The Learning Forest

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

Issue 3 • May 2018

Editorial Board Message

We would like to thank those who attended the annual Olympic Experimental State Forest (OESF) Science Conference on April 24, 2018, in Forks, WA. Along with this newsletter, the conference is a major way for the Washington State Department of Natural Resources (DNR) and University of Washington Olympic Natural Resources Center (ONRC) to share information about the OESF. We appreciate your support. Having an engaged local community that is well-informed about natural resource issues and highly committed to addressing them constructively is what gives us the energy and enthusiasm to continue with both of these outreach activities. Check out the review on page 7 of this newsletter for attendance statistics, your feedback, and potential future directions for the conference. Please continue to send us your comments and suggestions.

This issue's featured article describes a complex and highly ambitious study that is aligned with the core mission of the OESF: finding better ways to integrate ecological values and revenue production and to share this information broadly. Called the "Large-Scale Integrated Management Experiment," the study reflects evolving thinking about sustainability in which people are considered an integral part of the ecosystem. This view of "rural ecosystem sustainability" requires management strategies that benefit both ecological and human wellbeing.

In this Issue

The guest article feature will return for the October, 2018 issue.

Testing the effectiveness of such strategies scientifically in the OESF is challenging. For example, many community wellbeing indicators are difficult to define. Our coastal landscapes are highly variable, making it difficult to find areas that are similar enough to serve as experimental units. Implementing the study as part of the DNR timber sale program requires coordination between timber sale operations and research activities, and finding sufficient funding is always an issue.

Despite the challenges, ONRC and DNR are committed to the study and even more importantly, to the ongoing communication with the local community and potential research partners that will make this study a success. The featured article is part of these communication efforts.

We hope you enjoy this issue of the Learning Forest.

Featured Article

Care for the Land, Care for the People

A Fresh Look at Sustainability in Forest Management

by Bernard Bormann, Marc Miller, Teodora Minkova, and Cathy Chauvin

Harvest this much. Save this type of habitat. Achieve these markers of biodiversity. Traditional approaches to forest management tend to focus on specific ecological and revenue objectives, how much land to dedicate to these objectives, and how to achieve them.

But there is something largely missing from these approaches. Us. Humans. Under traditional approaches, humans exist somewhat outside of the forested ecosystems we are managing, even as we look to the forest to meet our needs.

Yet there is a growing recognition that humans are an integral part of these systems. Consider the interactions and interdependencies of a community and the forest and streams that surround it (Figure 1). The forest needs human intervention to stay safe and healthy due to past timber harvest, fire suppression, and major environmental shifts such as climate change. And communities need the forest's ecosystem services, which can range from timber for harvest to carbon storage, filtered water, and streams with healthy fish populations for food and recreation. Such services keep communities healthy and more likely and able to care for the forest.

This recognition is the basis for a sustainable forest management concept that the ONRC and its partners refer to as "rural ecosystem sustainability." Under this concept, the forest and its communities are defined as a "rural ecosystem" and managed with strategies that benefit both. "To care for the place, you have to care for the people. And to care for the people, you have to care for the place," says Hilary Franz, the Commissioner of Public Lands and leader of DNR, steward of over two million forested acres that touch the lives of communities across the state.

Although this concept has been documented in recent scientific literature—for example, the 2017 Island Press book *People, Forests, and Change: Lessons from the Pacific Northwest* described a "human-forest ecosystem"—it has not been tested at a landscape scale. That is about to change. An ambitious new study called the "Large-Scale Integrated Management Experiment" or T3 Experiment for short is being developed to test this

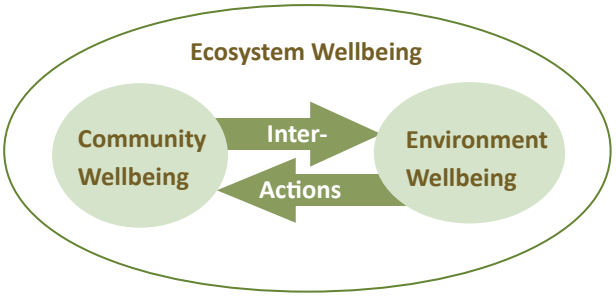
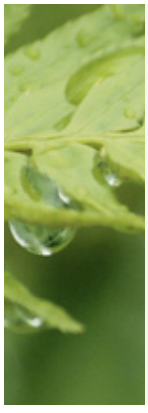


Figure 1. Holistic View of Sustainability



The Learning Forest is an electronic, biannual newsletter published jointly by the **Washington State Department of Natural Resources** (DNR) and the University of Washington's **Olympic Natural Resources Center** (ONRC).

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holistic sustainability concept across thousands of acres of forest on the western Olympic Peninsula.

A Unique Study

A basic requirement for studying rural ecosystem sustainability is to define an ecosystem that contains people in the context of the surrounding land. The OESF on the western Olympic Peninsula fits this description. Defined largely along watershed lines, the OESF's boundaries encompass over a million acres of both forestland and communities. Communities include small towns like Forks and four Native American reservations, plus farms and other businesses. Forests are managed for a range of objectives by DNR, tribes, private landowners, conservation organizations, the US Forest Service, and the National Park Service. DNR manages over 270,000 acres in the OESF on behalf of public trust beneficiaries such as counties and schools.

The T3 Experiment's central purpose is to find a management strategy that lifts the wellbeing of the OESF's communities and forests above what is being experienced right now. In this study, which is co-led by the University of Washington's ONRC and DNR, researchers will apply three management strategies and a no-action control on DNR-managed lands in 16 Type 3 watersheds in the OESF (Figure 2). DNR will define ecological and community wellbeing indicators through a collaborative process, quantify how well each strategy meets these indicators over time, and then conduct a comparative analysis to draw conclusions on which strategy improves ecological and community wellbeing the most. (Type 3 watersheds are catchments of the smallest fish-bearing streams.)

This is not your typical forestry study.

Forestry studies seldom include something so nebulous….subjective….and difficult to measure as community wellbeing. Elements of environment wellbeing have been studied for decades, and scientific literature abounds for how to do so. For example, many studies have measured biodiversity, productivity, regeneration capacity, and other characteristics.

But community wellbeing can be many things to many people. Jobs. Knowing one's neighbors. Road access into the forest for recreation. Gathering places like libraries. High school seniors who stay after graduation instead of lighting out at the first opportunity.

So how do you define it?

By asking stakeholders, especially those who live in these communities. Members of the community, local tribes, environmental groups, timber company representatives, and other stakeholders will be invited to define what wellbeing means to them. They may have other opportunities to participate as well, such as workshops. Collaboration with stakeholders is an important feature of this study because there is no way to succeed without involving them, particularly members of the very communities the study is intended to benefit (Figure 3).

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Teodora Minkova, DNR

Figure 2. One of the 16 Type 3 watersheds in this study

Konrad Roeder

Figure 3. Timber Museum in Forks, WA

Timber harvest and management has been part of the city's history for decades.

Another unique aspect of this study is that each strategy will be implemented through DNR's Olympic Region timber sale program, not as separate research experiments. This is nothing but practical. "It can be difficult to translate the results of a small research study to normal timber operations," explains Bill Wells, Coast District Manager with Olympic Region. "We have to be able to incorporate what we learn from this experiment at an operational scale." So why not start at that scale to begin with? Study units have been sized accordingly.

In other words, researchers are not pursuing knowledge for the sake of knowledge. They want defensible results that can be used to make informed management choices. Through an adaptive management process, results may be used to improve the management of the OESF and possibly other areas DNR manages.

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Ideally, results also will benefit forests and communities far beyond the boundaries of the OESF. ONRC and DNR are inviting participation in this study from other land management, academic, and scientific organizations with a major goal of collaborative learning and sharing of knowledge.

16 Watersheds, 4 Blocks, 4 Strategies

One of the first steps in this study was to select the 16 Type 3 watersheds in which the strategies would be tested. To yield meaningful results, each watershed had to be at least 500 acres, be managed mostly by DNR, include at least some older or old-growth forest, include the steep slopes that are so common across the OESF, and contain timber that was ready to harvest. Researchers and DNR managers chose watersheds within the basins of the Hoh, Clearwater, and Queets rivers.

Researchers grouped watersheds into blocks of four based on how similar the watersheds were to each other. For example, they grouped watersheds that were at a similar elevation, were roughly the same size, and had trees of roughly the same age. Grouping watersheds this way helps to screen out nuisance factors, which are traits like elevation that can skew results and make it difficult to compare results from different watersheds.

Within each block, each watershed was assigned one of the four strategies in a way that was completely random – in this case, by rolling the dice (Figure 4). This spatial design is called a "randomized block" (Figure 5 on page 5).

Within each block, each watershed will be managed under its respective strategy. Where the harvest will be and what harvest technique will be used will depend on the strategy.

Under the "plan" strategy, the watershed will be managed per the integrated management concept and harvest techniques described in the 2016 OESF Forest Land Plan. Under integrated management, most sensitive areas are managed for ecological values but are not part of fixed, permanent ecological reserves. In areas managed for revenue, DNR uses harvest techniques designed to create and maintain a structurally varied forest that can provide additional support for ecological values as well as revenue.

Integrated management is a marked contrast to the "zoned" strategy, which is widely used by the US Forest Service as well as DNR in other areas it manages. Under the zoned strategy, the watershed is divided into permanent areas or "zones" for either ecological values or timber harvest. Harvests will be located in the latter; the former will be left unmanaged. Techniques likely will be similar to the plan strategy.

Figure 4. DNR Olympic Region manager Mona Griswold rolls dice to randomly assign strategies to watersheds in each block

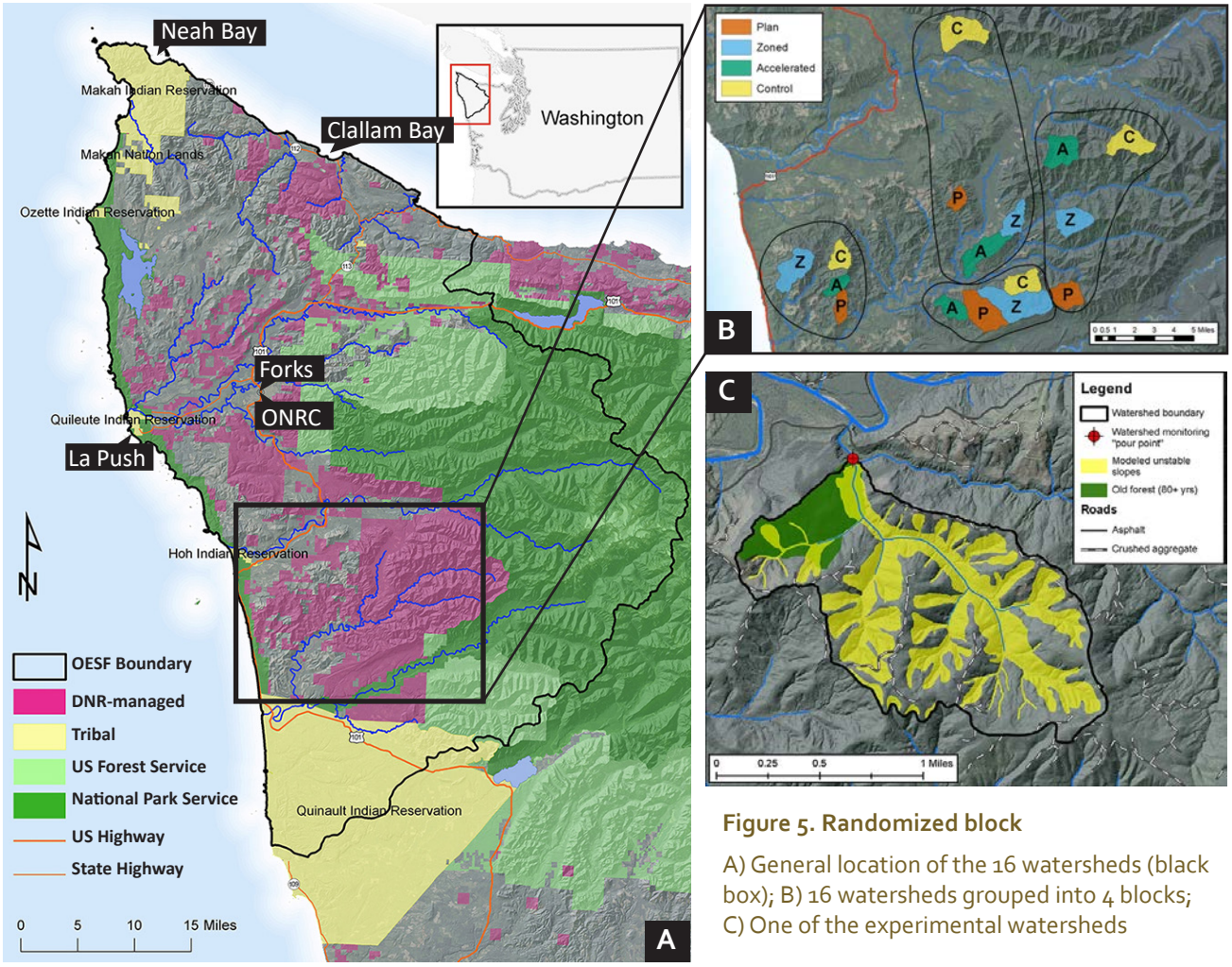


Figure 5. Randomized block

A) General location of the 16 watersheds (black box); B) 16 watersheds grouped into 4 blocks; C) One of the experimental watersheds

The "no-action control" is not a viable management strategy for DNR under state law. However, these watersheds will provide a contrast to active management and enable researchers to understand how the forest interacts with natural disturbance in absence of management. The control strategy also reflects stakeholder interest in managing some areas as carbon sinks and using carbon payments in lieu of harvest to generate revenue. DNR is committed to leaving these four watersheds unmanaged for 10 years.

The "accelerated" strategy is similar to the plan but with one key difference: management will explore techniques and areas that are more innovative or uncertain but may offer greater benefits to both community and environment. For example, DNR may thin riparian areas to a wider spacing than is currently allowed under the plan in the hope of producing larger trees that contribute higher-quality down wood to streams. DNR also may experiment with "tethered logging," in which logging equipment is tethered to the slope with cables. Tethered logging is more cost effective than cable logging and safer for forest workers, and may enable DNR to operate on steeper slopes than is currently feasible with ground-based equipment.

There is a general perception that the accelerated strategy may spur the most creative answers to how to boost community and environmental wellbeing (Figure 6 on page 6). But will it? Time will tell.

Next Steps

The T3 Experiment is in its infancy. After discussing the study proposal with stakeholders and managers in 2016, in 2017 DNR and ONRC began collaborating with scientists from the US Forest Service Pacific Northwest Research Station, Oregon State University,

Figure 6. Examples of wellbeing indicators and how they might perform over a decade or longer

C is the no-action control strategy, Z is zoned, P is plan, and A is accelerated. C > Z = P = A means that for CO_2 sequestration, researchers think the control strategy will outperform the other three strategies, which will perform roughly the same for this indicator.

	Rural ecosystem wellbeing indicators	Initial expectations
Environment	CO_2 sequestration (in forest and built environment)	C > Z = P = A
	Soil productivity (indicators and actual growth responses)	A > Z = P = C
	Stream health	A > P > Z = C
	Near-term late-seral bird habitat (owls, murrelets)	C > Z = P = A
	Long-term late-seral bird habitat (owls, murrelets)	A > P > Z > C
	Early-seral neo-tropical bird habitat	A > P > Z > C
	Ungulate habitat	A > P > Z > C
	Viable salmonid populations	A > P > Z > C
Community	Local jobs	A > P > Z > C
	Local salaries gross/net	A > P = Z = C
	Revenue to trust beneficiaries	A > P > Z > C
	Human health	A > P = Z > C
	Road access to the forest (for example, recreation or hunting)	A > P > Z > C
	Poverty level	A > P = Z > C
	High school students wanting to stay	A > P = Z > C
Both	Solar energy capture (photosynthesis driving all food chains and wood production)	A > P > Z = C
	People-land connectedness	A > P = Z > C

NOAA, and other organizations to develop a draft study plan. The full study plan is being developed and will be submitted for peer review later this year. The watersheds have been selected as described earlier. Next steps include specifying experimental treatments, identifying wellbeing indicators for monitoring, and exploring funding options.

Another step is determining how to quantify community wellbeing indicators for each strategy, and how to tease out the differences between the strategies and how well they support the community. That will take creative problem solving.

However challenging and complex, this study is necessary. Rural communities in Washington and elsewhere are struggling as our demands from the forest become more complex, more numerous, and potentially more conflicting. At the same time, the forest is experiencing environmental changes such as rising temperatures and more extreme weather. We need creative, sustainable, and balanced solutions, and we need them now. This study will not only help find those solutions, but provide a model for working collaboratively to achieve a higher level of wellbeing for forest and community alike.

About the Authors

Bernard Bormann, Ph.D, is a professor at the School of Environmental and Forest Sciences College of Environment, University of Washington and Director of the ONRC. His research includes forest ecology, the role of soils in long-term productivity, and adaptive management.

Marc L. Miller, Ph.D, is a professor of Marine and Environmental Affairs and adjunct professor of Environmental and Forest Sciences at the University of Washington. His domestic and international research has concerned social and cultural change, globalization, sustainable livelihoods, natural resource and protected area governance, and outdoor recreation and tourism.

Teodora Minkova, Ph.D, is a natural resource scientist in DNR's Forest Resources Division and an affiliate assistant professor at the University of Washington's School of Environmental and Forest Sciences. She manages the research and monitoring program for the OESF and is one of principal investigators on the T3 Experiment.

Cathy Chauvin is a writer, editor, planner, and graphic designer for DNR. She was part of the team completing the forest land plan and related environmental documents for the OESF.

You are Invited to Participate

The Washington Department of Natural Resources (DNR) and the Olympic Natural Resources Center (ONRC) invite researchers and stakeholders to participate in research, monitoring, and other learning activities in the Olympic Experimental State Forest (OESF). Contact Teodora Minkova at teodora.minkova@dnr.wa.gov or Franklin Hanson at fsh2@uw.edu. Information on past and current projects in the OESF can be found at this **link**.

Event Recap

OESF Science Conference

Linking Science to Natural Resource Management

by Teodora Minkova

DNR held its annual OESF science conference on April 24, 2018, at the ONRC in Forks, WA. The purpose of the conference was to communicate the results of research and monitoring activities taking place in the OESF and the relevance of those results to management of the OESF and other Pacific Northwest coastal forests.

In the morning, DNR researchers and scientists and students from the University of Washington and The Evergreen State College presented talks and posters on winter stream temperature, hydrological monitoring, wetlands characterization, watershed-level experimentation, predictive models for red alder, acoustic monitoring, and archeology. In an afternoon workshop, DNR staff explained and demonstrated the use of small unmanned aircraft (drones) in natural resource management of state trust lands.

DNR welcomed 79 people to this year's conference, which was similar to last year's count of 86 people. Most were natural resource specialists such as foresters, biologists, or ecologists (Figure 1). A third of the at-

tendees were from DNR, and the remaining two-thirds were from local tribes, federal agencies, non-profit organizations, educational institutions, the private sector, and other organizations (Figure 2). Through survey forms and informal feedback, attendees indicated a high level of interest in the science taking place in the OESF and expressed satisfaction with the quality of the research, the relevance of the drone workshop, and the opportunities for networking. One area for improvement was the size of the room and visibility of the screen. DNR will explore larger venues for future conferences.

DNR also is considering expanding participation in the conference from students in undergraduate and graduate programs at the University of Washington, The Evergreen State College, Peninsula College, and other institutions, possibly through a concurrent session. Another idea is to invite Forks High School students to present their capstone projects in environmental sciences.

Two years of attendance data and feedback suggest that the conference is addressing the need for scientific information relevant to local forest management. DNR's goal for this event is to advance the understanding that science-based, adaptive natural resource management is the path to long-term sustainability.

For more information and abstracts, refer to the conference program posted on the **OESF webpage**. Videos from **this year's conference** and the **2017 conference** are posted on DNR's YouTube channel.

Teodora Minkova, DNR

The conference provides ample opportunities for networking

Teodora Minkova, DNR

Attendees listen to the presentations in the morning

Cathy Chauvin, DNR

DNR employee Justin Schmal demonstrates the capabilities of a small drone

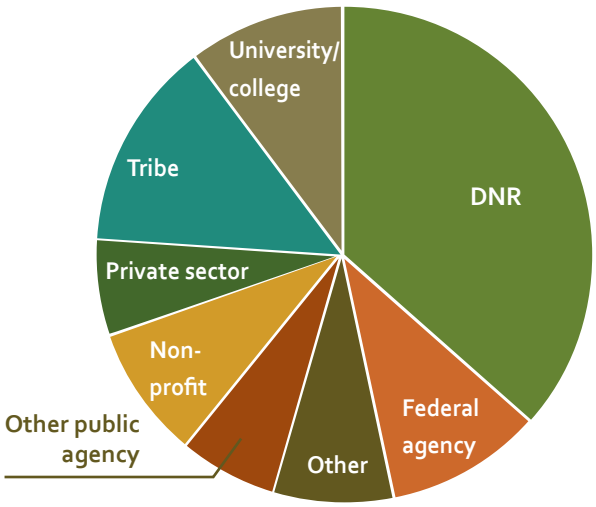


Figure 1. Professional affiliation (Based on data from 79 attendees)

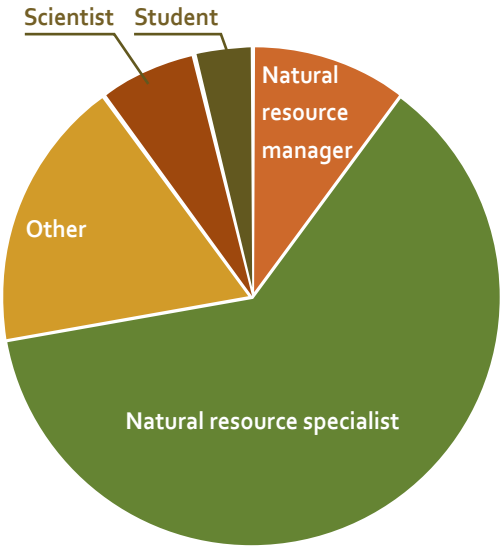


Figure 2. Professions (Based on data from 79 attendees)

Project Updates

Swiss Needle Cast in Coastal Washington

The Washington State Legislature has provided support to the ONRC for a pilot project to "develop a mitigation plan for Swiss needle cast disease in coastal Washington." The disease is caused by a fungus (*Phaeocryptopus gaeumannii*) that infects Douglas-fir, resulting in loss of older needles and reduced tree growth (photo, right).

The ONRC will review literature relevant to Washington's forests and host a meeting of the Swiss Needle Cast Cooperative on May 1 and 2 (refer to Upcoming Events on page 10). Swiss needle cast already is affecting Douglas-fir trees in coastal Washington and the impact is likely to increase with warmer winters and wetter springs. This work will be performed in conjunction with a new DNR aerial survey in May. For more information, contact Bernard Bormann at bormann@uw.edu.

USFS

Swiss needle cast

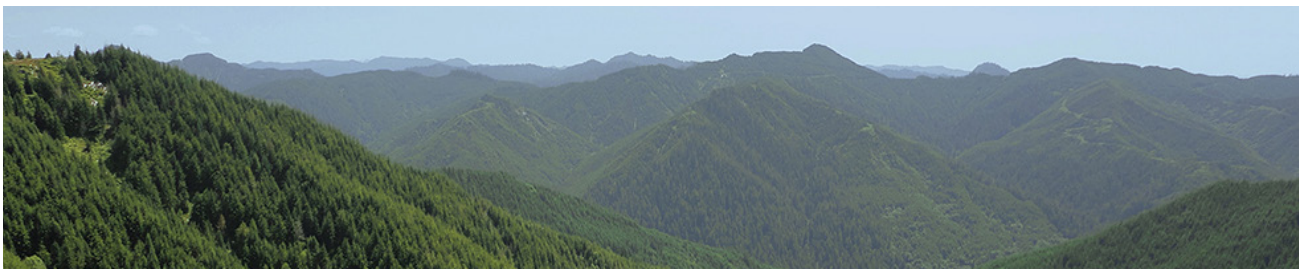
Status and Trends Monitoring of Riparian and Aquatic Habitat in the OESF

DNR is collaborating with the US Forest Service to add four to six unmanaged or minimally managed (reference) watersheds on the western Olympic National Forest to the existing monitoring network. With these new watersheds, the total monitoring network will include 50 managed watersheds on DNR-managed land in the OESF, four reference watersheds in Olympic National Park, and four to six reference watersheds in Olympic National Forest. An adequate sample of reference sites is needed to distinguish between the effects of management and the effects of natural disturbances and to assess the natural range of variability in habitat conditions.

This mutually beneficial collaboration was made possible by the federal Good Neighbor Authority, an agreement between DNR and the US Forest Service that allows agencies to work together to manage public forests and watersheds across jurisdictions. The US Forest Service will receive site-specific information on the status and trends of habitat and fish in its unmanaged watersheds in Olympic National Forest. This information will be delivered at relatively low cost because experienced DNR staff will use already-tested monitoring protocols and well-established data management processes and databases. In addition, the US Forest Service will have access, at no cost, to data and information from the other 54 sites, monitored since 2012. This valuable information could be used for planning activities such as the upcoming update of the forest management plan for Olympic National Forest. DNR will enhance its existing monitoring network at very little cost.

The selection of watersheds and establishment of the long-term monitoring installations will occur in the summer of 2018. For more information, contact Teodora Minkova at teodora.minkova@dnr.wa.gov.

Bill Wells, DNR



Olympic Experimental State Forest

Upcoming Events

Swiss Needle Cast Cooperative Biannual Meeting

Tuesday, May 1, 8 am to 5 pm *and*
Wednesday, May 2, 8 am to 1 pm
Hemlock Conference Room, ONRC
1455 S. Forks Avenue, Forks, WA

The ONRC is hosting the Swiss Needle Cast Cooperative for one of their biannual meetings on May 1 and 2. Local land managers and others have been invited to catch up on research and application developments relating to this problem, which appears to be spreading northward. Presentations will begin at 8:30 am. An afternoon field trip will explore possible needle cast influence on DNR's long-term ecosystem productivity experimental site near Sappho, WA. If you are interested in attending, contact Franklin Hanson, ONRC Education and Outreach Coordinator, at fsh2@uw.edu.

ONRC Evening Talk

Friday, May 11, 7-9 pm
Hemlock Conference Room, ONRC
1455 S. Forks Avenue, Forks, WA

On May 11, Joseph F. Murray of JMurray Forestry will give a presentation on forest restoration. He also will provide an introduction to the Cooperative Monitoring, Evaluation, and Research (CMER) Committee, which was established by the Forest Practices Board to implement four key goals in the **Forest and Fish Law**. Mr. Murray has decades of experience in helping forest landowners obtain the highest value from their forests, and has a working knowledge of forestland management, permitting, appraisals, forest restoration, and silviculture prescriptions.

Recent Publications

2017 Annual Report, Riparian Validation Monitoring Program for Salmonids on the Olympic Experimental State Forest

The purpose of the Riparian Validation Monitoring Program is to assess the response of salmonids to DNR's riparian conservation strategy. The program monitors 54 DNR-managed Type 3 watersheds, as well as a 12-kilometer section of DNR-managed land along the Clearwater River.

In 2017, DNR completed the scheduled multiple-pass removal surveys of juvenile salmonid abundance and redd surveys to determine abundance of adult coho salmon. DNR also completed habitat and snorkel surveys along the Clearwater River.

Juvenile salmonid densities in 2017 were similar (within 0.15 fish per meter) to densities in 2016. Snorkeling and habitat surveys in the Clearwater River suggest low levels of in-stream down wood. Slow-water sections

Warren Devine, DNR

Clearwater River

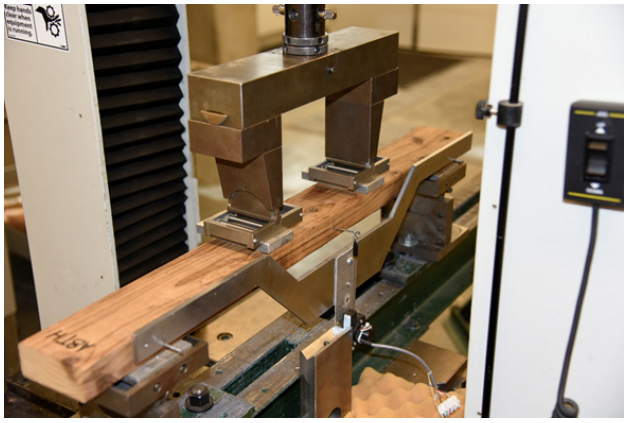
In September 2017, DNR completed a snorkel and salmon habitat survey of a 7.5 mile (12 kilometer) index section

that contain key pieces of in-stream down wood (>45 centimeter diameter and >2 meter length) have higher densities of juvenile salmonids than areas without these key pieces of wood. The annual report is available on DNR's **website**.

Final Project Report, Evaluating the Thermal Modification Process for Western Hemlock Lumber

A team from the University of Washington, led by Ivan Eastin with Indroniel Ganguly, Anthony Dichiara, Bernard Bormann, and Kunlin Song, recently completed a study funded by the University of Washington's Amazon Catalyst program. The study explored using thermal modification technology to turn low-value hemlock into a premium product. The test was a success and could open up a new avenue for manufacturing hemlock as siding, outdoor furniture, and decking. The report is available on the **ONRC webpage**.

University of Washington



Thermally modified hemlock board mounted in the testing apparatus for the bend strength test

Featured Photo

Joe Rocchio, DNR

Crowberry Bog in the OESF: A Unique Place

The pink flowers of bog laurel (*Kalmia microphylla*) provide beautiful spring color across the central plateau of Crowberry Bog, the only known raised bog in the western conterminous United States. Other species common on the plateau of the bog include crowberry (*Empetrum nigrum*), Labrador tea (*Rhododendron groenlandicum*), and oligotrophic peat moss species (*Sphagnum spp.*).