stress and restricted carbon supply in relation to potential demands for growth. We analyzed concentrations of starch, sucrose, glucose and fructose in upper branch wood, foliage and trunk sapwood of 15 mature Douglas-fir trees expressing a gradient of SNC symptom severity. There were significant negative relationships between disease severity and growth (mean basal area increment, BAI), as well as between disease severity and mean concentration of trunk NSC. The amount of NSC per unit growth (mean NSC/BAI), an index of the relative priority of storage versus growth, increased with disease severity in all three sampled tissues. These results suggest that under reduced carbon supply, Douglas-fir trees retain NSC at the expense of growth, particularly in the crown.

An evaluation of U.S. Forest Service planning standards and guidelines

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The U.S. Forest Service (USFS) uses planning standards and guidelines (S & Gs) to guide and constrain management actions and activities on National Forest System lands, pursuant to the National Forest Management (NFMA). Both are legally enforceable requirements in forest plans and planning regulations. Standards are mandatory, while guidelines allow for some deviation so long as the desired intent is achieved. There is longstanding conflict related to the restrictive, inflexible nature of S & Gs. In the future, the USFS will be tasked with making decisions within an adaptive system, with the goal of creating more environmentally resilient systems. Therefore, the goal of this study was to uncover common issues, questions, and concerns related to the use of S & Gs in order to provide recommendations for how they might be written and applied more effectively in the future. We analyzed public comment letters from the 2005/2008 and 2012 NFMA planning regulations, applicable case law, and background materials. Fifteen interviews were conducted with USFS personnel, NGO specialists, and legal experts in order to supplement and validate findings. Twenty-five forest plans, strategies and amendments were examined in order to create a typology of common standards and asses their operational use. From this typology, we developed three primary continuums of common standards: mandatory and discretionary, scale of application, and complexity. Several sub-categories are also described, including prioritization, threshold, process-based, management method, and mitigation. The article concludes with reasons why the USFS may benefit from imposing binding, enforceable S & Gs upon itself, including bolstering legal accountability, political credibility, and organizational efficiency. Recommendations for writing standards, incorporating best available science, working within an adaptive management system, supporting recovery efforts for threatened and endangered species, and making use of suitability determinations and management area designations are provided.

Tradeoffs between intensive forest management, plant diversity and cervid foraging: herbicides and herbivores

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Intensive Forest Management (IFM) in the PNW seeks to decrease rotational ages by reducing competition with young conifer seedlings through the use of herbicides. However, there is concern that IFM negatively affects biodiversity by reducing the abundance and richness of early seral plant communities which function as major habitat resources for wildlife such as cervids (deer and elk). Alternatively, foraging by cervids in plantations can result in seedling browse damage and mortality which leads to severe economic losses. Cervids are also known to influence plant community structure and composition through selectively foraging on nutritious plant species, especially in early seral stages of succession. We hypothesize that: (1) herbicides reduce cervid forage availability by reducing the abundance and diversity of forage species; (2) the influence of herbicides on plant diversity are exacerbated by cervid foraging due to interactive disturbance effects; and (3) conifer seedling browse damage increases with herbicide intensity due to lack of alternative forage resources. To test these hypotheses, we constructed cervid exclosures (225 m^2) in experimental clearcuts (15 ha) that represent a spectrum of herbicide application intensities as part of a greater manipulative experiment investigating the effects of IFM on biodiversity. The experiment represents a replicated block design (7 blocks) with 4 experimental clearcuts per block (no spray, light, moderate, and intensive herbicide treatments) and two herbivory treatments per experimental clearcut (cervid exclusion and open). In each of the 56 herbivory treatments, we are collecting plant community data (percent cover and height by species), conifer seedling growth (seedling volume, crown area, mortality) and non-seedling woody biomass. We are also monitoring cervid utilization and foraging behavior of the open plots through the use of motion sensing camera traps. Results from this project should provide important information regarding the tradeoffs between plantation development, biodiversity, and cervid foraging.

Quantifying the availability of woody biomass from fuel reduction and forest restoration thinning in the PNW

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Within the past 100 years western forests have undergone a fundamental change in function and structure. These changes in function and the forest structure that has developed as a result are responsible in part for the uncharacteristically high severity fires that have been occurring with ever increasing frequency. Massive conflagrations such as the Rodeo-Chediski, B & B Complex, Wallow, Las Conches and Whitewater-Baldy fires are out of line with historical ecological disturbance regimes and are incongruent with the needs and values that society places on our nation's forests. In order to alter this trend towards an ever increasing number of mega-fires, a proactive fuels management strategy that produces significant results at meaningful scales must be undertaken by federal land agencies. Through my research I will look at what role the utilization of biomass material can play in offsetting the cost of fuel reduction and forest health thinning on federally owned land in Oregon, Washington, Montana, and Idaho. A series of archetypal forest stand conditions will be developed in order to determine treatment cost benefit thresholds that will help inform future management planning.

Characterization of Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) produced by mixed microbial consortia on agricultural waste by NMR spectroscopy and electrospray ionization mass spectrometry

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The bioplastic, poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) (PHBV), was biosynthesized and isolated from mixed microbial consortia culture fed with fermented agricultural waste liquor as the carbon source. The hydroxy valerate (HV) mole fraction of PHBV samples was determined by ^{1}H NMR spectroscopy, while the HV and hydroxyl butyrate (HB) sequence distributions were determined by ^{13}C NMR spectroscopy. The diad and triad sequence distributions followed Bernoullian statistics, suggesting that PHBV copolyester sequence was random. The chemical structure and sequence distribution of PHBVs were also characterized by electrospray ionization mass spectrometry (ESI-MS^n) after partial alkaline hydrolysis to oligomers. ESI-MS^n analysis showed HV and HB distribution was completely random. We have developed tools to monitor PHBV biosynthesis under different bioreactor and feed conditions to tailor PHBV properties.

RENO: A computerized decision support system for the economic optimization of forest biomass processing and transport

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A computerized model is presented to support operational decisions related to forest biomass recovery operations for energy purposes. In forest biomass operations there are several different types of technologies for comminution and transportation configurations. Among all available options, an important task for the analyst is to select the most cost-effective processing and transportation options given particular road characteristics and landing access in relation to the residue pile location. The Residue Evaluation and Network Optimization (RENO) software identifies the most cost effective combination of machines and methods to perform forest biomass processing and transportation operations. A solution procedure uses mixed-integer programming and deterministic discrete-event simulation to optimize the operations. The problem is solved as a directed network in which residue piles are source nodes and the biomass is transported through different arcs in the network that represent different processing and transportation options. RENO has a special graphical user interface that allows the analyst to load spatial data (vector) with the residue pile location and road access. The spatial information allows the program to calculate cost as a function of the residue pile location and road characteristics (i.e. truck turn-around and turn-out spaces). The model is specially designed for operations in steep terrain. An ant colony heuristic is also implemented in the model for users who do not have linear programming solvers.

POSTER PRESENTATIONS

Designing a strand orientation pattern for improved shear properties of oriented strand board

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In-plane shear stiffness is an important mechanical property of oriented strand board (OSB) when used as an engineered wood product, such as for webs of I-joists and shear walls. This study investigated modifying strand orientations to improve in-plane shear stiffness of OSB based on classical laminated plate theory. In-plane shear tests were performed on a total of 14 - 90 cm x 90 cm x 1.27 cm OSB panels manufactured with strand alignment patterns of 0˚/90˚/0˚ and 0˚/+45˚/-45˚/-45˚/+45˚/0˚. Phenol formaldehyde resin application was achieved by tumbling the strands in a rotating drum and passing resin though a spinning disc atomizer. Strand alignment was achieved by passing strands through a vibratory screen consisting of 12.7 cm deep aluminum veins with 5 cm spacing. A consistent hot-pressing schedule was held throughout the project. The panels were cut into bending and shear test specimens. The shear testing consisted of a modified ASTM-D2719 method C two rail shear test to find the in-plane shear stiffness and strength. Shear strain was measured with digital image correlation (DIC). The bending specimens were tested for parallel and perpendicular moduli of elasticity and moduli of rupture using ASTM-D3043. Preliminary results show a 27% increase of in-plane shear stiffness with a 12% reduction of parallel bending stiffness. In-plane shear stiffness of OSB controls the lateral deflection of wall structures. Further steps of the study include building 60 cm x 60 cm wall structures with typical stud framing and investigating the racking stiffness of OSB wall structures using alignment patterns of 0˚/90˚/0˚ and 0˚/+45˚/-45˚/-45˚/+45˚/0˚.

Investigating anthropogenic variables in relation to tree basal area and herb abundance in Bale Mountains National Forest

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Bale Mountains National Park (BMNP) in southeast Ethiopia was established over forty years ago. In the last twenty years it has faced increasing human and livestock populations. The Harenna forest is approximately 7000 km^2 with roughly 1000 km^2 in the southern part of BMNP. It forms the second largest tract of moist tropical forest left in Ethiopia (OARDB 2007). All highland areas over 1,100 m above sea level (asl) in Ethiopia, including BMNP, fall within the Eastern Afromontane Biodiversity Hotspot. In 1986, Hillman estimated the park's human population to be 2,500 with about 10,500 head of cattle; twenty-one years later the population is estimated to be 20,000 people with a seasonal influx increasing the estimate to 40,000 with 168,300 head of cattle (Hillman 1986; OARDB 2007). This observational study was undertaken in Rira, the largest permanent village in the 2700 – 3200 masl elevation belt to document current forest composition and structure of herbaceous, seedling, shrub, and tree communities. This belt has been largely ignored by current park managers as being too disturbed. The identification of important disturbance variables was undertaken using Nonmetric Multi-dimensional Scaling (NMS). The vegetation matrix (45 plots x 73species) contains percent cover for all observed herbaceous species and average basal area by tree species. The environmental matrix (45 plots x 51 variables) contains both environmental variables and anthropogenic disturbance variables. The results identified browse, distance to village, and average canopy cover as important indicators of anthropogenic disturbance. Additional work remains to explore the combination of these variables to create a disturbance index for use by park managers. Further analysis of the species is needed to understand which species are more likely to be found in disturbed areas versus less disturbed areas.

Water repellency of preservative treated railroad ties

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Railroad ties are a crucial component of railway track systems. When ties fail in service, serious consequences may result, including the derailment of trains. Most often these tie failures result from physical defects such as cracks and checks that develop in the wood near the rail fastenings. These defects result from the shock loading experienced by the wood from the passing trains, but are also exacerbated by drying stresses that develop in the wood as it undergoes repeated moisture cycling. To prevent biological degradation, wood ties used for railroad applications are treated with preservatives. Traditionally, ties have been treated with creosote, a thick oily substance made by distilling coal tar obtained from the high temperature carbonization of coal. In addition to protecting the ties from insect and fungal attack, creosote may also impart some physical stability to the wood by providing water repellency and lessening moisture cycling. Other wood preservatives such as copper naphthenate and amoniacal copper zinc arsenate are also available for treating wood ties and are known to provide excellent decay resistance. However, as ties often fail physically before they degrade biologically, the water repellency and derived physical stability of the different preservative systems is also of great importance. Thus, a test to assess the impact of different preservatives on the water repellency of wood ties would be useful. The objective of this research will be to develop a small-scale, accelerated test that will assess the effect of preservative systems on the water repellency and derived physical stability of treated wood ties.

Development and characterization of wood fiber reinforced engineering polymers

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Traditional fiber reinforced polymers are often made using glass fibers which are non-renewable and energy intensive to manufacture. These fiberglass composites are used in high performance to lower performance semi-structural applications. Wood and other natural fibers offer distinct advantages over glass fibers; they are typically less expensive to produce, more environmentally sustainable, more ductile, and less abrasive on equipment. Additionally, natural fibers can be recycled for energy and can be used to make lighter weight composites since they have lower densities than fiberglass. Of the natural fibers, wood fibers are very abundant since there is an existing wood pulping industry. Being readily available and offering advantages over glass fibers, wood fibers can be used as a reinforcement to create natural fiber composites which could replace fiberglass composites in certain applications. These wood fiber reinforced polymers (WFRPs) could be produced using wood fibers derived from either chemical or thermomechanical pulping and a variety of matrix polymers. The development of a WFRP manufacturing industry would benefit the wood pulping industry by providing a new market since wood fibers have not traditionally been used as a reinforcing material. This is especially important considering that the American wood pulping industry has struggled economically and declined in recent years.

WFRPs have been made from Kraft and MDF fibers with EPONTM 828, a difunctional bisphenol-A-epichlorohydrin epoxy, hardened with DETA. These WFRPs were manufactured using a hot press and mechanically tested for tensile properties. Eventually the volume fraction of these composites will be measured. A vacuum forming process is currently being developed for better manufacturing of WFRPs. Further research will include the use of other matrix polymers, measurement of interfacial stress transfer, and a direct comparison of WFRPs to glass fiber reinforced polymers manufactured using identical processing methods.

Influence of anthropogenic alteration of environment on natural forest disturbance regimes in western United States

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Disturbance has a profound effect on forest composition, structure, and function. Disturbances are caused by both natural and anthropogenic agents. Feedback mechanisms between anthropogenic alterations of forests and their environment, and natural disturbance pattern in space, time, and magnitude are considered in this project. The goal is to document disturbance history in western United States using recently developed satellite image-based change detection methods and relate natural disturbances to the environmental characteristics under which they occur. This information will help to better understand human impacts of forest management and climate change on natural disturbance events. Achievement of this goal will include 4 steps: (1) integrating Landsat Multispectral Scanner System data into an existing satellite image change detection program (LandTrendr), allowing 40 years (1972-2012) of annual disturbance history information to be extracted; (2) investigating uncertainty and error associated with limitations of the imagery and variation in parameterization of change detection; (3) testing different approaches to analyzing, aggregating, and representing change information, and u nderstanding how these different realities affect the application of the data; (4) relating natural disturbance timing, frequency, magnitude, and extent to a series of environmental variables including: topography, climate history, stand characteristics, and proximity to forest management operations using spatial, and time series statistics.

The effects of agricultural conservation practices on landscape matrix quality for amphibians

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Amphibian populations have experienced marked declines in global distributions and increased extinction rates. Agricultural development has been a leading cause of habitat loss and degradation for amphibians. The continual demand for food from a growing human population has encouraged the expansion of cultivated areas and the adoption of intensive agricultural practices that has increased pressure on remnant ecosystems. With our society's reliance on agriculture, there is very little chance of returning cultivated land to its natural state, but improvement in the management of agro-ecosystems to minimize impacts and improve connectivity can greatly enhance wildlife populations and ecosystem service production. For example, organic farming practices, which are characterized by reduced use of pesticides, have been correlated with greater biodiversity than conventional intensive agriculture. The quality of the landscape matrix (non-habitat areas) has also been shown to have significant effects on the connectivity of remnant habitats, increasing dispersal rates for many species. Further, landscape components in addition to agricultural systems, including urban areas, roads, must also be considered when managing for landscape-scale conservation of wildlife (i.e., landscape matrix management). To understand why organic farming and other conservation practices support a higher biodiversity and abundance of wildlife than conventional farming, I propose to investigate how quality and management of the landscape matrix be evaluated. I will investigate landscape matrix within the Willamette Valley, Oregon, which supports five native

(Continued on next page)

amphibian species despite widespread urban and agricultural land use. To better understand how these indicator species persist in the Willamette Valley, I propose to conduct a multidisciplinary study of how different management practices of agricultural matrix impact the connectivity, genetic structure, and dispersal behavior of amphibian populations. This research will enhance our understanding of how agricultural land quantitatively affects sensitive amphibian species and can inform decisions on best management practices to support ecosystem services.

Use of puff dispersion models to decrease cost of MCH treatments

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The Douglas-fir beetle (Dendroctonus pseudotsuga) has the ability to kill high numbers of Douglas-fir trees (Pseudotsuga menziesii) across a landscape during periods of population outbreaks. The most effective method for protecting small high value stands from Douglas-fir beetle attack uses MCH (3-methylcyclohex-2-en-1-one) (Ross et al. 2006). MCH treatments are effective, but expensive to install.

MCH is a naturally produced anti-aggregation pheromone which has been synthetically replicated to prevent beetle attacks (Ross et al. 2006). Currently MCH is used in a grid spacing of 40 feet throughout areas experiencing outbreaks to effectively prevent tree mortality. Recent studies using puff dispersion models have shown that a 79 and possibly 93 foot grid spacing may be equally effective at preventing Douglas-fir beetle attacks (Strand et al. 2012). The purpose of this study is to compare the 79 and 93 foot grid spacing to the currently used 40 foot spacing.

The main cost associated with MCH treatments is the labor used to install the treatment (Ross and Wallin 2008). Increasing the grid spacing reduces the labor time by limiting the number of stops needed to apply the treatment. Decreasing the cost associated with treatment installation can result in an increase in the amount of land which can be protected on a given budget.

Results from this study will provide evidence of puff dispersion models as an effective tool for anti-aggregation pheromone modeling. At the conclusion of the study we will know the maximum effective grid spacing per acre for MCH or if further research is necessary.

Comparing aboveground biomass estimates using existing allometric equations, LiDAR, and tree based physiological models in Central Oregon lodgepole pine

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Above ground live woody biomass (AGLWB) estimates remain one of the largest uncertainties for landowners. Biomass estimates are very important to property owners as they relate directly to forest fuel loading and carbon sequestration.

The overarching goal of this project is to understand the uncertainty associated with allometric biomass estimates. Specific objectives are to: A) Compare the measured (control) AGLWB to modeled/ predicted AGLWB values and create a specific allometric equation for Central Oregon lodgepole pine, and B) Compare measured AGLWB to modeled/ predicted AGLWB estimates on high versus low productivity site. Within these objectives there are the following outcomes: 1) Develop aboveground biomass estimates for lodgepole pine trees in Central Oregon, comparing existing allometric equation estimates to a control estimate, 2) Develop aboveground biomass estimates for lodgepole pine trees in Central Oregon, comparing LiDAR estimates to a control estimate, 3) Develop aboveground biomass estimates for lodgepole pine trees in Central Oregon, comparing physiological tree growth model (TREGRO) estimates to a control estimate, 4) Compare measured AGLWB to modeled/ predicted AGLWB estimates on high versus low productivity sites, 5) Determine if there is a significant difference in biomass due to site productivity, and 6) Adjust biomass estimations for site productivity if necessary.

In order to perform the research two pre-existing sites, one high productivity site and one low productivity site will be selected in the Deschutes National Forest. On these sites trees will be randomly sampled, cut and measured using allometric equations to estimate the AGLWB. The trees that are selected will also provide LiDAR data and will be measured to provide physiological modeling data.

The data gathered from this study will add clarity to forest biomass estimation and will aid in forest fuel calculations and forest carbon sequestration estimation.

Initial impacts of burn severity on ponderosa pine *(Pinus ponderosa*) seedlings in relation to ectomycorrhizal fungal community composition and soil nutrients

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Exposure of soils to heating from severe fire reduces soil nutrients, water availability, and causes mortality of soil microbes. An increasing frequency of high severity fires in the interior ponderosa forests of central Oregon has created a need to comprehend its causes and impacts.

Ectomycorrhizal fungi (EMF) are soil organisms affected by fire. EMF are considered essential for conifer seedling growth and establishment by aiding seedlings in water and nutrient capture. Previous studies have shown that EMF improve ponderosa seedling growth and survival after fire, but did not compare community composition between low and high severity burned soils in a field setting. For this study, I will compare burn severity impacts with an in situ experimental design using 3 prescribed burn treatments: high severity burn (HSB), low severity burn (LSB), and unburned control (UB).

Do fire severity-related changes to soil nutrients and EMF community composition affect planted ponderosa seedling growth and survival over the first growing season? The goals of this study are to a) elucidate the differences in initial impacts of high and low severity fire on ponderosa pine regeneration and b) determine the importance of EMF communities in ponderosa pine forests that face a future of increasing high severity fire frequency. I hypothesize that 1) lower soil nutrient concentrations are present in HSB soils compared to LSB soils, 2) ponderosa seedlings grown in HSB soils have a lower EMF species richness and relative abundance than in LSB soils, 3) ponderosa seedlings grown in HSB soils have lower growth and survival rates compared to LSB soils, and 4) growth and survival rates of ponderosa seedlings positively correlate with soil nutrient concentrations and EMF diversity and abundance.

The results of this study will contribute to scientific knowledge of severe fire impacts and could influence fuel reduction methods in forest management.

Examining the relationship of forest structure to defoliation by the pine butterfly *(Neophasia menapia), in the Blue Mountains of Oregon*

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The Pine Butterfly (*Neophasia menapia*) is a native insect, the larvae of which feed almost exclusively on Ponderosa pine foliage. At endemic levels, butterfly populations are relatively small, and the effects of its defoliation on timber are negligible. Infrequently, however, the Pine Butterfly population expands to outbreak proportions. In 2011, Oregon Department of Forestry reported that 250,000 acres of Ponderosa pine were heavily defoliated by the larvae. There are currently no silvicultural prescriptions regarding managing for resilience to pine butterfly. Forest structure has shown to be an important factor in the control of other defoliators. In an attempt to develop realistic guidelines for managers, I am studying the relationship of forest structural characteristics and defoliation. In addition, my work is part of a long-term monitoring project that will study tree mortality and growth loss from defoliation.

Comparing Himalayan blackberry *(Rubus armeniacus)* management techniques in the upland prairies of the William L. Finley National Wildlife Refuge

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Upland prairies of the Willamette Valley of Oregon are some of the most threatened ecosystems in existence. Within the last two centuries human-induced activities have reduced the area of these prairies to 1% of their pre-settlement range. Altering the natural disturbance regime, such activities have allowed invasive species like Himalayan blackberry (*Rubus armeniacus,* HBB) to spread and convert prairies to dense, inhospitable thickets of woody canes, further reducing prairie physiognomy. As the main habitat of many threatened and endangered species, upland prairies are of great concern to the William L. Finley National Wildlife Refuge and management of HBB is essential to conservation and restoration efforts.

Previous studies have focused on the techniques used to reintroduce disturbance to invaded prairies and control the spread of HBB; however, the impact of a few techniques on HBB population dynamics and community response has not been fully analyzed. This is true of the techniques of mowing, burning, and combined mowing and burning. As the refuge's most frequently used HBB control techniques, it is necessary to understand these impacts and responses.

This study will utilize multiple HBB invaded sites throughout the refuge, containing plots of each of the following treatments: 1) mowing 2) burning 3) mowing followed by burning and 4) no manipulation. The plots will be measured before and after treatments to analyze effects on HBB population dynamics including 1) number of canes 2) number of root collars 3) percent cover and 4) number of leaves. Other species responses will also be measured, including 1) percent native cover 2) percent non-native cover and 3) percent invasive cover. Differences in mean responses will be analyzed and significant results will be provided for inclusion in resource management plans in hopes that improvement occurs in upland prairie preservation on the refuge and throughout the Willamette Valley.

Terrestrial laser scanner point cloud interpretation using commercially available software

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Terrestrial Laser Scanners gather millions of points that can be used to describe the surface of a tree in just a few minutes. These scanners are simple to use, and produce reliable and accurate results. The information gathered can be used to determine tree volume, tree location, sweep, lean, and volume of merchantable timber, all are variables that determine the potential value of a tree. This information when combined with data describing ground cover, slope, and tree density, can determine stumpage values for forested areas.

The goal of the project is to develop a method for analysis of the point clouds that result from a scan with the terrestrial laser scanner. The point clouds contain millions of individual points, each with an X, Y, Z coordinate as well as an intensity value. By filtering out stray returns, and applying algorithms to determine the location and size of tree stems, we can transform the point cloud into a virtual forest that is capable of analysis.

Autodesk AutoCAD Civil 3D 2013 fits the needs of the project goal. This was used in combination with Faro Scene 4.8, software designed for use with the Focus 3D laser scanner, to create virtual models of plots in the Oregon State University Dunn Forest, located in Corvallis Oregon. The accuracy of the models was compared to hand measured post-harvest volumes of the same trees.

The initial findings show that the models generated are consistent with the actual volumes present in the standing timber.

Log truck fuel usage in SE Alaska

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A fuel usage model is needed by the USDA Forest Service in Alaska to more accurately estimate the amount of fuel consumption by timber sale and cutting unit. This is crucial because fuel prices have risen from $2.00 to $4.50 per gallon in the last five years and therefore fuel may overtake labor as the largest logging cost component. This knowledge can be used by not only the Forest Service, but others as well.

My project looks at: How can the factors most affecting log truck fuel usage be measured and input into a model to predict future fuel usage? The primary factors influencing fuel usage that can be measured and input into the model are from engine data (Avg. fuel economy (mpg), trip distance (miles), fuel used (gallons), maximum speed (mph), etc), road surface (rock or pavement), road grade (percent) and length of that segment of road (miles), radius of curvature (feet), condition of the road (rough to smooth), species being hauled (hemlock, cedar, Douglas-fir), weight of load (pounds), season of haul (winter to summer), and air resistance (size in feet that the load extends past the cab). These response variables will be most affected during log haul, changing with each load. They can be measured and put into the model in MSExcel, using code, so as the values or response variables change, so will the resulting fuel usage amount.

Through this study, the prediction of fuel usage for log trucks (in gallons) during logging operations will be predicted. The scope of this project is Region 10 in SE Alaska, on the Prince of Wales Island.

Biogeography of aspen in North America: Inferring climatic niche differentiation

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For broadly distributed species like quaking aspen (*Populus tremuloides*), wide climate tolerances potentially complicate species distribution models (SDMs) that predict species range. This is because most models create predictions using a single climate characterization as opposed to leveraging regional differences in climate that may be important to local phenotypes. In this study, the aim was to identify differences of within range climate to infer climate niche differentiation in trembling aspen (*Populus tremuloides).* SDMs and statistical analyses were used to quantify relationships of aspen occurrence to climate. Aspen presence points across the US were divided into climatically similar groups (identified from Hierarchical Cluster Analysis) and distributions and inferred climatic niches were compared. Time series data also provide context to climate norms and coarse analysis suggests that future climate that may not be hospitable to aspen in their current range within the conterminous United States of America if warming trends continue.

This study found two spatially distinct groupings of aspen in the eastern and western United States that are strongly distinguished by climatic characteristics. Potential evapotranspiration, Growing Degree Days, and Mean Annual Precipitation were the most important climate layers in predicting aspen presence, and their relative rankings were different between the eastern and western groups. Predictive models of aspen range derived from presence data spanning the entire range, from only eastern aspen points, or from only western points, produced distinct aspen maps and climatic responses. Additionally, time series analysis demonstrated that available climatic niche space within aspen's current range could be shrinking. Niche differences align with biological differences such as clone size in the eastern and western United States. Ultimately, the results indicate that the eastern and western groupings of aspen inhabit different climates, and thus it can be inferred that they inhabit different climatic niches. This suggests that, for at least this cosmopolitan species, niche differentiation within the range was important for species distribution modelling and in predicting range shifts under climate change.

Organic carbon dynamics in fluvial hydrosystems: A network perspective in the face of climate change

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The function of fluvial hydrosystems is strongly affected by its network structure. This particular spatial pattern could be key to understand the controls behind a variety of interlinked processes such as extreme flood events and organic carbon (OC) export from watersheds. The important role of fluvial hydrosystems in the global carbon cycle has been recently recognized, connecting land-water-atmosphere C fluxes. However, with the alteration of OC sources in watersheds due to human intervention and the modification in the frequency and magnitude of extreme events due to climate change; we face a high uncertainty in the OC dynamics in lotic systems. The network structure of fluvial hydrosystems affects the OC dynamics in two opposite process in the C balance: transport and processing. An efficient OC transport facilitates its storage in natural reservoirs (lakes, oceans) and an efficient processing facilitates its release to the atmosphere as CO2. We will explore those effects in two catchments in the Oregon Coast Range with different patterns of landuse. In the Trask River catchment, we will try to understand the effects of network confluences in the processing of OC coming from different sub-basins and transported to the watershed outlet. Then, we will try to apply those findings to understand the biogeochemical signatures of Particulate OC transported during extreme events into the sediments of a lake at the outlet of the Loon Lake catchment. We will also try to unravel the connections between different landuse scenarios and OC dynamics, as this knowledge could be the basis for adaptive land management in a changing climate regime.

Community engaged recreation planning on college forests: An Oregon case study

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Amenity migration to natural resource-based communities and growing suburban populations continue to drive the expansion of the wildland-urban interface (WUI) and escalate demand for recreation on forests managed for multiple uses. At the same time, the broader public increasingly expects managers to solicit their input in planning, and in some cases allow them to drive the decision-making process. Together these phenomena make managing WUI forests particularly challenging as user conflicts can become more common and dissatisfaction may increase as expectations are not met. In such cases, engaging community stakeholders becomes imperative to strategic planning. This may ensure that user needs are reflected in final plans while strengthening manager-community relations. Alternatively, informal plan development can bring inefficiencies, user conflicts, inequitable access to different user types, unintentional damage to the resource, and disruption of primary uses such as harvesting and research.

This project uses collaborative principles to engage a community of stakeholders in a strategic recreation planning conversation for several WUI forests. Oregon State University's College Forests are popular recreation destinations for the community of Corvallis, the primary location for much research, and a frequent source of timber revenue which supports teaching, research, and demonstration activities. While these harvesting funds and volunteer labor occasionally allow managers to bring user-created unauthorized paths into the official trail system, an overarching strategic plan for recreation on the forests is lacking. In this presentation we describe the community engagement process of this forest recreation planning effort. This involves aggregating the interests of individual stakeholder groups, followed by an engaged draft and review process where stakeholders assist in determining acceptable management actions and the trade-offs they necessitate. In addition to collecting valuable data about the Forests' users, we hope to build trust with the community by developing mutually beneficial recommendations for future recreation enhancements.

Assessing the use of fuel treatments at a landscape scale in central Oregon

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Private landowners wanting to reduce the likelihood or severity of wildfire on their properties are encouraged to perform resource management actions, such as fuel treatments. Financial and technical assistance is being offered by some federal and state agencies, as well as local community groups, to aid in the applications of these treatments. It is currently unclear if these attempts are being implemented in areas most at risk to fire events. With limited capital, agencies that assist in fire prevention should focus on areas with the greatest risks to maximize the benefits of their efforts. By using recent fire data, current fuel loads, fire modeling, spatial analysis with LandTrendr, and survey data collected from landowners, this project will attempt to more accurately describe fire reduction programs' benefits and costs within central Oregon. The fire risk for individual properties, both probability of an event and the possible damages, will be examined in the context of current management activities on the landscape. By attempting to characterize both individual landowner's management actions and the potential economic gains or losses incurred by those actions, this project will provide valuable information to managers considering how to allocate their fire mitigation resources.

Using Radio Frequency Identification (RFID) to examine hummingbird movements in a deforested tropical landscape

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Tropical deforestation has potentially large impacts on hummingbird communities and their pollination services for native plants. The type of land use that replaces forest is of interest because it may influence the behavior of pollinators. Some types of land use may preserve functional connectivity between forested areas and others may not. My research question is: Does the type of tropical deforestation reduce and/or constrain Costa Rican hummingbird movement and pollen transfer? The primary response variable that I will be measuring is the pattern of visits to simulated flowers. By tagging birds with Passive Integrated Transponder (PIT) tags I can accurately measure each visit to artificial food resources (flowers/feeders) placed across landscapes in varying levels/types of deforestation. The strategy of using Radio Frequency Identification Devices (RFID) allows me to accurately measure number, length, and precise location of these visits. Specially invented feeders that provide limited amounts of sugar solution (simulated nectar) will be used to mimic natural flower provision rates and minimize the possibility of altering hummingbird behavior.

Inventorying urban forests of the Pacific Northwest using the USFS Forest Inventory and Analysis (FIA) approach

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Urban forests are the green infrastructure of our cities. Over eighty percent of the United States population resides in urban areas. More than 250 million people are affected each day by trees and vegetation along roadways, in the planted landscape and in backyards. Trees in urban areas provide a host of social, environmental and economic benefits. Green infrastructure is an essential component of our cities and to society. Careful urban forest management is necessary in order to maintain healthy, livable urban areas.

This observational study will utilize urban forest survey data collected from urbanized areas of Oregon and Washington. An inventory was conducted in 2012 in accordance with the USDA Forest Service's Forest Inventory Analysis (FIA) program, and additional parameters specific to the urban environment in populated areas of 50,000 persons or more. We will assess the structure, composition, health and benefit of the urban forest across varying spatial scales. The acquisition of this information provides a unique opportunity to study large-scale forest patterns in the urban environment. A ground-based urban forest inventory of this size is unprecedented in the region.

As the quantification of benefit from the urban forest becomes increasingly of interest for developing best management practices, the need for periodic inventories becomes apparent. This study will evaluate not only patterns of the forest resource in the Pacific Northwest region of the United States but also the effectiveness of Urban FIA to quantify the structure, health and benefit of urban forests throughout the country.

Songbird abundance and demography under an intensive forest management regime in the Oregon Coast Range

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Global consumption of wood products is expected to double by 2050. While global demand for wood products is increasing, global forest area is decreasing. Average annual net loss of forests has reached approximately 5.2 million hectares within the past 10 years. Intensive forest management (IFM) has become a widely used approach to maximize timber production on a diminishing forest resource base. Potential costs to IFM plantations are poorly understood, however, and include degradation of ecological communities and declines in biodiversity. Rapid declines in several Pacific Northwest songbird species in particular are attributed to increasing scarcity of floristically diverse early-successional forest. Structurally and compositionally diverse and early successional ecosystems may already be the scarcest forest habitat in the Pacific Northwest; thus, expected increases in the amount of land dedicated to forest plantations may contribute to songbird decline. The purpose of this research will be to measure songbird response to an IFM regime in the Oregon Coast Range. This will be achieved by examining measuring (1) changes in white-crowned sparrow abundance over time and between treatments, (2) reproductive success as a function of forest management intensity, and (3) frequency of white-crowned sparrow nest predation as a function of forest management intensity. In collaboration with forest managers, study results will be used to support the development of a decision support model that allows managers to quantify tradeoffs between bird populations and IFM.

The relationship between ecological distribution and drought tolerance traits in first-year seedlings of three conifer species

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Vegetation patterns and species distributions are strongly linked to soil moisture regimes. Shifts in the distributions of plant populations occur when seedlings establish beyond current population boundaries or fail to establish within current population boundaries. Understanding mechanisms contributing to seedling establishment, especially under variable environmental conditions, is crucial for predicting future population distribution patterns. Conifer seedling survival is necessary for successful forest regeneration, and may be a more important factor in determining species distributions than performance of adult trees.

The goal of this research project is to understand how physiological traits that permit carbon gain while avoiding desiccation relate to conifer species distribution patterns. The research is focused on three hypotheses: 1) that the ecological and climatic distribution of a species is more strongly correlated with early germinant and first-year seedling traits that facilitate establishment than functional traits of older (2 year-old) seedlings, 2) that different populations of species may exhibit different drought resistance strategies, and 3) that the ontogenetic timing of development of mechanisms for desiccation resistance determines a species drought tolerance. To test these hypotheses, two populations from contrasting precipitation regimes for three species (*Pinus ponderosa, Tsuga heterophylla, Pseudostuga menziesii*) from Pacific Northwest coniferous forests will be used. Seedlings will be grown in raised soil beds under altered light and precipitation regimes. Survival, growth, physiology, and anatomical features will be measured to characterize traits related to desiccation tolerance and avoidance through control of water loss. These measurements will be made over two growing seasons to compare development of measurable traits across the first and second years of growth.

Results from this investigation will advance our understanding of how species-specific responses to limiting environmental factors affect species distributions. Further, these data can be used toward enhancing modeled predictions of vegetative responses to future climate change.

Hydraulic redistribution in improved fallows: the influence of coppicing and root trenching of Gliricidia sepium on maize survival and biomass yield in western Kenya

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Hydraulic redistribution by deep rooted tree species alters water distribution and balance in agroforestry systems. Tree roots can lift water from deep soil reserves and release it into shallow soil layers in a process known as hydraulic lift. This process has the potential to be utilized in agroforestry practices as a biological irrigation system. Through shoot removal, trees are turned into irrigators that may sustain crops and prevent desiccation during periods of drought.

The goal of this study is to determine if coppiced trees can fulfill the role of biological irrigators in agroforestry systems under drought conditions. My objectives for this study are to determine (a) if Gliricidia sepium hydraulically redistributes water, (b) how different levels of coppicing affect this process, (c) if hydraulic redistribution by G. Sepium can sustain corn (Zea mays) yields and prevent desiccation during a drought period, and (d) howz` different levels of coppicing affect corn yield in relation to hydraulic redistribution by G. sepium. The hypotheses that address these objectives are that (a) soil around completely coppiced G. sepium will have the smallest fluctuations between nighttime maximum and the daytime minimum soil water potentials compared to either partially coppiced or uncoppiced trees; (b) completely coppiced and untrenched G. sepium plots will have the highest corn yields after a period of drought stress than either trenched or untrenched plots of partially or uncoppiced G. sepium.

Community Urban Forest Plans (CUFPs) and Community Wildfire Protection Plans (CWPPs): A match made in heaven?

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Trees and forests within and around urban and suburban areas serve a variety of purposes and are subject to varied levels of management, ranging from none to carefully prescribed. Urban forests, trees that are grown and managed within a city, bring value to communities but also have the potential to be a liability if improperly managed. Urban and suburban forests are highly susceptible to damage including pests, disease, and natural fire. Through a systematic tree inventory, community urban forest plans (CUFPs) enable a community to develop long-term strategic goals, identify community partnerships, and foster public support to maintain healthy forests in many communities. Community wildfire protection plans (CWPPs) can also lead to monitoring and management of trees and forests in and around urban and suburban areas, with the goal of reducing fuels and fire risk to populated areas. CWPPs enable a community to strategize and plan how it will reduce the risk of wildfire by identifying sites and methods for fuel reduction projects in the area.

In this presentation we examine the potential for marrying CWPPs with CUFPs by applying concerns about fire risk and CWPP processes to an urban forest case study from Illinois. In summer 2011, we participated in the development and application of a CUFP and tree survey, which included considerable interaction with the local community. The occurrence of two disturbance events (tornado and emerald ash borer) provides an opportunity to examine how fire may impact the urban forest and parlays into the potential union of CWPPs and CUFPs. We will present a community plan that addresses: (1) the importance of a healthy and diverse urban and suburban tree population and (2) methods and practices that would allow a community to effectively maintain a healthy, diverse and fire resistant tree population through development of a merged CUFP/CWPP.

Ectomycorrhizal communities of golden chinquapin *(Chrysolepis chrysophylla)* and ponderosa pine *(Pinus ponderosa)*: Investigations along a soil moisture gradient

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Mycorrhizae are an essential part of every forest ecosystem as they are intricately involved in host plant water and nutrient access. "Mycorrhizae," literally meaning "fungus-root," form when certain fungi develop symbiotic relationships with the roots of host plants. Many temperate forest trees form a particular type of mycorrhizal relationship called ectomycorrhizae (ECM). This study aims to investigate the ECM fungal community composition and species richness of two host trees, *Chrysolepis chrysophylla* (golden chinquapin) and *Pinus ponderosa* (ponderosa pine) along a naturally occurring soil moisture gradient on Lookout Mountain in the Pringle Falls Experimental Forest, Deschutes National Forest, in central Oregon. Characterizing the ECM community of golden chinquapin in comparison to the ECM community of ponderosa pine will provide knowledge about what species of ECM fungi are maintained by the presence of golden chinquapin in the ecosystem. Determining how the ECM communities of these two host species respond to a soil moisture gradient may provide insight into how ECM communities and tree species in this region will adapt to climate change. In addition, if the ECM communities of both hosts contain species overlap it may indicate a non-competitive relationship between golden chinquapin and ponderosa pine which would challenge the forest management strategy of removing golden chinquapin from pine dominated systems as a competitor.

Analysis of the suitability of natural areas for the study of climate change in the Pacific Northwest

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Natural areas are tracts of land set aside for research, education, and conservation purposes. There are currently more than 500 natural areas in Oregon and Washington managed by 20 federal, state, local, and private agencies and organizations. The natural areas network is possibly unparalleled in its representation of the diverse ecosystems found in the region and may be the best collection of sites for monitoring long-term responses to climate change. However, many sites were designated based on their representation of plant association groups. The extent to which they characterize other environmental conditions or gradients important for measuring and understanding the effects of climate change and protecting biodiversity, has never been examined. The goal of this study is to develop a successful climate change monitoring framework using natural areas by: (1) conducting a critical literature review to define a set of biotic and abiotic variables that appear best suited for developing a climate change monitoring program in the Pacific Northwest, (2) evaluate the depth and breadth of the current natural areas network to determine if chosen biotic and abiotic variables are effectively represented, and (3) develop a climate change monitoring program for the natural areas network that is scientifically sound, economically feasible, and synergistic with other regional and national efforts to monitor climate change. A monitoring program based on these analyses could result in both a better understanding of the long-term effects of climate change as well as lead to management approaches that consider both site- and region-specific responses to climate change over the long term.

Treeline ecotone and alpine plant community response to climate change and atmospheric nitrogen deposition in Rocky Mountain National Park, USA

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Global nitrogen (N) cycling has been significantly altered over the preceding century, in large part due to growth of human and livestock populations, production and application of N-based fertilizers, and combustion of fossil fuels. As a result, increased atmospheric emissions and subsequent deposition of N to sensitive ecosystems have altered competitive relationships among plant species, decreased plant species richness, and adversely impacted rare species in favor of others better able to benefit from increased nutrient supply. Increased N availability interacts with changing climate and affects plant biodiversity. Plants located in subalpine and alpine zones have been shown to be particularly sensitive to changes in climate and N supply. This research will evaluate the sensitivity of subalpine and alpine vegetation in Rocky Mountain National Park to simultaneous changes in N deposition and climate using a dynamic model. The coupled biogeochemical and plant competition model ForSAFE-VEG will be used to forecast changes in plant biodiversity at high-elevation sites within the park. The primary question driving this research is: How are future changes in N deposition and climate expected to affect the composition of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa)* treeline ecotone and alpine meadow plant communities in Rocky Mountain NP? The potential impacts of changing N inputs and climate on sensitive resources within national parks has become an important management concern for the National Park Service. The results of this research will provide information to park managers responsible for understanding and responding to the expected impacts of elevated N deposition and climate change in this Class I area.

Disturbance dynamics and feedbacks on land surface temperatures and vegetation communities from global to regional scales

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Disturbance regimes are now in a phase of rapid change and it is critical that we increase our understanding of the causes and consequences of these changes at multiple spatial scales. Important feedbacks are underway between climate change, changing disturbance regimes, and one of the most powerful and ubiquitous of global drivers, surface temperature. Because Land Surface Temperature (LST) is a primary environmental control on biological systems, these feedbacks represent a critical aspect of climate change that needs to be better quantified. This study will test a new integrative metric for monitoring change based on annual maximum LST histograms at global, continental, and regional scales. At each scale these histograms will be developed and evaluated for shifts from 2003 to 2012, and the causes of these changes will be investigated with existing disturbance detection approaches from MODIS and Landsat at continental and ecoregional scales respectively. The consequences of changing disturbance regimes on biodiversity will be further explored at the regional scale from 1985 to 2012.

Impacts of truck traffic on sediment yield in the Hinkle Creek Watershed, OR

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Eroded sediment resulting from activities related to timber harvest has led to regulation and monitoring of forest operations related to excess sediment production. Forest roads have been identified as a potential management area and factors that influence erosion rates have been extensively investigated. Previous studies on the relationship between log truck traffic and sediment yield have produced a range of results, with several orders of magnitude difference between high and low estimates of how sediment production increases with increasing traffic intensity. This relationship can be better defined using current monitoring techniques and updated to reflect more common practices in forest management and road design. This study investigates three questions regarding sediment erosion in forest watersheds: 1) by what factor does log truck traffic, at levels common in industry harvest operations, increase sediment yield from forest roads in the Western Oregon Cascades; 2) how much do forest roads contribute to the overall sediment budget of a watershed; and 3) can the highest sediment producing roads be identified using road characteristics or ditch hydrology? Continuous turbidity threshold sampling and discharge measurements are used to approximate sediment concentration in ditch flow, allowing sediment generation from roads experiencing high volumes of log truck traffic to be compared to roads that experience minimal traffic levels. Results from similar studies, in addition to preliminary results and field observations from this study, indicate that there is a quantifiable positive relationship between log truck traffic and sediment production from forest roads in Western Oregon, that strong relationships exist between road runoff and sediment yield, and that this relationship can be extrapolated to estimate sediment yield on a watershed scale.

The effects of fire and grazing on arbuscular mycorrhizae in an upland bunchgrass-dominated ponderosa pine forest in eastern Oregon

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Reestablishing historical fire regimes is a high priority for North American coniferous forests, particularly ponderosa pine ecosystems. Prescribed fires are being applied on or planned for millions of hectares of these forests to reduce fuel loads, alter forest structure, and enhance the productivity of native plant communities. Cattle grazing is ubiquitous in ponderosa pine forests and the impacts of post-fire cattle grazing on plant communities and their associated fugal communities is not well understood. Mycorrhizae form a critical link between above-ground plants and soil systems by influencing plant nutrition, nutrient cycling, and soil structure. Understanding how mycorrhizae respond to disturbances may lead to important advances in interpreting aboveground plant recovery. I am evaluating the long-term effects of 5-year fall reburning and cattle grazing on the arbuscular mycorrhizal fungi (AMF) community from an upland bunchgrass dominated ponderosa pine forest in eastern Oregon. AMF diversity and composition will also be examined in relation to, host, aboveground plant diversity and composition, plant nutrient status, soil pH, soil nitrogen and phosphorus availability. Five host species were selected and sampled within four ponderosa pine stands, one species common to all four stands (*Elymus elemoides*) and four species specific to each of the four stands (*Pseudoroegneria spicata, Festuca idahoensis, Achnatherum occidentale, Carex geyeri*) for a total of 96 samples. Diversity of the AMF community will be determined by pyrosequencing sequencing a fragment of the AMF SSU rRNA.

Stand "health" following Spruce Beetle outbreaks: Tree physiological characteristics, stand composition and carbon storage

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Spruce Beetle (SB) is the primary mortality agent in Spruce/fir forests of the Intermountain West. SB is a native episodic herbivore that persists in weakened and dying trees until populations reach high enough numbers to overcome more vigorous growing trees' defenses. Increases in yearly global temperature, coupled with decreases in snowpack at higher elevations, have resulted in larger scale outbreaks than previously recorded. These large scale outbreaks have been linked to increases in wildfire abundance and frequency. It is thought that wildfires and SB outbreak mitigation measures (i.e. harvest operations) are causing decreases in carbon stored in Spruce/fir stands.

Western conifer forests are one of the major carbon storage regions in the United States. Increases in wildfire abundance and frequency coupled with salvage logging and harvesting operations may be resulting in decreases in carbon stores over time. This decrease in carbon stores resulting from SB activities and management may be creating a positive feedback loop (i.e. increases in greenhouse gases in the atmosphere and increases in global temperatures), which is creating stand conditions that are more appropriate for further SB outbreaks.

Identifying and describing Spruce/fir stands tree health ratings, stand composition and resulting carbon storing potential pre and post SB outbreak will provide some insight on this complex interaction. The specific goals of this study will be to qualify and quantify: mortality agents, tree physiological characteristics related to SB defense (growth rate, resin production and water potential), hazardous wildfire fuel conditions/stand composition and live/dead carbon stores pre and post SB outbreak in Engelmann Spruce/Subalpine Fir stands in North/Central Utah Mountains.

Subsidizing forest management versus investing in road infrastructure as mechanisms to foster the development of the Guatemalan forestry

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How can the government of a developing country make decisions about the allocation of public funds to develop forestry? Is subsidizing the forest management costs the most suitable way to help local forestry develop? Or is improving the local road network a more effective way to help the forest activity thrive? How can this decision-making process be assessed and support? These questions describe one of the problems that Guatemala, the Latin American country with the biggest economy in Central America, faces since the 1990s in context with the development of its local forestry. Since the first Guatemalan Forest Incentive Program was created (the PINFOR as its acronym in Spanish), a remarkable progress in establishing and managing forests has been made. However, subsidies driven to productive activities are often questioned due to the uncertainty of their real impact. The public funds allocation strategy appears as a challenging problem involving decision-making about investing public funds in fostering forestry with direct economic incentives against allocating them in an alternative public investment as the improvement of local road networks. The main purpose of this research project is to formulate a long-term fund allocation strategy for Guatemala based on the performance of two public investment mechanisms to fostering the development of the local forestry. The mechanisms to assess are: (1) subsidizing forest management costs according to the existing subsidies program, and (2) improving the standard of the local road infrastructure. The research is conducted through a modeling approach based on linear programming. Financial indicators are being used to assess the performance of the mechanisms. The result of the research will provide an important tool to support the strategic-level decision-making about the allocation of public funds oriented to developing the Guatemalan forestry. It will also be an important planning approach to assessing fund allocation in countries encountering similar challenges about forestry development.

Encounters, crowding, conflict, and displacement on the Sandy River, Oregon

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Carrying capacity is an important concept that can be useful for estimating the number of users and both social and biophysical impacts that a particular recreation site can accommodate. Concepts such as encounters, norms, conflict, displacement, and substitutability inform carrying capacity related decisions such as specifying objectives, indicators, and standards of quality for an area. This study will address these issues on the Sandy River, Oregon, which is a popular resource for self-guided and commercially guided anglers and boaters (e.g., rafting, kayaking, floating). Onsite sampling and surveys will be conducted in winter and early spring 2013-2014 (i.e., main fishing season) and summer 2014 (i.e., main boating season) at three main sites along this river (Oxbow Regional Park, Dabney State Recreation Area, Dodge Park) to determine current use levels and recreational satisfaction, crowding, conflicts, and displacement. Findings will assist agencies (e.g., BLM, Oregon State Parks) in managing sites along this river.

The Cameron Tract: A demonstration forest for the future

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Nestled in the Soap Creek drainage north of Corvallis, Oregon is a 260-acre expanse of timber called the Cameron Tract. Elizabeth Starker-Cameron donated the land to Oregon State University in 1995 as a demonstration forest. She envisioned the university maintaining the land as an example of sustainable non-industrial family forestry. From 1995 to 2004, the College of Forestry facilitated two timber harvests and one salvage sale. Since then, management activity has slowly decreased. Hiking enthusiasts, mountain bikers, and horseback riders are drawn to the Cameron Tract for its natural beauty and close proximately to the college forests and Corvallis. A great potential exists for innovative management endeavors, recreation, and education opportunities benefitting both Oregon State University and the community.

The goal of this Master of Forestry project is to revitalize the management of the Cameron Tract and create a working example of a demonstration forest. Furthermore, I hope to utilize and expand on my skills as a professional in the field of forestry. I have identified three focus areas for the duration of my project: 1) Ensure the fulfillment of the original objectives set forth by Elizabeth Starker-Cameron. 2) Develop a harvest plan to generate a consistent source of revenue benefitting the College of Forestry at Oregon State University. 3) Provide additional recreation and public education opportunities for the community. To accomplish these objectives an interdisciplinary team will be assembled from the College of Forestry, OSU extension and the College Forests. My duties will be to facilitate cooperation between these different departments and document each stage of the project. I will also be responsible for engaging in communication between OSU and nearby residents. Maintaining a "good neighbor" relationship in the Soap Creek watershed will be vital to the success of this project and future of the Cameron Tract.

Error propagation in estimating forest biomass using terrestrial LiDAR

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Individual-tree biomass equations are applied at the plot-level then expanded up to the stand-level to estimate above ground biomass (AGB) for large areas of forest land. Due to spatial variability of AGB across the landscape, the practice of expanding individual-tree estimates to larger scales is subject to several sources of error that interact and build. Error propagation is primarily driven by choice of component model and incorrect measurements. Propagating these independent sources of error produces uncertainty that affects sound forest planning. Terrestrial light detection and ranging (LiDAR) technology can reduce measurement error of tree-level attributes, helping refine models of AGB used for scaling biomass across the landscape.

With this study my aims are to determine: 1.) How propagated error associated with using newly developed regional biomass equations compares to that of nationally used Jenkins equations; 2.) Estimates of propagated error associated with using terrestrial LiDAR to measure independent variables for the newly developed regional biomass equations. My working hypotheses include: 1.) The specific equation form chosen to model the new regional biomass equations is the greatest source of error among all independent sources of error for stand-level estimates of AGB; 2.) The propagated error of the newly fitted regional equations is less than the error associated with using the Jenkins equations; 3.) The propagated error of AGB estimates derived from using terrestrial LiDAR to measure the independent variables is less than error associated with using conventional inventory measurement techniques.

This study will use destructive sampling of trees and field inventory plots to validate LiDAR data available from a commercially available instrument. Multiple regression, error analysis techniques and geometric LiDAR point cloud modeling will be used to assess evidence for my hypothesis. Expected results include the creation of regional biomass equations for several Pacific Northwest conifer species, with associated propagated errors depicting the effect of using terrestrial LiDAR to acquire stand-level AGB estimates.

Influence of local environmental and stand structure conditions on patterns of tree interactions

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Plant competition is considered the predominant mode of interaction between trees in forests. Hence, numerous competition indices have been developed representing different aspects and modes of competition. Examples include indices that reflect one-sided versus two-sided competition, different weighing schemes for the distance among trees, neighborhood versus population level competition, with neighborhood radii reflecting tree sizes, and others. Comparing the fit of regression models that utilized the various indices has been a common approach to explore the relative importance of different modes and competitive mechanisms on tree growth. However, such investigations mostly have been limited to find modes and mechanisms that "on average" best reflected patterns in the data, i.e., underlying experimental conditions. Exceptions include investigations how these patterns change with absolute and relative (target tree versus competitor tree) tree size. I propose to investigate whether such "averages" are suitable for stands with high variability in environmental conditions and high variability in stand structures. Therefore, I will assess the performance of various competition indices in terms of

(Continued on next page)

their ability to predict tree growth as they are influenced by small-scale environmental and structure variability, and their interactions. Variables reflecting environmental variability include slope, aspect, rainfall patterns, and potential annual direct incident radiation and heat load. Structural variability includes differences in overall densities, spatial patterns, and relative sizes of trees. I will use data from the Density Management Study (DMS), a large scale management experiment in which treatments were designed to promote of a wide variety of spatial and structural conditions within the stand, comprising non-thinned control areas, homogenous thinned areas with different densities, trees in thinned stands that border gaps and unthinned leave islands. My findings will increase the understanding of the spatial patterns of tree interactions and how these patterns are influenced by local conditions. The information will be helpful when designing management prescriptions aimed at increasing variability and diversity in managed forests.

Participatory frameworks in Philippine coastal resource management

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Participatory frameworks are the foundation of a community-based approach and have been proposed as a vital first step in the sustaining of local level resources through the development and enforcement of management plans. The Philippines has formalized a co-management approach, which emphasizes community involvement, towards coastal resources through the development of their Integrated Coastal Management Plan. Since the shift towards this management style, the Philippines has successfully devolved power to local governments but has generally failed to build the frameworks to hold those governments accountable to stakeholders.

The goal of my research is to enhance natural resource management and development decisions by identifying how municipalities in the Philippines can more effectively utilize participatory frameworks. To achieve this goal, research has been organized around questions related to three objectives; determining the effect of participatory spaces in coastal resource management, identifying the role of community organizations in resource use decisions among stakeholders, and identifying factors affecting stakeholder participation in management decisions.

Research will be organized as a multi-method approach to a single case study analyzing embedded units of analysis. Both formally recognized community management institutions such as Fisheries and Aquatic Resources Management Councils and People's Organizations, as well as informal organizations will act as the embedded units of analysis within the case study. These units can be more broadly categorized as participatory spaces and will act as proxies for the measurement of stakeholder participation in the coastal resource management and development process. I will explore how participatory spaces interact with each other and state actors through institutional arrangements and decision-making. Research methods will include interviews, surveys, participatory mapping and historical data analyses.

Patches, habitat, and connectivity: A species-centered perspective

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Island biogeography theory (IBT) has had a profound impact on the landscape ecology field, helping researchers to conceptualize the importance of patch size and connectivity for communities and species. However, despite thousands of studies investigating the effects of habitat loss and fragmentation, little generalization can be made about how these variables influence organism distributions. Others have argued that this dichotomy between theoretical predictions and empirical results is driven by the oversimplification of real landscapes in IBT, and confounded by idiosyncratic definitions of fragmentation. However, we propose that this lack of consensus is driven, in part, by poor empirical representations of "habitat" and "matrix." Recent developments in species distribution modeling allow us to take a species-centered view of such landscape features, which have been predominantly based on human-defined cover types in the past. Defining such metrics as patch size, habitat amount, distance between patches, and connectivity from a species' perspective may facilitate generalizations about the effects of habitat loss and fragmentation. We distributed 690 bird point count stations across a fragmented forest landscape in southern Indiana, using an approach that minimizes correlation between amount of forest and patch size. We will conduct 12 avian point counts and 2 vegetation surveys per point over 4 years. Using dynamic occupancy modeling, we will model occupancy, colonization, and extinction rates as a function of local habitat variables, and landscape features defined both from human (e.g., forest/non-forest) and species-specific perspectives. We hypothesize that if landscape is perceived idiosyncratically at the species level, then: 1) models containing species-specific landscape metrics will fit the data better than those containing human-defined metrics; and 2) we will find some congruency between the way species respond to landscapes, and predictions made by IBT.

Effects of BMP procedures on migration of metals from water-born preservative-treated Douglas-fir lumber

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Wood has long been used as a preeminent construction material in the United States for a long time, as well as many other countries where the timber resources are abundant. Among the practices developed to improve the serviceability of wood, an important one is the impregnation of wood with preservatives. Waterborne heavy metal preservatives are most commonly used chemicals for protecting dimension lumber employed in residential applications. The most common component in these systems is copper, which has excellent activity against most fungi and insects. Field studies have shown that copper based preservatives provide decades of effective protection against deterioration. While heavy metal-based preservatives provide excellent protection, they can also have potential negative effects. The active chemicals in the preservative can also be toxic to non-wood-degrading organisms in the surrounding environment. Thus, there is increasing concern preservative migration out of the treated wood and accumulating in the surrounding environment to levels that pose risks to organisms, especially those in sensitive aquatic environments. The purpose of this project is to develop data on the effects of various post-treatment practices on mobility of heavy metals in wood treated with ACZA, ACQ or CA, and examine the methods for improving fixation.

Photo by René Zamora

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