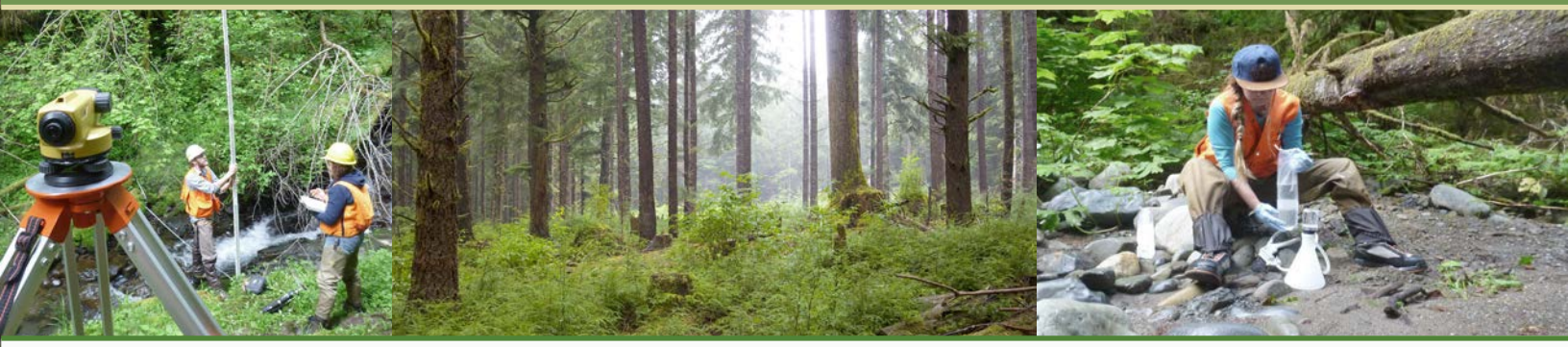
2017 OESF Science Conference

Linking Science to Natural Resource Management



April 20, 2017, 8:30 am to 4 pm
Olympic Natural Resources Center
Forks, WA

Contents

About this Conference

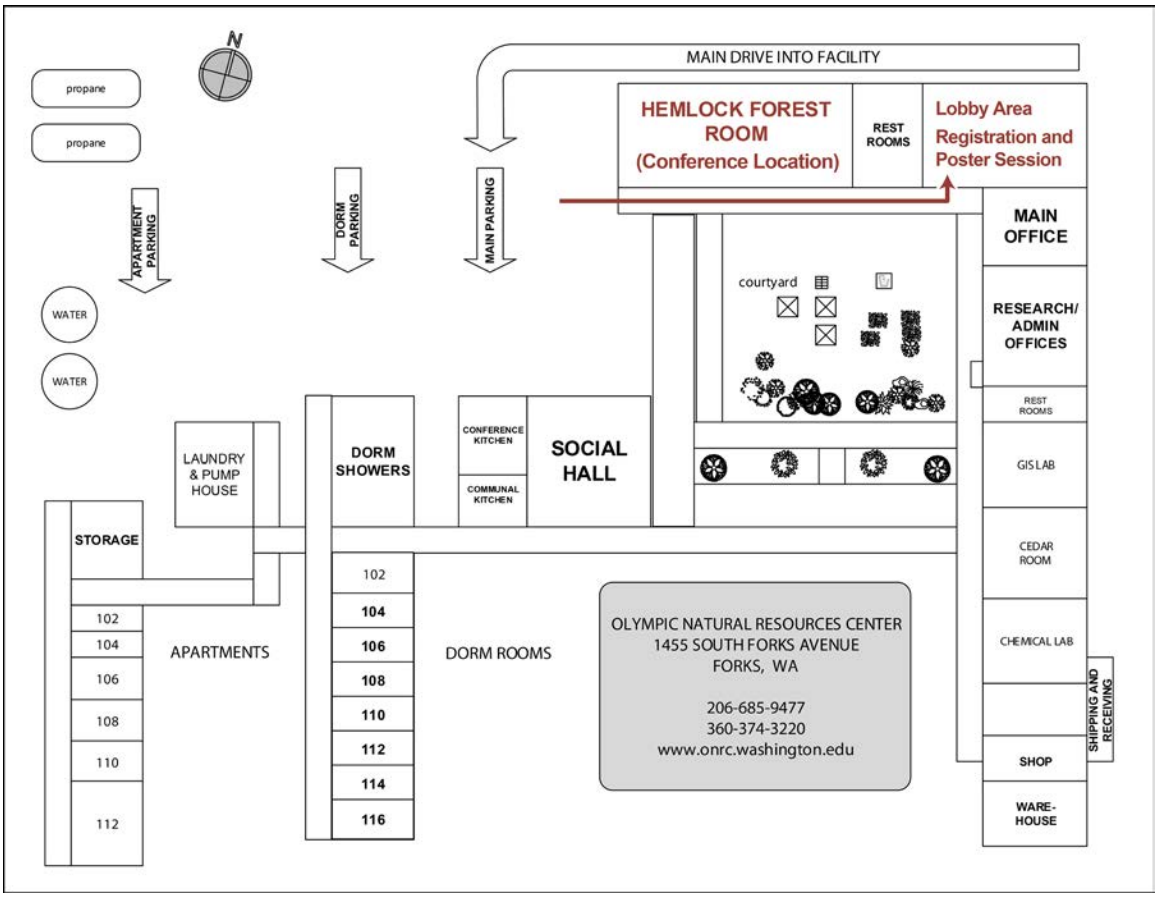
Welcome to the first Olympic Experimental State Forest (OESF) science conference. The Washington State Department of Natural Resources (DNR) intends to make this conference an annual event. Its purpose is to communicate the results of research and monitoring activities taking place in the OESF and their relevance to land management uncertainties faced by DNR and other land managers. We hope the conference will encourage dialog among researchers, natural resource specialists, managers, and the public about the scientific foundations of land management.

The 2017 OESF Science Conference is sponsored by DNR, with contribution from the University of Washington's Olympic Natural Resources Center.

DNR Conference Committee:

Teodora Minkova
Cathy Chauvin
Jessica Hanawalt
Ralph Johnson
Warren Devine
Kyle Martens
Bill Wells
Justin Zarzeczny
Eric Steffen

Olympic Natural Resources Center Campus Map



Conference Agenda

8:00 – 8:30 am: Refreshments and socializing

8:30 – 8:40 am: Welcome from Teodora Minkova, OESF Research and Monitoring Manager

8:40 – 10:30 am: Session 1, Aquatic Ecology

1. **Fluvial Connectivity of a Deep-Seated Landslide to Upstream Tree Harvests** | **Jeff Keck,** DNR
2. **Stream Habitat Conditions after 20 Years of Passive Riparian Restoration** | **Warren Devine**, DNR
3. **Nutrient and Carbon Budget in the Streams of Olympic Experimental State Forest: Seasonal and Morphological Influences** | **Rebekah Korenowsky,** The Evergreen State College
4. **Salmon Monitoring on the OESF - How Initial Monitoring will Guide Future Efforts** | **Kyle Martens**, DNR
5. **Using eDNA to Understand Aquatic Biodiversity** | **Brooke Penaluna**, Forest Service Pacific Northwest Research Station

10:30-10:50 am: Break with refreshments and poster session

- **Modeling Soil Risks** | **Miles Micheletti**, DNR
- **A Comparison of the Abundance and Distribution of Select Vertebrate Species Between OESF and all Olympic Peninsula Public Lands Based on Three Years (2013-2015) of Monitoring Baited Camera Traps** | **Jessica Hanawalt**, DNR and **Scott Horton**, DNR (retired)

10:50 am-12:20 pm: Session 2, Landscape Ecology, Silviculture, and Forest Roads

1. **Comparing Historic Range of Variation and Current Landscape Conditions to Inform Habitat Targets in Western Washington** | **Joshua Halofsky**, DNR
2. **The New Watershed Experiment on the Olympic Experimental State Forest** | **Bernard Bormann**, University of Washington
3. **Understory Development in Thinned Stands as Part of the Long-term Ecosystem Productivity Study** | **Courtney Bobsin**, University of Washington
4. **Factoring Road Costs into Forest Harvest Scheduling** | **Kai Ross**, Cramer Fish Sciences

12:20 – 12:30 pm: Closing remarks, Teodora Minkova

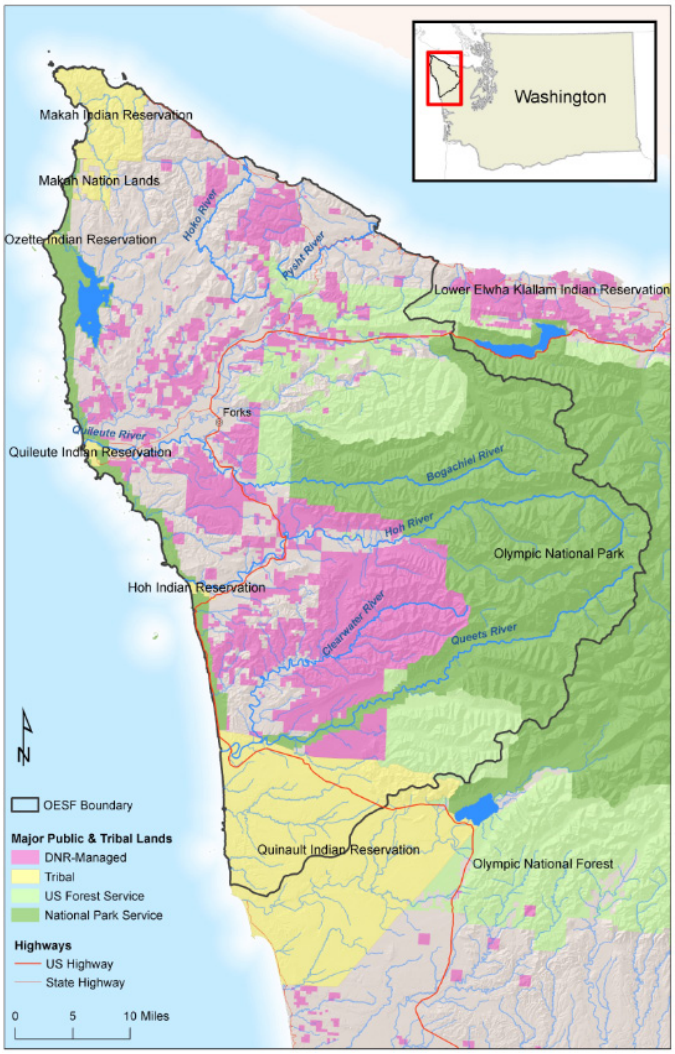
12:30 – 1:45 pm: Lunch and preparation for field tour

1:45 pm – 4 pm: Field tour on the Reade hiking trail

4 pm: Adjourn

About the OESF

Located on the western Olympic Peninsula, the OESF was established to learn how to integrate revenue production (primarily through timber harvest) and ecological values (primarily habitat conservation) in a working forest.



Across approximately 270,000 ares (110,000 hectares) of state trust lands in the OESF, DNR generates a sustainable flow of revenue to its trust beneficiaries and restores and maintains habitat for native species, including the federally protected northern spotted owl and marbled murrelet. DNR balances these objectives through an experimental approach called "integrated management." Under this approach, DNR does not divide the land base into fixed, permanent areas to be managed primarily for revenue or ecological values. Instead, DNR manages the entire land base for both. DNR achieves integration through landscape-level planning and a combination of passive and active management. Active management involves silvicultural techniques designed to create and maintain a variety of forest stand structures.

Key components of this approach include intentional learning through research and monitoring and application of new information to management through a formal adaptive management process. Through its OESF research and monitoring program, DNR implements and coordinates projects; establishes and maintains research partnerships with universities, colleges, federal agencies, and other organizations; collaborates with local land managers, tribes, environmental organizations, and regulators; facilitates adaptive management; and provides educational opportunities such as internships and field trips.

DNR's management strategies are described in its recently-adopted forest land plan and based on its *State Trust Lands Habitat Conservation Plan (HCP)* adopted in 1997. For more information on the OESF, visit http://www.dnr.wa.gov/oesf/.

Presentation Abstracts

Session 1: Aquatic Ecology

Fluvial Connectivity of a Deep-Seated Landslide to Upstream Tree Harvests.

Jeff Keck[1].
[1]Washington Department of Natural Resources, Forest Resources Division

A deep-seated landslide located in the Clearwater River Watershed in the OESF may have reactivated three times following harvest upstream of the landslide. High stream flow (a 25-year event) coincides with one period of activity; however, the magnitude of flow events larger than a 1.1-year event are unaffected by tree harvests. High precipitation and snow melt (water input) events coincide with two of the landslide events but at the time of landslide activity, evapotranspiration rates of the plantation trees may have been nearly equal to that of the original forest. In contrast, debris flows, which coincide with all periods of deep-seated landslide activity, dramatically increase following harvest in the headwaters despite below average annual maximum 1-day precipitation and no change in annual maximum 30-day precipitation. Tree harvests in the headwaters of the watershed appear to have caused the increase in debris flow frequency which in turn triggered landslide activity. Harvest effects on peak flows are inferred from a basin-scale hydrology model calibrated to flow data from status and trends monitoring of aquatic and riparian habitat in the OESF, initiated in 2012.

Contact Information:
Jeff Keck | Hydrogeologist
Jeff.Keck@dnr.wa.gov
Washington State Department of Natural Resources
1111 Washington St SE, Olympia, WA, 98504
Phone: 360-701-3283

Stream Habitat Conditions After 20 Years of Passive Riparian Restoration.

Warren D. Devine[1], Kyle D. Martens[1], Teodora V. Minkova[1], Alex D. Foster[2], and Richard E. Bigley[1].
[1]Washington State Department of Natural Resources, Forest Resources Division
[2]US Forest Service Pacific Northwest Research Station

In 2012, DNR initiated status and trends monitoring of riparian and aquatic habitat in the OESF to document long-term changes in riparian and in-stream conditions in watersheds managed for timber, fish and wildlife habitat, and other ecosystem values. After extensive timber harvesting from the 1960s through the 1980s, the current expectation is that the riparian conservation strategy in the *State Trust Lands Habitat Conservation Plan* (HCP), adopted in 1997, is allowing the processes of ecological succession and natural disturbance to improve aquatic and riparian habitat conditions over time. In 54 watersheds containing small fish-bearing streams, DNR is monitoring channel morphology, channel substrate, in-stream large wood, shade, stream temperature, channel habitat units, stream flow, and riparian microclimate and vegetation. Twenty years after implementation of the HCP, the monitored streams are well-shaded by a dense riparian forest canopy, and summer stream temperatures are relatively cool, generally below regulatory

temperature thresholds for salmonids. Volumes of in-stream large wood, compared with other studies, suggest that this component of stream habitat will recover more slowly. As in-stream wood increases over time, stream pools are expected to deepen, providing refugia for fish during low summer streamflow. Future sampling will assess trends, but initial data show some aspects of riparian and aquatic habitat have improved under passive restoration.

Contact Information:
Warren Devine, PhD | OESF Data Management Specialist
Warren.Devine@dnr.wa.gov
Washington State Department of Natural Resources
1111 Washington St SE, Olympia, WA, 98504
Phone: 360-902-1682

Nutrient and Carbon Budget in the Streams of Olympic Experimental State Forest: Seasonal and Morphological Influences.

Rebekah Korenowsky[1], Erin Martin[1].

[1]The Evergreen State College

Measurements of nutrient and carbon export via streams can tell land managers more about how these watersheds process critical chemical components and can provide a dataset from which to compare future conditions at these sites. In this study, nutrient, carbon, and biogeochemical data were collected at 10 small fish-bearing streams in the OESF over the course of one year, with one sampling event per season. The sample sites are part of DNR's long-term monitoring of aquatic and riparian conditions in 50 managed watersheds. Concentrations of nitrate, ammonia and phosphate are presented. As expected, nutrient concentrations are very low at these sites, due to uptake by productive riparian and in-stream vegetation. The lowest concentrations of nitrate are observed during the growing season and low concentrations of phosphate are observed during high flow, likely as a result of dilution from rainfall. Correlations of stream nutrients' concentrations with hydrology and stream morphology are also explored.

Contact Information:
Rebekah Korenowsky | Masters of Environmental Studies Student
rebekahkorenowsky@gmail.com
The Evergreen State College
2700 Evergreen Parkway NW, Olympia, Washington 98505

Salmon Monitoring on the OESF - How Initial Monitoring will Guide Future Efforts.

Kyle D. Martens[1].

[1]Washington Department of Natural Resources, Forest Resources Division

DNR's Riparian Validation Monitoring Program (RVMP) was designed to assess the salmonid response to the department's riparian conservation strategy as required in the HCP. The RVMP's goal is to document whether the conservation strategy is achieving the desired outcome of maintaining or improving salmonid habitat and expressing stable or positive effects on the salmonid populations of the OESF. In 2016, the first year of monitoring under the recently released study plan, several key questions needed to be assessed before initiation of the full sampling design.

These key questions included how the Status and Trends Monitoring of Riparian and Aquatic Habitat program's 50 watersheds represent the distribution of salmonid species across the state trust lands of the OESF, what is the best method for assessing juvenile populations within the OESF watersheds, and how the larger DNR Type 1 or Type 2 rivers of the OESF should be monitored. In this presentation, I will explain how the first year of monitoring will guide the future direction of the RVMP.

Contact Information:
Kyle Martens | Fish Biologist
Kyle.Martens@dnr.wa.gov
Washington State Department of Natural Resources
1111 Washington St SE, Olympia, WA, 98504
Phone: 360-902-1272

Using eDNA to Understand Aquatic Biodiversity. Brooke Penaluna[1].

[1]US Forest Service Pacific Northwest Research Station

As aquatic biodiversity declines worldwide with many species already threatened, extirpated, or extinct, there is a pressing need for assessing aquatic biodiversity using a rapid, accurate, and standardized approach. Cutting-edge approaches using eDNA metabarcoding, which allows for the simultaneous consideration of multiple species, have been shown to be better than traditional sampling methods. We couple eDNA metabarcoding with taxon-specific primers to detect multiple native species from various aquatic taxon. We present preliminary results from our proof-of-concept study where we evaluate fishes, amphibians, macroinvertebrates, and pathogens along a stream continuum with an impassable barrier to hatchery fish. We also describe work we are conducting across the region in western Washington (including the Olympic Experimental State Forest), Oregon, and northern California. Ultimately, our work will allow for data-driven prioritization of conservation actions for aquatic species.

Contact Information:
Brooke Penaluna, PhD | Research Fish Biologist
bepenaluna@fs.fed.us | brooke.penaluna@oregonstate.edu
USDA Forest Service PNW Research Station
3200 SW Jefferson Way, Corvallis, OR 97331
Phone: 541- 758-8783

Session 2: Landscape Ecology, Silviculture, and Forest Roads

Comparing Historic Range of Variation and Current Landscape Conditions to Inform Habitat Targets in Western Washington

. Joshua S. Halofsky[1], Daniel C. Donato[1,2], Matthew J. Reilly[3].

[1]Washington Department of Natural Resources, Forest Resources Division
[2]University of Washington, College of the Environment, School of Environmental and Forest Sciences
[3]Oregon State University, College of Forestry, Department of Forest Ecosystems and Society

Robust estimates of historic range of variation (HRV) for the abundance of late-successional conditions, a proxy for northern spotted owl habitat, are currently lacking in Western Washington. Such information is necessary to address a Priority 1 research need under DNR's HCP. Here we present results from a modeling effort, informed by fire-frequency data from existing literature, to estimate historic ranges of late-successional conditions in forests with stand-replacing fire regimes across western Washington. Results suggest infrequent wildfire events (or episodes) historically tended to burn hundreds of thousands to millions of acres. Such wildfire events result in modeled late-successional forest composing between ~50 and 80% of the region at any given time, although ranges differed among individual forest types. While current conditions suggest overall departure of all successional conditions across the region, DNR's northern spotted owl habitat targets of 50% of designated landscapes is within our modeled HRV and therefore has ecological relevance.

Contact Information:
Joshua Halofsky, PhD | Landscape Ecologist
Joshua.halofsky@dnr.wa.gov
Washington State Department of Natural Resources
1111 Washington St SE, Olympia, WA, 98504
Phone: 360-902-1755

Understory Development in Thinned Stands as Part of the Long-term Ecosystem Productivity Study

. Courtney Bobsin[1], Bernard T. Bormann[1], Teodora V. Minkova[2], and Kern Ewing[1].

[1]University of Washington, College of the Environment, School of Environmental and Forest Sciences
[2]Washington Department of Natural Resources, Forest Resources Division

Understory species richness and abundance influences overall forest dynamics in a myriad of ways including providing habitat for wildlife, creating nutrient cycling through leaf litter, influencing seedling regeneration and growth, and more. The overall forest dynamics are altered by the presence or absence of an understory layer. In this long term ecosystem productivity study based on the OESF, treatments were implemented in the mid-1990s to create early seral, late seral and Douglas-fir forests with low, medium, and high levels of woody debris left on site. Pre-treatment and post-treatment measurements were taken in 600 understory plots throughout 40 mensuration plots since the study began. The understory percent cover, seedling growth, plot composition

and overall biomass were measured and studied. Understory species composition was evaluated to determine how the ecosystem dynamics have changed since the treatment was implemented showing an overall increase in deciduous ferns and woody shrubs. A seedling regeneration count showed significant differences in the amount of seedlings between several of the treatment groups and over time. This long term study will help answer questions on overall forest dynamics and the role the understory plays in early seral, late seral, and Douglas-fir forests.

Contact Information:
Courtney Bobsin | Masters of Science Student
cbobsin@uw.edu
University of Washington
3715 W Stevens Way NE, Seattle, WA 98195

The New Watershed Experiment on the Olympic Experimental State Forest.

Bernard T. Bormann[1], Teodora V. Minkova[2].

[1]University of Washington, College of the Environment, School of Environmental and Forest Sciences, Olympic Natural Resources Center
[2]Washington Department of Natural Resources, Forest Resources Division

The OESF and Olympic Natural Resources Center were set-up to explore new ways to achieve both economic and ecological goals of land management. The new OESF Forest Land Plan, adopted in 2016, sets forth an "integrated management" approach, which differs from fixed land-allocation approaches on other DNR and Forest Service lands. Our proposal for a watershed-scale experiment takes the next step in evaluating the plan by experimentally comparing it to three other approaches using a broad rural-ecosystem-sustainability framework to evaluate success. Results will help shape future decisions by asking a core question: Will a higher sustainable level of rural ecosystem wellbeing emerge from an array of land management strategies implemented and compared across the OESF landscape? The study will begin with 16 experimental units - 4 treatments (including a no-action control) with 4 replications on 1000 to 2000-acre watersheds on OESF in the Jefferson County selected as microcosms of the OESF. Experimental treatments will be DNR management actions applied through the Olympic region's timber sale program over time across these watersheds (except the no-action control). The study plan unfolds this spring, pre-treatment monitoring begins this summer, and initial treatments in the experimental units may begin in 2018. Help is sought in developing innovative silviculture and operations to fold into the experiment.

Contact Information:
Bernard Bormann, PhD | Professor and Director of Olympic Natural Resources Center
bormann@uw.edu
Olympic Natural Resources Center, University of Washington
1455 S. Forks Ave., Forks, WA, 98331
360-374-4554

Factoring Road Costs into Forest Harvest Scheduling. Kai Ross[1], Sándor Tóth[2], and Weikko Jaross[3].

[1]Cramer Fish Sciences
[2]University of Washington, College of the Environment, School of Environmental and Forest Sciences
[3]Washington State Department of Natural Resources, Forest Resources Division

The maintenance of forest roads is one of the most expensive management activities in forestry both financially and in terms of environmental impact. Unfortunately, most practitioners maximize net timber revenues first and account for road costs only post-optimization. We demonstrate that there are lost opportunities by not accounting for road maintenance in an integrated spatial optimization approach. We begin by describing the Endogenous Fixed Charge Problem (EFCP) that arises when you consider the connection between harvest scheduling and road maintenance and reconstruction. Using the upper Clearwater landscape in the OESF as a case study, we demonstrate that this approach provides harvest schedules that simultaneously increase Net Present Value (NPV), while decreasing the overall amount of maintained road, possibly reducing ecological impact. Second, we consider the limitations of pre-defined hauling routes in spatial harvest scheduling, and introduce a new approach that allows an integrated harvest scheduling model to identify the best hauling routes, in conjunction with the optimal harvest decisions to maximize NPV. This allows the model to make routing decisions that are based on the entire system, as opposed to individual least-cost paths. We demonstrate the computational feasibility of the approach in a case study using sites across the Olympic Peninsula.

Contact Information:
Kai Ross, PhD | Biometrician
kai.ross@fishsciences.net
Cramer Fish Sciences
1125 12th Ave NW, Suite B-1, Issaquah, WA, 98027
Phone: (503) 660-3480

Poster Abstracts

Modelling Soil Risks. Miles E. Micheletti[1], Nicole Jacobsen[1].

[1]Washington State Department of Natural Resources, Forest Resources Division

Soils are important ecosystem components that are often overlooked in a forest management environment. In this poster, we explore using soil components as indicators in fuzzy logic-style risk models to evaluate risks to soil function (based on previous work by the USDA Forest Service). We describe the models, and consider the possibilities for using them in an adaptively-managed environment like the OESF. In some respects, our findings were linked most directly to the accuracy of available soils data (the primary model input) which was compromised by inconsistent surveys

and overlarge soil polygons. However, by rasterizing the data and combining it with fine-scale LiDAR products, we demonstrated that even coarse-scale soils data can be relevant at a local level.

Contact Information:
Miles Micheletti | Forest Inventory Technician
Miles.Micheletti@dnr.wa.gov
Washington State Department of Natural Resources
1111 Washington St SE, Olympia, WA, 98504
Phone: 360-902-1369

A Comparison of the Abundance and Distribution of Select Vertebrate Species Between OESF and all Olympic Peninsula Public Lands Based on Three Years (2013-2015) of Monitoring Baited Camera Traps.

Jessica Hanawalt[1], Scott Horton[1]*.

[1]Washington State Department of Natural Resources, Olympic Region
* retired

The fisher re-introduction and subsequent monitoring efforts amassed a large body of data that presents an opportunity to compare species abundance on OESF lands to the whole Olympic Peninsula (largely composed of public lands, state and federal). Monitoring data collected in the OESF by region DNR biologists was compared to the whole at two different scales: station-visits and hexes. The monitoring design divided the study area into 24-km^2 hexagons (hexes) that were sampled with three baited stations per hex and three visits per station. Comparisons by species (proportion of overall vs. OESF) for hexes gives a coarse-grain view of their distribution, abundance and attraction to stations; while similar comparisons of station-visits gives a finer grain view with greater influence from species' behavior, i.e. attraction to or caution of the station set-up. Chi-square tests were performed for species with greater than one visit on OESF lands at the scale of station-visits and hexes. Black bear, ravens, elk and humans were more common for both metrics (station-visits and hexes) on OESF lands; while blacktail deer were less common. Only cougars presented no significant difference between OESF land and the whole for station-visits. For hexes, those species exhibiting no significant difference were bobcat, spotted skunk, cougar, fisher, jays and crows, and Douglas squirrel.

Contact Information:
Jessica Hanawalt | Olympic Region Fish and Wildlife Biologist
Jessica.Hanawalt@dnr.wa.gov
Washington State Department of Natural Resources, Olympic Region
411 Tillicum Lane, Forks, WA, 98331
Phone: 360-640-5387

Field Tour

In the OESF, DNR creates and maintains a diversity of forest stand structures across the landscape by leaving some areas unharvested (passive management) and harvesting others using techniques such as thinning and variable retention harvest, a type of stand-replacement harvest in which snags, down wood, and green leave trees are retained between one harvest and the next. This field tour is an opportunity to see these harvest treatments firsthand and learn about recreation trail development. DNR foresters and recreational specialists will guide the tour.

The Reade hiking trail is new and not yet open to the public. Located within walking distance of the Olympic Natural Resources Center (ONRC), this non-motorized trail was built with capital funds from DNR and help from the Washington Conservation Corps and Earth Corps. It is 4.2 miles long with 440 feet of elevation gain. Expected to open in summer 2017, future phases may include interpretive signs and links to the ONRC trail system.

The trail starts in a recent variable retention harvest. From there, the trail passes through both thinned and unthinned forest stands that were planted after harvests 31 to 40 years ago. The upper part of the trail loops through an unmanaged stand that regenerated naturally after the "21-blow," a powerful windstorm that swept the area in 1921 and caused widespread windthrow.

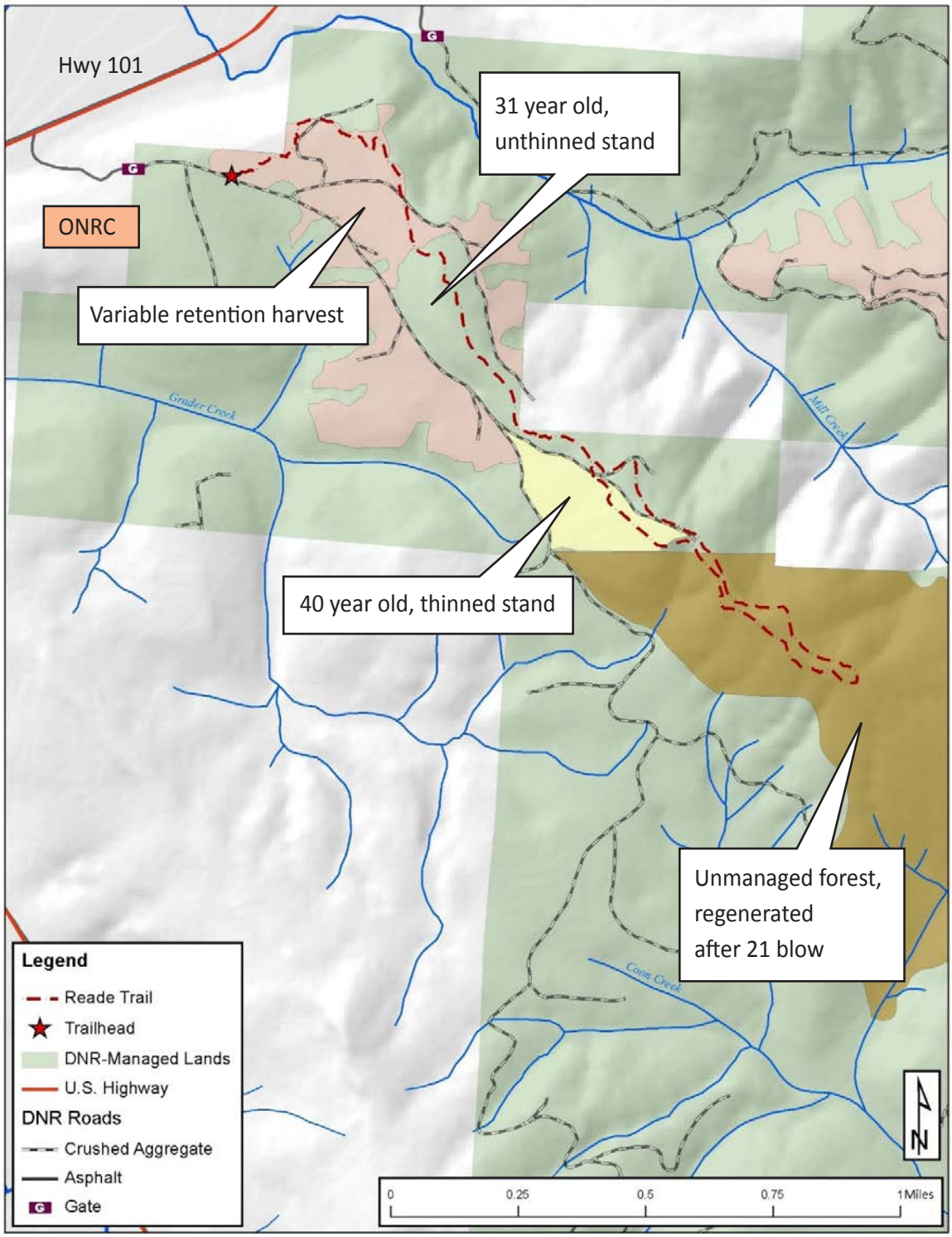
Variable Retention Harvest

Thinned Stand

Unmanaged Stand

Unthinned Stand

Reade Hill Trail Map



Lunch Options

The fastest and easiest options for lunch are listed below. All of these restaurants are located along Forks Avenue North or South (Highway 101), which is the main road through town. The closest option to the conference center is Forks Outfitter Deli.

- Forks Outfitters Deli (sandwiches, soup, chicken, hot case), 950 South Forks Avenue
- Subway (76 Food Mart and Subway sandwich shop), 490 North Forks Avenue
- Sully's Drive In (hamburgers, sandwiches, chicken, ice cream), 220 North Forks Avenue

The following options are good, but with an hour allotted for lunch you may not make it back in time for the field trip.

- Pacific Pizza (pizza, pasta, sandwiches, soup, salad bar), 870 South Forks Avenue
- In Place Restaurant (sandwiches, burgers, soup, pasta) 320 South Forks Avenue
- Forks Coffee Shop (burgers, full service restaurant) 241 South Forks Avenue

If you prefer to bring your own lunch, you may enjoy it in the conference room or at picnic tables scattered across the ONRC campus.