The Learning Forest

Sharing scientific knowledge on sustainable land management in the Olympic Experimental State Forest and beyond

Issue 13 • Spring 2023

Editorial Board Message

This issue of The Learning Forest demonstrates the energy and fresh perspectives that motivated and curious college students can bring to ecological research. Both the featured and guest articles focus on research completed for masters and doctoral degrees.

The feature article is about a management-relevant, ecologically important and culturally significant topic: increasing the amount of western redcedar growing in forests on the western Olympic Peninsula. University of Washington student Rose Cornwell authored a study plan focused on methods to deter deer and elk browse of redcedar seedlings, with the ultimate goal to provide feasible, operational-scale, anti-browse solutions for cultivating cedar. Cornwell belongs to one of the eight learning groups established as part of the **Type 3 Watershed Experiment**. This project was a potent combination of a driven young scientist being supported by the knowledge and professional experience of seasoned natural resource practitioners.

The guest article summarizes an exciting Ph.D. research project on the little-known topic of canopy soils, which form beneath thick mats of mosses and other epiphytic plants on large tree branches. Korena Mafune and her team explored the role of these soils in the growth and survival of old-growth forests, a project that required meticulous lab work and impressive rope climbing skills to collect soil samples from old-growth bigleaf maples.

Student research in the OESF has been expanding rapidly in past months. In the Education and Outreach section, we describe capstone projects and two theses defences. Plus, nine student posters were presented at the 2023 OESF Science Conference. Accommodating and mentoring students doing field research is hard but rewarding work that helps to shape the next generation of natural resources scientists.

In this Issue

Teodora Minkova, DNR

Scholars from Doris Duke Conservation Scholars Program are all smiles, surveying forest habitat as part of an acoustic monitoring project in the OESF.

Featured Article

Cultivating an Iconic Tree

Protecting Western Redcedar Seedlings from Deer and Elk Browse

by Cathy Chauvin, DNR, and Rose Cornwell, University of Washington

During outreach for the Type 3 Watershed Experiment, stakeholders and tribes cited the decline of western redcedar (*Thuga plicata*) on the Olympic Peninsula as a primary concern.

Western redcedar is prized for its fragrant, reddish, rot-resistant wood that supports jobs in the manufacture of decking, siding, and fences. The species is highly valued by Northwest tribes, who use it to make objects ranging from clothing to canoes and often refer to it as the "tree of life." Ecologically, redcedar adds diversity to the Northwest forest and can grow in places other conifers cannot, such as wet soils. It also can reach impressive sizes, and the large branches of old-growth trees (Photo 1) can host the nests of deep-woods dwellers like owls and murrelets.

A near miss for Washington's state tree in 1947, redcedar grows from sea level to the timber line, in wet soils and dry, in forests and city parks and suburban backyards. So why are we worried about the abundance of such a ubiquitous species?

In his book **Identifying Mature and Old Forests in Western Washington**, Robert Van Pelt explains that wester redcedar forests were once extensive along the coastal areas of Washington and British Columbia. These forests took centuries to form, and developed in wet areas that escaped stand-replacing wildfires. Because it lives so long, redcedar eventually dominates the forest as shorter-lived species die out. An old-growth redcedar can live well over 1,000 years, and some are believed to be as old as 1,500 years.

Most of the ancient redcedar forests on the western Olympic Peninsula fell to timber harvests before the 1990s, when harvest laws were changed to protect the

Cathy Chauvin, DNR

Photo 1. An old-growth western redcedar along Highway 101 near Kalaloch Beach, Washington in 2013. This tree is thought to be over 1,000 years old. Its trunk was 19.8 feet in diameter before a 2014 windstorm brought a third of the tree crashing down.

old-growth. Today, redcedar is found mixed with other species and is often planted in small patches, such as areas affected by root diseases that kill other conifers. Case in point, in 2022 only 5 percent of the trees that the Washington State Department of Natural Resources (DNR) planted west of the Cascades were redcedar.

An obvious solution to increasing the amount of redcedar on the western Olympic Peninsula is to plant it more extensively. Unfortunately, the soft, nutritious needles are almost irresistible to deer and elk, especially in winter when browse is scarce (Photo 2). Deer and elk browse can delay a seedling's growth or kill it outright, and no seedling is safe until it reaches a free-to-grow height of at least 6 feet.

As any gardener can attest, thwarting a hungry animal can be a formidable and expensive task. To make that investment, one "would have to assume cedar prices are stable and will remain high over 40 years into the future, when the tree approaches harvestable age," explains Florian Deisenhofer, a DNR silviculturist. Even with recent redcedar prices as high as $1,000 per

Photo 2. Browsing Roosevelt elk (*Cervus canadensis roosevelti*) caught on a wildlife camera in the OESF.

thousand board foot (mbf), the investment is a risk, as efforts to protect the seedlings may fail.

Collaborating to Find Solutions

In response to stakeholder and tribal concerns, researchers with the Type 3 Watershed Experiment established the Cedar Browse Learning Group in 2022. Learning groups are part of a new research approach called "learning-based collaboration," in which managers, scientists, stakeholders, tribes, and others work together on issues that interest or concern them, with the ultimate goal of gaining insight into both the chosen subject and the learning process itself. The cedar group has 11 members with expertise ranging from forest ecology to on-the-ground stand management. "Participants either work in natural resource management, or are affected by it," explains group coordinator and University of Washington (UW) student Rose Cornwell. "This learning group gives people a chance to work on the same level to address a complex issue." The cedar browse group is **one of eight learning groups** formed for the Type 3 Watershed Experiment.

In a highly collaborative process that spanned six meetings over six months, the cedar browse group designed a study to test four anti-browse methods, track how much they cost, and provide this information to anyone looking for feasible, operational-scale solutions for cultivating redcedar in the forest. The four methods will be tested against a no-action control, in which no steps will be taken to hinder browse. The study plan was written by Cornwell as part of her graduate research for UW's Masters in Forest Resources degree.

The first method is fencing. Fences will be made of plastic mesh instead of the more expensive metal wire, and will range from seven to eight feet tall to deter jumping. This option will give researchers an understanding of how redcedar grows with no browse pressure.

The second method is to plant spruce and redcedar in the same hole, in the hopes that the prickly spruce needles will discourage a browsing animal (Photo 3). When the redcedar seedling reaches a free-to-grow height of 6 feet, the spruce will be removed. A key question is how the spruce will affect the development of the redcedar seedling.

Joseph Murray, DNR

Photo 3. Combined spruce and redcedar plugs (a plug is a seedling grown in a modular tray, not in the ground)

If combined cedar/spruce plugs are not available, researchers will plant a cedar plug and a spruce plug in the same hole in the field.

The third method is to treat the seedlings with wildlife repellent to make the seedling taste or smell bad. Repellents have a few drawbacks. If the spray works on taste, the animal must eat the needles to learn to avoid them, so some browse damage will occur. Sprays that depend on smell are less effective in the winter, when other browse is scarce. Furthermore, repellents are expensive and need to be applied on dry days, which is challenging in rainy areas like the Olympic Peninsula. This study will test **Trico PRO repellent**, a new product made from sheep fat that works on smell and taste. Trico PRO performed well in **a recent study**. It will be applied twice per year at six-month intervals.

The final method is to place individual protective tubes over the seedlings (Photo 4). The group will test 3-foot and 4-foot Vexar mesh tubes, and 4-foot and 5-foot solid Protex tubes. All tubes will be attached to steel stakes rather than the more common bamboo stakes, which can be ripped or blown away.

Florian Deisenhofer, DNR

Photo 4. Mesh tube.

Some of these methods have been studied in the past. Fencing, for example, has strong empirical evidence of its effectiveness. The unique value of this study is in determining how well these methods work on the Olympic Peninsula at an operational scale, and in tracking how much they cost to implement. That information should be highly useful to anyone wishing to cultivate this species in the forest.

Study Design

The redcedar browse study is considered a sub-study of the Type 3 Watershed Experiment. It will take place on 33.16 acres in four of the 16 experimental watersheds in the Type 3 Experiment, but will not overlap the other treatments in the watershed.

All four methods and the no-action control will be replicated at random in each of four units, which range from 5 to 10 acres each (Figure 1). All units will be planted after logging, which should occur over the next two years.

Once the units are planted, a field crew of UW students will visit the units each summer to look for signs of browse, including the tell-tale piles of scat. The crew will record the growth, mortality, and browse damage of 75 trees within the center of each sub-unit and the five most abundant plants growing in the area.

The study is currently expected to run seven years after initial planting, long enough for the planted seedlings to achieve free-to-grow height and provide insights into the effectiveness and costs of each method.

Cedar Browse and Climate Change

A study on redcedar mortality in Washington and Oregon recently made a splash in the Pacific Northwest news. "Has the western redcedar reached a tipping point?" posited one Seattle Times reporter. "The Pacific Northwest's 'trees of life' are dying," decried a Columbia Insight reporter. The exact cause is still unknown, but one culprit may be the recent trend of longer, hotter, drier summers in the Northwest. A number of agencies, including DNR, are **monitoring and researching the issue**, and some scientists are experimenting with planting redcedar seedlings that are better adapted to these conditions.

These efforts demonstrate that redcedar matters. And it shows that the Type 3 experiment and the cedar browse group are on the right track. Whatever the future looks like with climate change and adaptation strategies, anything that improves the cultivation of this iconic tree is well worth doing.

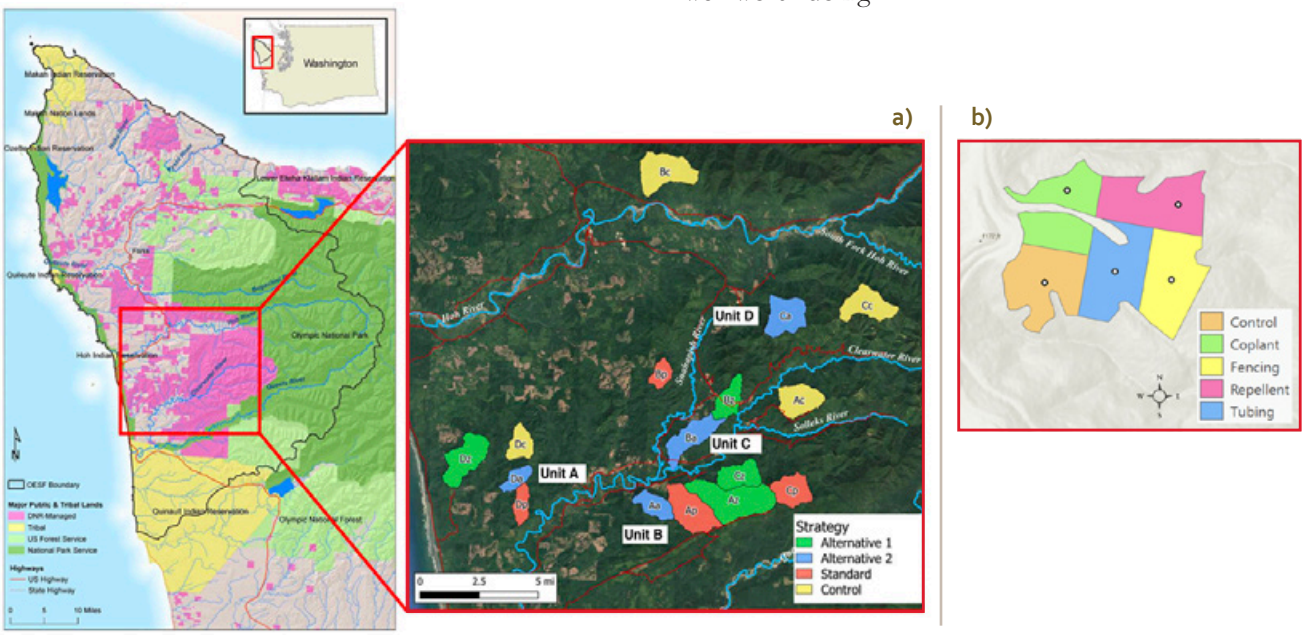


Figure 1. The 16 experimental watersheds of the Type 3 Watershed Experiment (a) and one of the four cedar browse experimental units (b). The four cedar browse units are located in the blue watersheds marked "Alternative 2." Units range in elevation from 310 to 2,111 feet. Each unit will be divided into five sub-units and the treatments (four anti-browse methods and a control) will be assigned to the sub-units at random.

About the Project Coordinator

Rose Cornwell has a bachelor's degree in Political Science from Saint Louis University Madrid, Spain and recently graduated from the Master of Forest Resources program at the University of Washington (UW). Past research includes tracking macaw nesting sites in old growth trees in the Amazon rainforest and collecting data for the Continuous Forest Inventory (CFI) at UW's Pack Forest.

Recent Publications

Kyle D. Martens and Warren D. Devine. 2022. Pool Formation and the Role of Instream Wood in Small Streams in Predominantly Second-growth Forests.

Environmental Management

As part of **Riparian Validation Monitoring in the Olympic Experimental State Forest (OESF)**, OESF Natural Resources Scientists Kyle Martens and Warren Devine examined the relationship between pool formation and instream wood, which are critical indicators of salmonid habitat in small streams. The authors used recent monitoring data from 74 stream reaches to understand how 25 years of passive restoration (placing buffers on streams and depending on natural processes) has affected current conditions.

They discovered that pool depth was affected mostly by the size of the stream, and the density of pools within the stream reach was affected largely by stream size and steepness. In comparing their results with results from studies in both second- and old-growth forests, they found that streams associated with second-growth forests have reduced pool densities and smaller pieces of instream wood than streams in old-growth forests.

Many riparian forests in the OESF are young because of pre-1990s harvest practices. A more active restoration approach in these forests, such as thinning, could accelerate recovery in terms of pool formation and delivery of larger pieces of instream wood from riparian forests.

Katrina R. Keleher, Richard E. Bigley, and Warren D. Devine. 2023. Drivers of Forested Riparian Microclimate on the Olympic Peninsula of Washington State.

Northwest Science, Vol. 96, No. 1–2

Microclimate refers to climate conditions in a highly localized area. Conditions at this scale are relevant to plants or animals that have specific temperature or humidity requirements, such as amphibians.

Part of **Status and Trends Monitoring of Riparian and Aquatic Habitat in the OESF**, this study involved monitoring microclimate near 10 small streams in the OESF. Automatic sensors gathered air temperature and humidity data for three years. The authors also examined the effects of topography-related factors such as valley slope, solar exposure, and elevation, as well as distance from stream, forest canopy shade, and distance from coast.

In steep valleys, cooler and more humid conditions were confined to a narrow zone near the stream. Riparian microclimate was more dispersed in gently sloping areas. Lower-elevation streams had cooler, more humid microclimates than those at higher elevations, owing to the influence of the Pacific Ocean, and south-facing watersheds had warmer and drier air near streams. Because the riparian forest canopy was consistently dense across all sites, the authors were unable to determine how variations in canopy shade affect microclimate. These results will help scientists better predict the extent of the riparian microclimate along streams.

Guest Article

Don't Forget to Look Up

Canopy Soils in Washington's Old-growth Temperate Rainforests

by Korena Mafune, Ph.D., University of Washington

In the old-growth temperate rainforests of western Washington, immense amounts of rainfall and fog promote the growth of ferns, mosses, and other epiphytic plants in the forest canopy. The thick appearance of these mossy mats can be attributed to what is hidden underneath: canopy soils. Canopy soils are thick mats of organic material that form from the accumulation of dead epiphytes, as well as other intercepted plant litter that decomposes over time.

The role canopy soils hold in the forests in which they occur has been a topic of interest to scientists for about 40 years. Canopy soils contribute to forest carbon and nutrient cycles, increasing resources available throughout the ecosystem. They also provide habitat to a wide diversity of species, including endangered species and species that have yet to be discovered, like microarthropods and microorganisms. Scientists also learned that bigleaf maple trees grow adventitious roots (roots that grow from non-root tissue) from their branches into canopy soil mats. In these rooting networks, thick roots branch out to much thinner roots (Figure 1), similar to what you would find in the ground. Canopy roots associate with arbuscular mycorrhizal fungi, a type of symbiotic (mutually beneficial) fungus that associate with about 80 percent of plants globally. Mycorrhizal fungi in the soil extend a fungal network into a plant's small roots. Within this fungal network, nutrients flow from the soil to the plant, and sugars flow from the plant to the fungus. In addition to enhanced nutrient uptake, mycorrhizal fungi can also provide the plant other benefits, such as better resistance to root pathogens.

Although it is clear that canopy soils are important, many unknowns remain about their ecology. For example, fungal structures were found in canopy roots, but no studies have explored the diversity of root-associated fungi in these canopy soils and how they differ from

Figure 1. Exposed canopy soil with thick adventitious roots (A) and a close-up of canopy soil and fine adventitious roots (B).

communities below ground. Further, little is known about the rate in which organic forms of nitrogen and phosphorus are converted into inorganic forms available for plant uptake (a process called mineralization). A better understanding of these processes could help elucidate how canopy soils enhance host-tree nutrient acquisition and forest-level nutrient cycling.

Climbing into the Treetops to Understand Soil Processes

For my Ph.D. research at the University of Washington (UW), I designed a study that aimed to contribute to our fundamental knowledge of Washington's bigleaf maple canopy soils. I first explored root-associated fungal diversity and compared nutrient mineralization between bigleaf maple canopy soils and forest floor soils. Second, I aimed to shed light on how these processes may be impacted by climate change scenarios, such as increased winter rainfall and longer summer

droughts. Overall, this project helped define why canopy soils should not be overlooked in old-growth forest management and conservation.

The study took place at two sites in old-growth temperate rainforest stands on the Olympic Peninsula in Washington State (Figure 2), on lands managed by The Nature Conservancy and Olympic National Park. At each site, myself and a team of researchers from UW collected soil samples from the forest floor environment. We also rigged six old-growth bigleaf maples at each site to allow us to climb into the canopy to collect canopy soil samples (Figure 3).

After assessing how many beneficial fungal structures were present in canopy roots and ground roots, I set-up a one-year experiment. Starting in spring 2018, we collected ground and canopy soil samples in all seasons except winter. In each sampling period, root-associated fungal communities were identified and nitrogen and phosphorus mineralization rates were determined using a combination of lab techniques. Note that this study only accounts for canopy soils on bigleaf maple branches; copious amounts of canopy soil also accumulate on old-growth Sitka spruce.

What is Going on up There?!

We identified a diversity of arbuscular mycorrhizal fungi in ground and canopy soils, and also found that fungal diversity was different in canopy versus ground

Figure 3: Dr. Korena Mafune sampling canopy soils at the Hoh research site.

soils. However, the abundance of these fungal structures was comparable in both soil types (Figure 4), demonstrating that the host tree is investing resources to sustain these symbiotic fungi. We also identified a variety of other root-associated fungal species, including some unknown species.

The function of arbuscular mycorrhizas in canopy soils is likely similar to ground roots, including increased access to nutrients and enhanced water uptake. Fungal

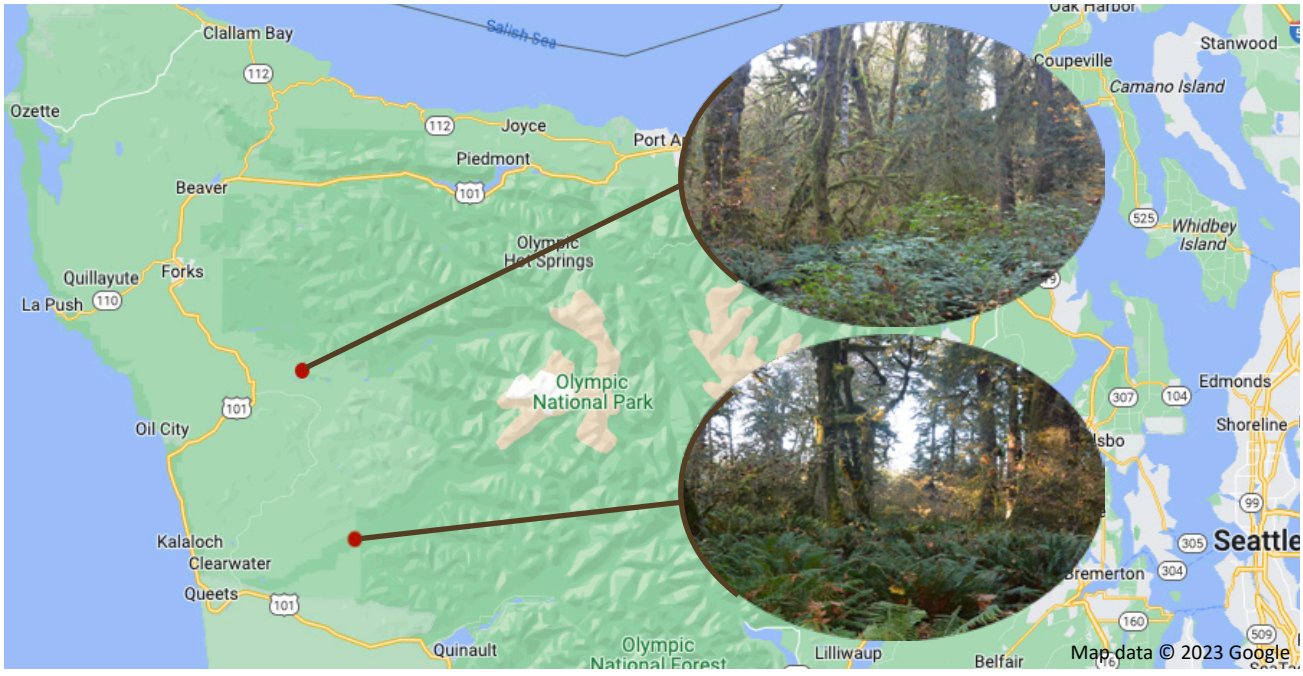


Figure 2: The general location and site characteristics of the two old-growth study areas.

communities in both soil types showed significant shifts across seasons. For example, fungi that are known to help trees acclimate to water stress were more abundant during the summer drought. The amount of nitrogen and phosphorus available to the tree was much higher in canopy soils (Figure 5). During certain seasons, nitrogen and phosphorus available for plants was lacking in the forest floor. In these times of nutrient scarcity, canopy soils provided additional nutrients that the host tree could tap into through its canopy roots.

When we shifted our perspective to the forest stand level, we calculated that canopy soils enhance plant-available nitrogen and phosphorus pools by 9.3 and 3.7 percent, respectively. This demonstrates that canopy soils contribute to forest-level nutrient dynamics, especially because rain and other moisture can leach nutrients from the canopy soils into the ground.

Other studies we have completed have also found that canopy soils contribute to the carbon cycle, including greenhouse gases. At the forest stand level, bigleaf maple canopy soils contribute about 4 percent to soil CO_2 emissions and 4 percent to soil CH_4 (methane) absorption. Ignoring how canopy soils contribute to greenhouse gas dynamics leads to an incomplete understanding of how these ecosystems integrate into the global carbon cycle. Additionally, over 100 mushrooms have been collected from canopy soils, demonstrating a widespread and barely explored diversity.

The field of canopy soil science is relatively young, compared to other well-established fields, and many unknowns remain about these unique soil environments in old-growth temperate rainforest canopies. When modeling ecosystem processes, assessing forest productivity, and predicting the impacts of longer droughts and heavier rainfall on old-growth forest processes, canopy soils should not overlooked. We welcome any inquiries that may result in the development of future canopy-soil-related research.

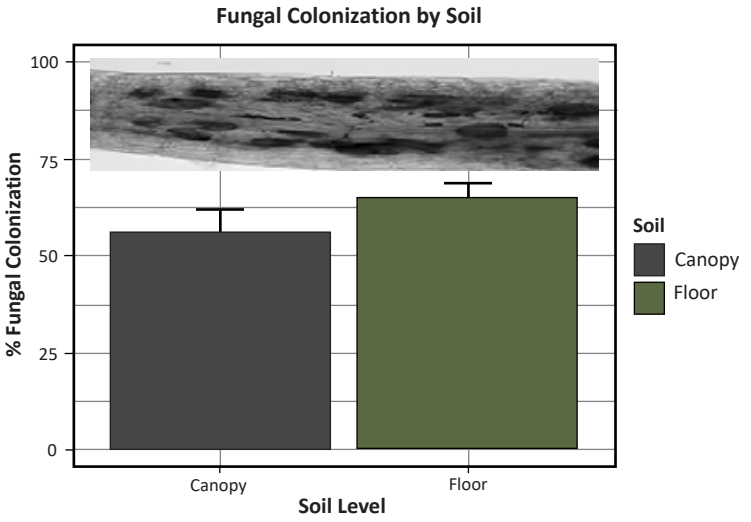


Figure 4. A graph showing the percent of fungal colonization between adventitious canopy roots and roots at the ground level. The picture above the bars shows a root with arbuscular mycorrhizal establishment (dark stained structures).

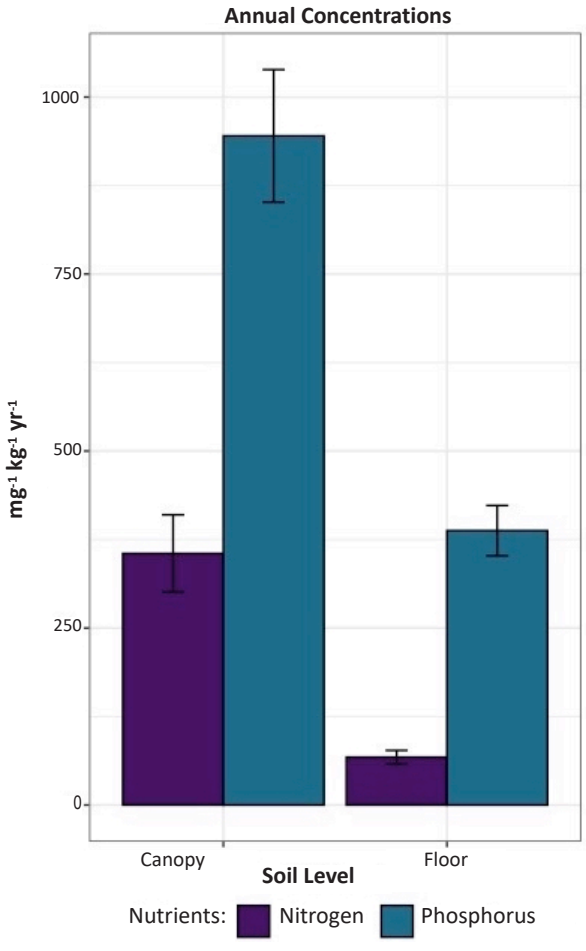
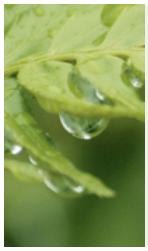


Figure 5. Annual mineralization rates of nitrogen (Net N, purple) and phosphorus (Net P, blue) in canopy soils and soils at the ground level. Rates are reported in milligram (mg) nutrient per kilogram (kg) soil per year.

About the Author

Dr. Korena Mafune is a fungal ecologist conducting research at the University of Washington. She is passionate about science communication and has taught various courses focusing on sustainability, soil ecology, and environmental assessment. Korena is fascinated with tripartite interactions among plants, fungi, and bacteria, and aspires to better understand how these drive ecosystem function from small to large scales in a changing climate. Her research and passion for science has been featured across various media outlets including The Seattle Times, RadioLab, National Geographic Magazine, Hulu, and PBS.



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Type 3 Watershed Experiment Updates

The **Type 3 Watershed Experiment** seeks to expand the Washington State Department of Natural Resources (DNR) forest management toolbox by identifying land management strategies that benefit both communities and forests. The experiment is being implemented through 13 timber sales covering 2,920 acres in 16 DNR-managed, experimental watersheds in the Olympic Experimental State Forest (OESF).

Upland Silviculture Study Plan

The uplands study plan describes a variety of new silvicultural tools that are being compared to standard practice and no action controls in the uplands across the 16 experimental watersheds. The final peer-reviewed document is available on the **Olympic Natural Resource Center (ONRC)** and **DNR** websites.

Implementation

Of the 13 timber sales in the experiment, 10 were auctioned between May 2022 and April 2023 and the remaining 3 should be auctioned this summer and fall. Logging operations have started in three timber sales. The first silvicultural activities are expected to begin in January 2024; planning for these activities is underway.

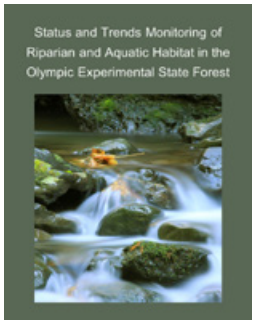
Learning-based Collaboration: History Learning Group

As mentioned in the featured article, **eight learning groups** are currently working in the OESF as part of learning-based collaboration. The history learning group is dedicated to the history of natural and human disturbances of forests (such as windstorms and logging, respectively) in the experimental watersheds between 1950 and 2018. This information will help members characterize forest conditions pre- and post-disturbance.

In the fall and winter of 2022, University of Washington (UW) students **Karena Iliakis** and **Ally Kruper** worked on a GIS layer of past management activities (refer to "Education and Outreach"). Members **Tom Rosmond** interviewed local community members **Pete Dahlgren** and **Richard Halvorsen**, who shared their logging experiences over the past 40 years. The interview was held in Forks and broadcasted on Zoom, with over 30 people attending across both venues. In addition, learning group member **John Tylczak** has been reviewing historical interviews from a series called "In Search of a Memory," a set of 30 interviews from the 1980s that recorded events such as the 1921 windstorm (the "21 Blow"), the 1962 Columbus Day storm, and the Great Forks Fire of 1951, a 38,000-acre wildfire that swept through the Calawah River valley and almost burned the town of Forks, WA.

Education and Outreach

OESF Flipbook Posted



Visit the **OESF website** for a **new online flipbook** that summarizes findings from the Status and Trends Monitoring of Aquatic and Riparian Habitat project. This project is helping to determine the effectiveness of the Washington State Department of Natural Resources' (DNR) current strategy for maintaining and restoring riparian habitat, which is described in DNR's *State Trust Lands Habitat Conservation Plan*.

Kyle Martens Gives Steelhead Trout Presentation

In March, DNR Natural Resource Scientist Kyle Martens gave a presentation to NOAA Fisheries on the status of steelhead trout and their habitat on DNR-managed lands in the OESF. NOAA Fisheries began a **90-day review** in February, 2023 to decide whether to list Olympic Peninsula steelhead trout under the Endangered Species Act.

DNR has been monitoring steelhead and their habitat since 2015. The presentation included recent data on the distribution and population trends of steelhead within the OESF, the impact of historic forest harvest activities on current salmonid habitat, and an update on DNR's fish passage barrier removal efforts. Martens also discussed recent findings from a study of salmonid abundance and biomass before and after the removal of a partial (33 percent passable) fish passage culvert.

University of Washington (UW) Students Complete Capstone Projects

Capstone projects provide UW students an opportunity to apply what they have learned to the type of issues they are likely to experience after graduation.

UW undergraduate student **Karena Iliakis** created a GIS layer of all forest management activities in the study area of the Type 3 Watershed Experiment (about 20,000 acres in the Clearwater and Hoh River basins) since the 1950s. The work included georeferencing and digitizing old aerial photos, analyzing satellite imagery, scanning and summarizing pre-1950s timber sale records, and incorporating existing digital records of post-1950s timber sales (Figure 1). Understanding past management disturbances will help researchers understand current forest conditions and how the forest responds to silvicultural activities. OESF Research Program Manager **Teodora Minkova and** OESF Natural Resource Scientist Warren Devine mentored this project over the winter and spring of 2023.

UW undergraduate student **Emily Anderson** analyzed coho salmon presence-absence data from three OESF projects (**Status and Trends Monitoring of Aquatic**

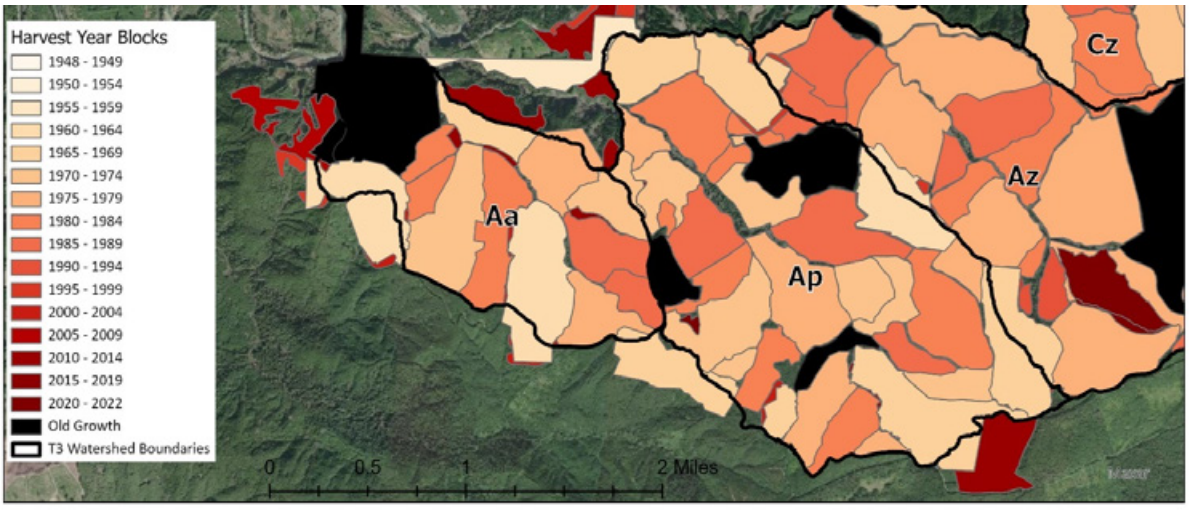


Figure 1. Management disturbance map created from GIS layer. Map shows timber harvests in 4 of the 16 experimental watersheds (Az, Aa, Ap, and Cz) in the Type 3 Watershed Experiment. Harvests took place between 1950 and 2022 and are grouped into five-year blocks.

and Riparian Habitat, Riparian Validation Monitoring and the Type 3 Watershed Experiment) to determine the suitable and optimal ranges of four habitat indicators: stream temperature, instream wood, canopy cover, and water temperature. This work will help researchers distinguish environmental from human impacts. OESF Natural Resource Scientists Kyle Martens and Warren Devine mentored this project during the fall and winter of 2023.

UW Students Defend Their Theses

Jeff Keck, DNR hydrologist and UW graduate student, defended his Ph.D. thesis titled *New Methods for Coupling Climate and Hydrology to Watershed-scale Sediment Dynamics Models* at 1:30 pm on May 25th, in Room 303 of the Electrical and Computer Engineering building on the UW Seattle Campus.

For his thesis, Keck developed new methods for coupling climate and hydrology to sediment production (landslides) and transport (sediment movement in rivers) models, and produced climate-driven, geomorphology models for predicting landslide runout and the transfer of landslide material to the channel network. He also examined the impacts of precipitation variability on sediment transport in streams. Keck's proposed ways to model watershed-scale sediment production and transport can be used to inform future hydrology-related cost-benefit assessments on state trust lands. The models were developed and tested in East Fork Kunamaskt Creek in the OESF.

Keck discussed potential applications of his model at the U.S. Geological Survey **Landslide Hazards Seminar**. At the recent **Land Surface Hazards Modelling Expo**, he discussed possible applications of his model to evaluating sediment hazards in response to land management and climate change.

Courtney Bobsin, research scientist and Ph.D. candidate at the University of Washington's School of Environmental and Forest Sciences, defended her dissertation titled *Ethnoforestry and Adaptive Management: Generating New Pathways to Manage Forests on the Olympic Peninsula, WA* on May 24th at 11:30 am in Anderson Hall Room 207 on the UW Seattle campus and via zoom.

Bobsin's dissertation seeks to demonstrate methods of better incorporating and integrating sciences, both biophysical and social, into forest management decisions, to assist in improving the collective capacity of managers, researchers, stakeholders, and tribes to adapt to a rapidly changing world. Her dissertation includes the evaluation of two adaptive management studies that seek alternative approaches to managing forests. In addition, she proposes and studies a new approach to continue, expand, and focus engagement, called learning groups. This approach, derived from the discipline of social learning, prioritizes collaborating to address issues that could be studied while learning through the outcome of the work and about the process itself.

Featured Photos

Cathy Chauvin, DNR

Cathy Chauvin, DNR

The 6th annual OESF Science Conference was held at the Rainforest Arts Center in Forks, WA on May 3, 2023. New this year were a panel discussion on the Type 3 Watershed Experiment (left) and information tables hosted by local organizations doing ecological research, monitoring, and habitat restoration on the Olympic Peninsula, including Westfork Environmental (right). Nearly 100 people attended this year's event.