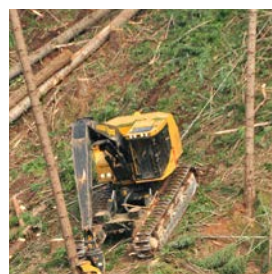
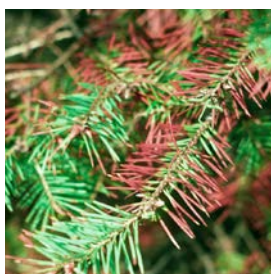




2021 Virtual

Olympic Experimental State Forest Science Conference



Linking Science to Natural Resource Management

Thursday, April 22, 2021, 8:30 a.m. to 3:45 p.m.
on Zoom

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About This Conference

Welcome to the fourth annual Olympic Experimental State Forest (OESF) science conference, hosted by the Washington State Department of Natural Resources (DNR). 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 2021 OESF Science Conference is sponsored by DNR.

2021 DNR Conference Committee:

- Teodora Minkova
- Cathy Chauvin
- Ralph Johnson
- Mark Enty

Conference Agenda

Morning Presentations and Poster Sessions

- 8:00 – 8:30 a.m. Technical support available
- 8:30 – 8:40 a.m. Opening remarks and introduction to the [Olympic Experimental State Forest \(OESF\) Research and Monitoring Program](#)

Oral Presentations, Session 1

- 8:40 – 9:00 a.m. [Status and Trends of OESF Riparian and Aquatic Habitat](#): 5-year Monitoring Results
- 9:00 – 9:20 a.m. Soil Responses to Cable-assisted Logging Equipment on Steep Slopes: Three Case Studies in the Western U.S.
- 9:20 – 9:40 a.m. [Ecological Characteristics of Crowberry Bog in the Hoh River Basin: The Only Known Raised Bog in the Western, Conterminous United States](#)
- 9:40 – 10:00 a.m. Monitoring Swiss Needle Cast in Coastal Washington Forests, 1997 – Present
- 10:00 – 10:10 Break
- 10:10 – 11:10 Student [poster session](#) in breakout rooms:
- The Sound of Science: Acoustic Monitoring and Occupancy Modeling of Songbirds in the OESF
 - Songbirds as Indicator Species on the Olympic Peninsula: Alternative Selection Criteria and Considerations
 - Stream Invertebrate Assemblage Composition in Relation to Environmental Variables: Progress Report on the T3 Study in the OESF
 - Using Lidar Data to Identify Red Alders in the Sappho Long-Term Ecosystem Productivity Experiment
 - Ethnobotany and Adaptive Management: Exploring New Pathways to Manage Olympic Peninsula Forests to Enhance Ecosystem Wellbeing

Oral Presentations, Session 2: [T3 Watershed Experiment](#)

- 11:10 – 11:25 a.m. Study goal, philosophy, and design
- 11:25 – 11:40 a.m. [Riparian Study Plan](#)
- 11:40 – 11:55 a.m. Upland Study Plan
- 11:55 – 12:10 p.m. [Acoustic Monitoring Plan](#)
- 12:10 – 12:25 p.m. Study implementation through DNR's timber sale program
- 12:25 – 12:40 p.m. Stakeholder outreach: Opportunities and timeline for participation

12:40 – 12:50 p.m. Closing remarks for morning session

12:50 – 1:30 p.m. Lunch

Afternoon Stakeholder Outreach Sessions for the T3 Watershed Experiment

- 1:30 – 2:30 p.m. Session 1: Upland Study Plan
- 2:30 – 2:45 p.m. Break
- 2:45 – 3:45 p.m. Session 2: Riparian Study Plan
- 3:45 p.m. 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 acres (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 achieves these objectives through landscape level-planning, harvest and silvicultural techniques designed to create and maintain a variety of forest structures, and protection of habitat and other features, plus research, monitoring, and adaptive management.

The mission of the OESF Research and Monitoring Program is to learn through applied research and monitoring and deliver scientific findings to land managers. Through this 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 the 2016 [OESF Forest Land Plan](#) and based on DNR's [State Trust Lands Habitat Conservation Plan \(HCP\)](#) adopted in 1997. For more information on the OESF, visit DNR's [OESF web page](#).



Presentation Abstracts

Oral Presentations, Session 1

Status and Trends of OESF Riparian and Aquatic Habitat: 5-year Monitoring Results

Warren Devine,¹ Teodora Minkova,¹ Alex Foster,² Kyle Martens¹

¹DNR, Forest Resources Division

²USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory

In 2013, Washington State Department of Natural Resources (DNR) initiated a program to monitor the status and trends of riparian and aquatic habitat in small fish-bearing streams in the Olympic Experimental State Forest (OESF). The program's purpose is to assess habitat conditions produced by DNR's riparian management under the *OESF Forest Land Plan*, which is in turn guided by the riparian conservation strategy of the *State Trust Lands Habitat Conservation Plan*. Monitoring is conducted in 50 DNR-managed watersheds and in 12 reference watersheds that have never been harvested. Nine aquatic and riparian habitat indicators are sampled at the reach level near the outlet of each watershed: channel morphology, channel substrate, instream wood, habitat units, stream shade, water temperature, riparian forest vegetation, and—for 10 of the 62 streams—stream flow and riparian microclimate. Data collected thus far show notable overlap in the range of habitat indicator values for DNR-managed watersheds and those of reference watersheds. For DNR-managed watersheds, most of the habitat indicators have not changed significantly since monitoring began. To conduct an assessment of salmonid habitat quality at the reach level, we developed an ecosystem management decision-support model which integrates a wide range of habitat indicators and ranks individual streams.

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Soil Responses to Cable-assisted Logging Equipment on Steep Slopes: Three Case Studies in the Western U.S.

Woodam Chung¹, Brett Morrissette¹, Austin Finster¹, Ben Leshchinsky¹, Preston Green¹

¹College of Forestry, Oregon State University

Cable-assisted or “tethered” mechanized timber harvesting systems are rapidly being adopted by the forest industry across the western U.S. as a replacement for conventional manual tree falling and cable logging. However, heavy forestry equipment operating on steep slopes has raised concern for environmental and soil disturbance impacts. To date, only a few studies have examined the impacts of cable-assisted harvesting systems on forest soil and vegetation, and the lack of scientific information on environmental impacts makes public land management agencies hesitant to adopt the new technology.

In order to fill the current knowledge and information gap, Oregon State University's College of Forestry has been conducting field studies to examine the impacts of cable-assisted logging operations on equip-

ment stability, soil disturbance, and subsequent soil erosion and plant growth. In our case studies, we measured pre- and post-harvest samples of soil bulk density and penetration resistance to assess immediate soil responses to heavy equipment operations on steep slopes. Subsequent impacts on soil erosion and plant growth were measured through two-year monitoring of sediment transport, moisture content and seedling growth. This presentation introduces our case studies and summarizes up-to-date results.

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Ecological Characteristics of Crowberry Bog, the Only Known Raised Bog in the Western, Conterminous United States

F. Joseph Rocchio¹, Edward Gage², Tynan Ramm-Granberg¹, Andrea K. Borkenhagen², and David J. Cooper²

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Bogs and fens are two commonly recognized types of peatlands. Bogs are solely dependent on precipitation for water and nutrients inputs (ombrotrophic), resulting in distinct hydrologic regimes, water chemistry characteristics, and vegetation patterns. Although the term "bog" is applied to many wetlands in the Pacific Northwest region, no published research has demonstrated the presence of an ombrotrophic peatland in Washington state. Raised, ombrotrophic bogs in western North America are known to occur as far south as coastal regions of British Columbia. However, a recent discovery of a peatland with a raised surface on the western Olympic peninsula (Crowberry Bog) suggested that the southern extent of this ecosystem type extends further south. Topographic, hydrological, chemical and vegetation data sets were used to determine whether Crowberry Bog is ombrotrophic. If true, the site would be the first documented ombrotrophic peatland in the conterminous western U.S. and would merit special protection, management, and long-term monitoring actions. This talk will discuss our research results and their implications for the long-term management of Crowberry Bog's ecological integrity.

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Monitoring Swiss Needle Cast in Coastal Washington Forests, 1997 – Present

Daniel W. Omdal¹

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The fungus that causes Swiss Needle Cast (SNC), *Nothophaeocryptopus gaeumannii* (T.Rohde) is found throughout the range of its only host, Douglas-fir. SNC causes premature foliage loss and can reduce growth of host trees, alter wood properties, and affect stand structure and development. In Washington, SNC is most prevalent in coastal forests due to a fungi-favorable climatic (mild winters and wet springs and summers) and topographic conditions. Efforts to quantify the incidence and severity of SNC, as well as detect and map the distribution of SNC, in coastal Washington forests have been ongoing since 1997.

An aerial detection survey has been conducted in coastal Washington in 1998 to 2000, 2012, 2015, 2016, and 2018, and ground surveys have occurred nearly annually since 1997. In spite of the large variability in symptomatic acres detected via aerial survey over the years, disease severity, as measured by pseudothecia occurrence and foliage retention, has remained relatively stable.

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Poster Abstracts

All posters can be viewed on [DNR's website](#).

The Sound of Science: Acoustic Monitoring and Occupancy Modeling of Songbirds in the Olympic Experimental State Forest

Therese Kaitis¹ and Lauren Kuehne²

¹ University of Washington, College of the Environment, Program on the Environment

² Omfishient Consulting

As forest management aims to integrate conservation goals with production priorities, there is a need to understand ecosystem function in varying stages of forest development. Washington Department of Natural Resources (DNR), University of Washington, and Omfishient Consulting have initiated a large-scale study in the Olympic Experimental State Forest (OESF) to evaluate habitat use by forest songbirds. Passive acoustic monitoring is used to collect audio data across four different forest stages. Audio recordings are analyzed for vocalizations of target species through automated templates and manual detection using spectrograms. Presence-absence data for ten indicator bird species will be analyzed through occupancy modeling to establish their habitat use across the four seral stages.

Data from 86 audio surveys are processed to identify ten bird species as well as jet noise and rain events. Preliminary occupancy models are developed for Pacific-slope Flycatcher and Orange-crowned Warbler, two indicator species known for different habitat associations. Pacific-slope Flycatchers are associated with mature conifer forest, whereas Orange-crowned Warblers are known to prefer shrubby understory

in early-seral mixed hardwood conifer stands. Understanding what stand and landscape features affect these birds' occupancy in the OESF will help DNR choose integrative forest management approaches to benefit long-term revenue and conservation goals on DNR-managed lands.

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Songbirds as Indicator Species on the Olympic Peninsula: Alternative Selection Criteria and Considerations

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Songbirds have frequently been utilized as indicator species of forest habitat quality and function in research, including research conducted within the Olympic Experimental State Forest (OESF). Protocols by which indicator songbird species are selected are highly variable, depending on the specific objectives and geographic locations of studies. While some selection criteria are considered universally applicable, ambiguity of specific indicator species selection criteria in forest research demonstrates the need for greater understanding of criteria, considerations, and their alternatives.

This study examines the body of forest research situated on the Olympic Peninsula utilizing songbirds as indicator species, and compares findings against the indicator species of a research study currently underway in the OESF. This study seeks to assess indicator species efficacy and identify species alternatives, considering criteria relative to suitability for passive acoustic monitoring and suitability in anticipation of climate change.

Results will provide a more robust evaluation of certain songbirds as indicator species of habitat quality and function. By providing greater and more thoroughly researched options for indicator species of habitat quality and function, these results can be useful to future research and management efforts in the region.

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Stream Invertebrate Assemblage Composition in Relation to Environmental Variables: Progress Report on the T3 Study in the OESF

Elsa Toskey¹, Stephen M. Bollens¹, Peter Kiffney², Gretchen Rollwagen-Bollens¹, and Kyle Martens³

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Benthic invertebrates are essential components of stream ecosystems, and discerning the abiotic, biotic, and dispersal processes that structure such assemblages is a central question in community ecology. Macroinvertebrate assemblage patterns are highly context-dependent, and in headwater streams appear to be heavily shaped by environmental filtering (in other words, abiotic factors that limit membership in a local community). This study is part of a larger research project (T3 Watershed Experiment) with the overarching goal of assessing the environmental and economic impacts of four different riparian management treatments on fish-bearing streams in the Olympic Experimental State Forest (OESF) on Washington's Olympic Peninsula. Specifically, we collected quantitative samples of benthic and drift invertebrates and associated environmental variables (for example, stream habitat, forest canopy, salmonids, periphyton and seston, stream temperature, stream flow, water chemistry, instream wood, stream substrate, stream geomorphology, and riparian forest) from 31 sites across 16 streams in summer 2020. The resulting data will be analyzed via non-metric, multidimensional scaling to quantify how macroinvertebrate assemblage structure is associated with environmental variables (and thus purported ecological drivers or processes). In addition to being of fundamental importance to the field of community ecology, our findings will provide information on balancing the need for forest harvest with stream conservation.

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Using Lidar Data to Identify Red Alders in the Sappho Long-Term Ecosystem Productivity Experiment

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³USDA Forest Service, Pacific Northwest Research Station

One of the fundamental questions of forestry is that of composition: what species are present and what are not, which informs management strategies and decisions. However, surveying large forest ecosystems can be both time consuming and costly. Thus, this project aims to combine remote sensing data, specifically light detection and ranging (lidar), and field data to create a model that differentiates red alder (*Alnus rubra*) from other tree species.

This project focuses on summer 2020 field data from the Long-Term Ecosystem Productivity Experiment (LTEP) located in the Olympic Experimental State Forest near Sappho, WA. LTEP was established in 1995, and consists of forested state land managed by the Department of Natural Resources that was selectively thinned and then planted with various treatments representing the different stages of forest development. The LTEP field data is combined with lidar data to create a training dataset of lidar point returns for each of the tree species present in LTEP.

Ultimately, this information will be used to create a model that will differentiate between red alder and other tree species. Preliminary results show a significant difference between red alder and other species using several lidar metrics. This project focuses on red alder in the LTEP experiment, but could potentially be applied to other species in similar forest ecosystems.

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Ethnobotany and Adaptive Management: Exploring New Pathways to Manage Olympic Peninsula Forests to Enhance Ecosystem Wellbeing

Courtney Bobsin and Bernard Bormann¹

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Throughout the Pacific Northwest, traditional forest management has primarily focused on producing a conifer timber crop while excluding potential competition (for example, from understory plants). While this can result in timber revenue, it also actively prevents the growth of complex early-seral habitat that promotes plants and wildlife with personal, cultural, and commercial value to local people. Using adaptive management principles and learning-based collaboration, we are creating alternatives to managing public lands through ethnobotany, where knowledge and input from local people is used to inform and develop forest management prescriptions.

This field study, located near La Push on land managed by the Department of Natural Resources (DNR), compares two ethnobotany prescriptions with a control. Ethnobotany treatments include an agroforestry, where densely planted valuable understory species are added along with Douglas-fir seedlings, and an early seral management, where understory species are added at wider spacings along with both Douglas-fir and red alder seedlings. Controls use DNR management prescriptions to compare a "business as usual" approach. Treatments and understory plant selection has been directly informed by engagement with local community members. In the coming years, this site will be monitored to determine plant growth and survival, quantity of browse, success of timber crop, and value to local communities.

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Afternoon Stakeholder Outreach Sessions for the T3 Watershed Experiment

The University of Washington Olympic Natural Resources Center (ONRC) and DNR are launching a major watershed-level experiment in the OESF to help determine how management of public forest lands can evolve to address societal needs. This project is called the T3 Watershed Experiment.

The role of innovation in changing how lands are managed cannot be overstated. In addition to the research component and the adaptive management framework of this study, ONRC and DNR are committed to ongoing partnerships with local communities, tribes, regional stakeholders, and potential research partners. Such collaboration can help us obtain the most value from this ambitious and complex project.

Conference participants are invited to join two information sessions to learn about the study objectives, the rationale behind the proposed treatments, and the expected outcomes. Researchers from multiple organizations and the DNR practitioners developing the study plans will be available at each session. Participants will be invited to share their initial comments, and opportunities for future engagement will be discussed. Project information is available at [this link](#).