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State Trust Lands Habitat Conservation Plan

Annual Report

for Fiscal Year 2023



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WASHINGTON STATE DEPARTMENT OF
NATURAL RESOURCES

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Acronyms

dbh	Diameter at breast height	P&T	Planning and Tracking
DFC	Desired future condition	PCT	Pre-commercial thinning
DNR	Washington State Department of Natural Resources	PhoDAR	Photogrammetric detection and ranging
ESA	Endangered Species Act	QMD	Quadratic mean diameter
FEIS	Final environmental impact Statement	RCW	Revised Code of Washington
FRIS	Forest Resource Inventory System	RD	Relative density
FY	Fiscal year	REF	Reference
GIS	Geographic information system	RFRS	Riparian Forest Restoration Strategy
HCP	State Trust Lands Habitat Conservation Plan	RMAP	Road maintenance and abandonment plan
LPU	Landscape planning unit	RMZ	Riparian management zone
LiDAR	Light detection and ranging	RS-FRIS	Remote-sensing Forest Resource Inventory System
LRM	Land Resource Manager	RVMP	Riparian Validation Monitoring Program
LTFC	Long-term forest cover	SEPA	(Washington) State Environmental Policy Act
MM	Marbled murrelet	SHA	Special habitat area
MMLTCS	Marbled Murrelet Long-term Conservation Strategy	SFT	State Forest Transfer
MoRF	Movement, roosting, and foraging	SOMU	Spotted owl management unit
NAP	Natural Area Preserve	TLT	Trust Land Transfer
NRCA	Natural Resources Conservation Area	UAS	Unmanned aircraft system
NRF	Nesting, roosting, and foraging	USFWS	United States Fish and Wildlife Service
NSO	Northern spotted owl	USFS	United States Department of Agriculture Forest Service
NOAA	National Oceanic and Atmospheric Administration	UW	University of Washington
OESF	Olympic Experimental State Forest	WAU	Watershed administrative unit
ONRC	Olympic Natural Resource Center (University of Washington)	WDFW	Washington Department of Fish and Wildlife
		WMZ	Wetland management zone

1.0 Introduction

The State Trust Lands HCP Annual report

Appendix: State Trust Lands HCP Overview

Each year, the Washington State Department of Natural Resources (DNR) releases a *State Trust Lands Habitat Conservation Plan (HCP) Annual Report* based upon commitments outlined in the HCP Implementation Agreement. The intended primary audience is the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (collectively, “the Services”) and other interested parties.

The HCP Annual Report is a summary of management activities completed on DNR-managed state lands covered by the [1997 State Trust Lands Habitat Conservation Plan](#), including monitoring, research, and progress toward achieving conservation strategy goals. Unless otherwise noted, information about DNR programs included in this report covers fiscal year (FY) 2023 (July 1, 2022 – June 30, 2023). Some activities such as roads management and recreation are instead reported by calendar year, depending upon the data management system used and specific information being reported.



State Trust Lands HCP Planning Units

We also include information in this report on DNR’s Natural Areas Program, under which we manage natural area preserves (NAPs) and natural resources conservation areas (NRCAs). Although these natural areas are not state trust lands, they contribute to the HCP’s overall conservation objectives. In this document, terms such as “DNR-managed lands” and “HCP covered lands” refer to these areas in addition to state trust lands.

Comprehensive Review of Selected Elements of the HCP

The HCP Implementation Agreement (HCP Appendix B, Section 21.0, p. B.8) requires periodic comprehensive reviews of the HCP, the Incidental Take Permit, and the Implementation Agreement, plus consultation in good faith between DNR and the Services to identify amendments necessary for mitigating incidental takes.

In 2012, DNR and the Services agreed to conduct periodic comprehensive reviews by selected subject as allowed by funding and staff availability. Links to the comprehensive reviews since 2012, summarized in Table 1.0, are publicly available at [HCP Monitoring and Reporting](#).

Table 1.0: Comprehensive reviews since 2012.

Publication Year	Subject(s)
2023	Assessment of RFRS implementation and tracking of riparian restoration treatments with the Land Resource Manager database.
2019	Comparing methods to monitor large, structurally unique trees and snags as a component of the multispecies conservation strategy.
2017	Assessment of the multispecies conservation strategy for uncommon habitats (e.g., balds, caves, cliffs, talus fields).
2016	Implementation review of the roads component of the Riparian Forest Restoration strategy.
2015	Review of implementation of the NSO habitat maintenance treatments.
2013	Monitoring report of management activities in wetlands and wetland management zones, and all hardwood conversion and individual conifer release riparian restoration treatments.
2012	Monitoring report of riparian restoration treatments and management of potentially unstable hillslopes.

2.0 Conservation Strategies: Progress & Implementation

The HCP established numerous conservation strategies designed to minimize and mitigate adverse effects of land management activities on the habitats of federally listed species and unlisted species of concern, riparian habitats, and uncommon habitats. Habitat conservation strategies for the northern spotted owl (NSO), marbled murrelet, riparian areas, and other species of concern are detailed in the [*1997 State Trust Lands Habitat Conservation Plan*](#).

The HCP is a dynamic, scientifically based management-planning tool, which allows refinement of conservation strategies as new information becomes available, with the approval of the Federal Services. At the time the HCP was adopted in January 1997, there was insufficient information to complete either the marbled murrelet or long-term riparian strategies. Using the best information available at that time, a team of biologists, ecologists and foresters developed interim strategies. With interim habitat protections in place, DNR moved forward with research designed to provide information for long-term conservation strategy development.

Documenting HCP Implementation

Implementation of DNR's HCP often requires interpretation of conservation strategies, including how those strategies apply to HCP-covered management activities. There are times when strict compliance would result in the wrong outcome, endanger human life, or conflict with other HCP objectives. There are also times when an activity unintentionally or inadvertently deviates from an HCP conservation strategy. HCP conservation strategies are therefore occasionally updated in response to research findings, plan development, regulatory changes, and/or adjustments to DNR administrative procedures. In these circumstances, DNR staff seek guidance to devise appropriate plans of action for complying with HCP objectives and strategies, develop alternative plans of action to avoid conflict with HCP objectives, or rectify unintended consequences of an activity.

HCP consultation represents the cooperative problem solving necessary during HCP implementation. Documentation of these discussions and agreements includes the following:

- **Implementation consultations:** Agreements between DNR's HCP and Scientific Consultation section and regions or programs related to operational challenges where assistance and approval for a mitigation plan has been requested.
- **Joint concurrences:** Agreements between DNR and the Federal Services related to strategy modifications and updates.
- **Non-compliances:** Unapproved deviations from HCP conservation strategies and/or objectives.
- **Other:** Informational documented issues and activities associated with HCP strategies, objectives, or implementation.

Table 2.0 catalogues the FY2023 implementation discussions and agreements. Not all activities specified within the agreements have yet taken place. All updates to conservation strategies for the northern

2.0 Conservation Strategies

spotted owl, marbled murrelet, riparian areas, and multispecies conservation plans are detailed in the relevant sections of this chapter.

Table 2.0: Summary of FY 2023 HCP implementation discussions and agreements by region.

Region/ Division	Approval Date	Type	Associated Project	HCP Strategy	Activity Summary
All Regions	03/13/2023	Other	RMAP completion	Riparian	Completion of Road Maintenance and Abandonment Plan (RMAP) obligations.
Northwest	07/19/2022	Implementation Consultation	Triple Crown Timber Sale	Multispecies / Uncommon Habitats	Implementation of the draft cave procedure.
Northwest	04/10/2023	Implementation Consultation	Szechuan Beef Timber Sale	Multispecies / Uncommon Habitats	Implementation of the draft cave procedure.
Northwest	06/15/2023	Implementation Consultation	Ridge Ender Timber Sale	Multispecies / Uncommon Habitats	Implementation of the draft cave procedure.
South Puget	09/15/2022	Implementation Consultation	Road Maintenance on I-90.	Northern Spotted Owl Marbled Murrelet	The Washington State Department of Transportation (WDOT) proposes to perform rock scaling as part of road maintenance for I-90.

2.1 Northern Spotted Owl Conservation

When the HCP was developed, areas on DNR-managed lands deemed most important for NSO conservation were identified. These NSO-designated areas are managed for specific habitat classes and types as defined in the HCP (p. IV.11–12) and [WAC 222-16-085](#). Habitat classifications and types for each westside NSO management area can be found in [Appendix A.2 --NSO Types of Management Areas](#).

West of the Cascade mountains, the NSO management strategy is to develop and maintain specified threshold targets as designated in each westside planning unit. In the Columbia and North Puget HCP Planning Units, there is a single-tier threshold target of 50% overall habitat for nesting, roosting, and foraging and dispersal spotted owl management units (SOMUs). The Olympic Experimental State Forest (OESF) and South Puget HCP Planning Units each have two-tiered habitat threshold targets, each of which is described later in this section.

Five primary factors can affect habitat percentages reported from year to year:

- Land is acquired or disposed of through a land transaction.
- Stands are inventoried, after which stand boundaries are refined and/or the habitat type is updated due to growth or enhancement thinning.
- A variable retention harvest is conducted within habitat in a SOMU that is over the habitat threshold target.
- Refinements are made to cadaster data.
- Candidate stands in the OESF are thinned to meet habitat requirements.

In some years, none of these factors may occur, while in other years, one or more of these factors may increase or decrease habitat percentages in a SOMU.

SOMUs below habitat thresholds have areas of non-habitat designated as “next best” to ensure the SOMU is on a trajectory to meet the habitat target. The sum of habitat plus next best equals the SOMU habitat threshold target. For example, if a particular SOMU has a threshold target of 50% but the current habitat amount is 40%, then 10% of the SOMU will be designated as next best and will be managed on a trajectory to achieve desired habitat conditions. SOMUs above habitat thresholds do not have next best.

Since FY 2022, all NSO habitat percentage reporting uses data from RS-FRIS. For a comprehensive review on the transition to RS-FRIS and relevant NSO queries, refer to the [Appendix: RS-FRIS and NSO Habitat Delineation](#).

In the sections below, figures 2.2a-2.2d display NSO habitat percentages by HCP planning unit, as they existed on July 7, 2023, when the data was extracted from RS-FRIS.

NSO Habitat Status: Columbia and North Puget HCP Planning Units

In the Columbia and North Puget HCP Planning Units, the HCP habitat goal is to restore and maintain at least 50% of nesting, roosting, and foraging (NRF) SOMUs and at least 50% of dispersal (DISP) SOMUs as habitat for spotted owls. The FY 2023 percent habitat for SOMUs in the Columbia and North Puget HCP Planning Units are shown in Figures 2.1a and Figure 2.1b, respectively. Only SOMUs with more than 1 percent habitat are included in the figures.

Habitat Percentages - Columbia

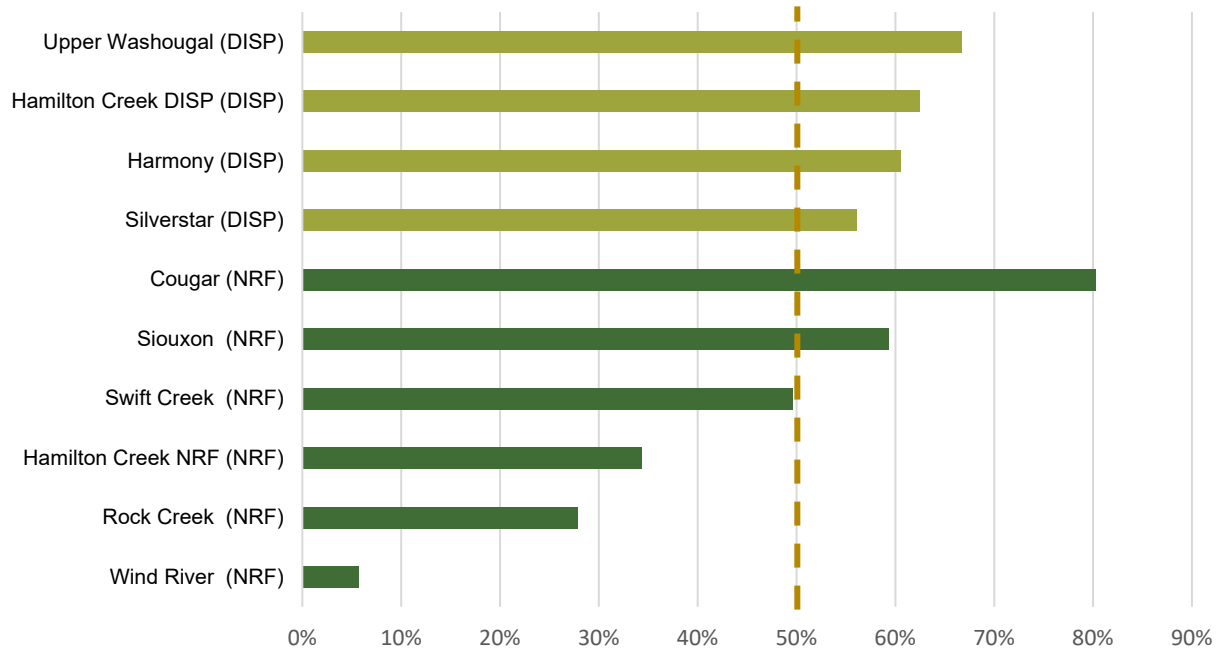


Figure 2.1a: Habitat Percentages by SOMU in the Columbia HCP Planning Unit as of 7/07/2023. The dashed line represents the habitat target. Habitat percentages are rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included.

NSO Habitat Percentages - North Puget

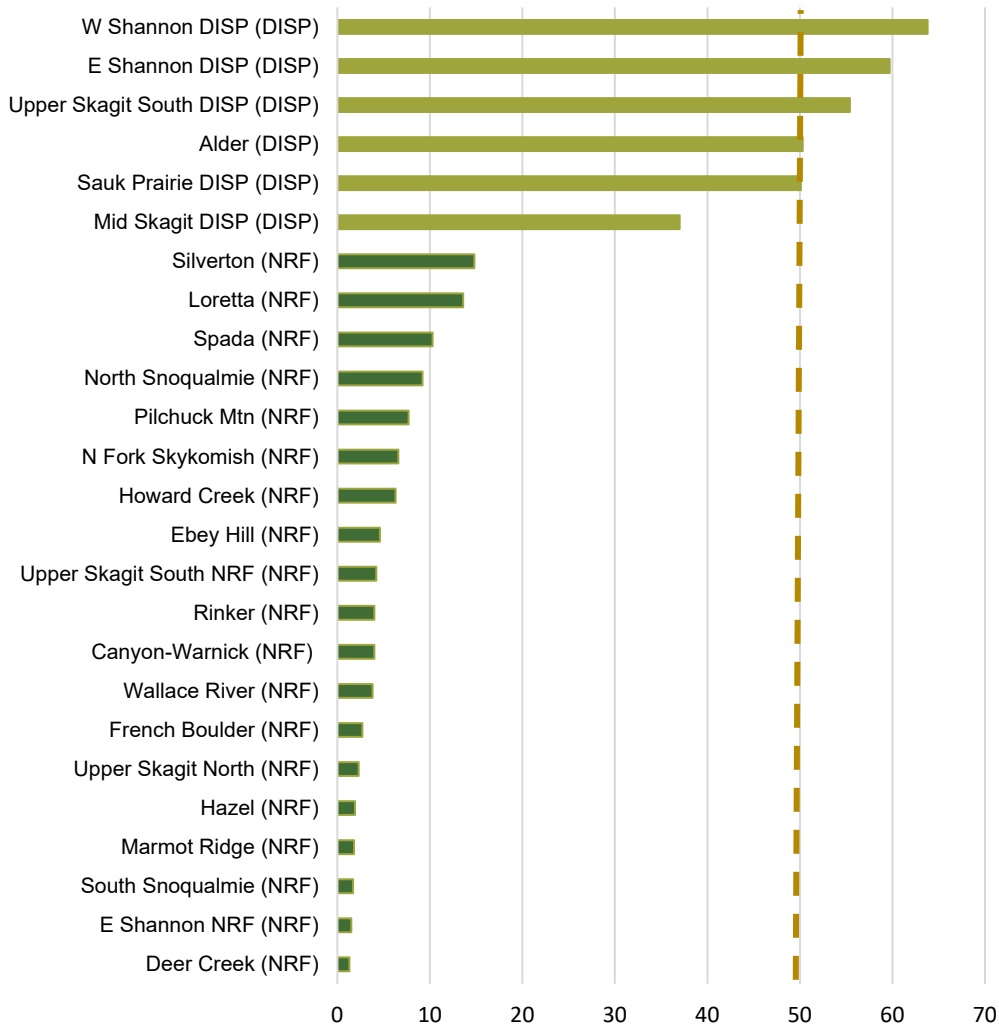


Figure 2.1b: Habitat Percentages by SOMU in the North Puget HCP Planning Unit as of 7/07/2023. The dashed line represents the habitat target. Habitat percentages have been rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included.

NSO Habitat Status: Olympic Experimental State Forest HCP Planning Unit

In the OESF HCP Planning Unit, habitat is tracked based on 11 landscape planning units (also generically referred to as SOMUs). Instead of designating specific areas on the land base as NRF or DISP areas, DNR manages the OESF for a “shifting mosaic” of habitat and applies management pathways to each landscape. A pathway is a course of action to attain threshold proportions of habitat, increase habitat patch, and/or create or accelerate habitat. Forest stands selected for active or passive management under the pathways are referred to as “candidate stands”. OESF candidate stands are described fully in the [OESF HCP Planning Unit Forest Land Plan \(Table 3-3 \(p 3-9\) and Table 3-4 \(pp 3-10 through 3-11\)\)](#).

In each of these 11 landscapes, DNR restores and maintains the following threshold proportions of northern spotted owl habitat: at least 40 % as Young Forest Habitat and better. Of that 40%, at least half (i.e., 20%) must be Old Forest Habitat. Habitat can be located anywhere within the landscape, and its location can shift over time: as one area matures into habitat, other existing areas of habitat can be harvested so long as threshold proportions of habitat are maintained.

Figure 2.1c shows current total percent NSO habitat in OESF Planning Unit SOMUs.

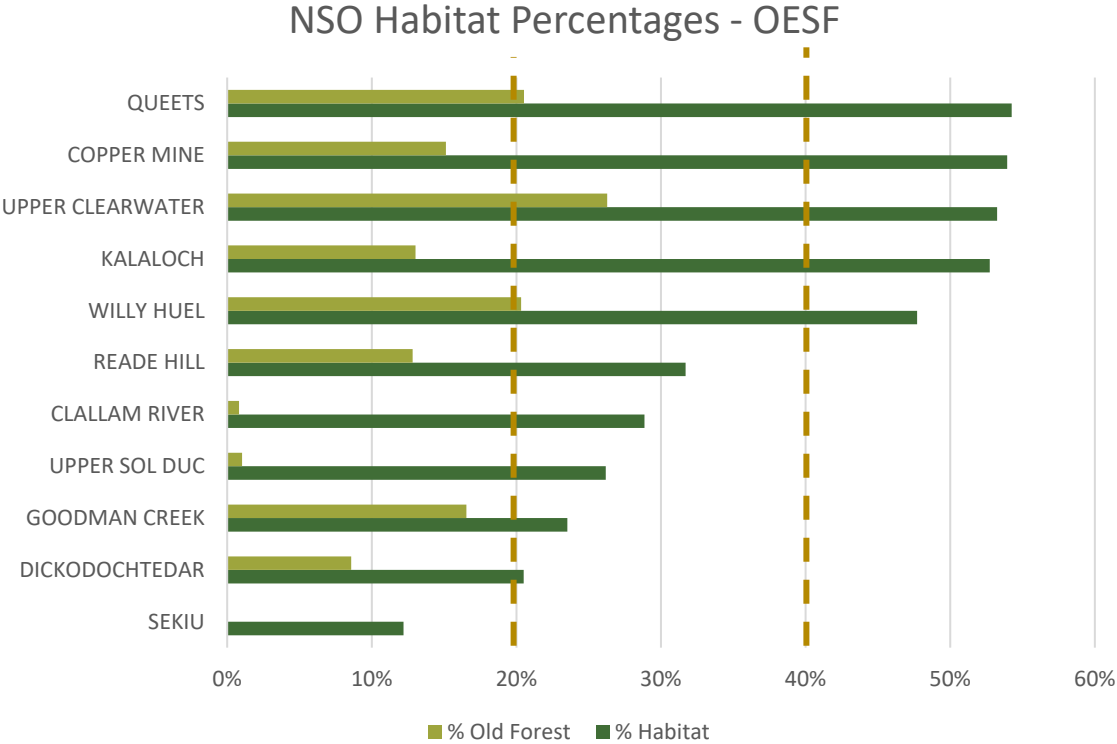


Figure 2.1c: Habitat Percentages by SOMU in the Olympic Experimental State Forest as of 7/07/2023. Dashed lines represent habitat targets. Habitat has been rounded to the nearest percent.

NSO Habitat Status: South Puget HCP Planning Unit

The South Puget HCP Planning Unit is addressed separately because the requirements for dispersal differ from elsewhere on the westside. The South Puget HCP Planning Unit has an overall habitat threshold target of 50% for each SOMU. Dispersal management areas have an additional target that at least 35% of each SOMU will be movement, roosting, and foraging (MoRF) habitat or better (MoRF Plus). The remaining habitat must be Movement habitat or better (Movement Plus). MoRF and Movement are two habitat types specific to dispersal management areas in South Puget HCP Planning Unit SOMUs. These DISP SOMUs were identified in the 2010 South Puget HCP Planning Unit Forest Land Plan Final EIS.

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In the South Puget HCP Planning unit, there are only two NRF management areas (Pleasant Valley NRF and Green NRF). As of FY 2023, both areas are under 1 percent habitat, therefore Figure 2.1d shows only dispersal management habitat for the planning unit.

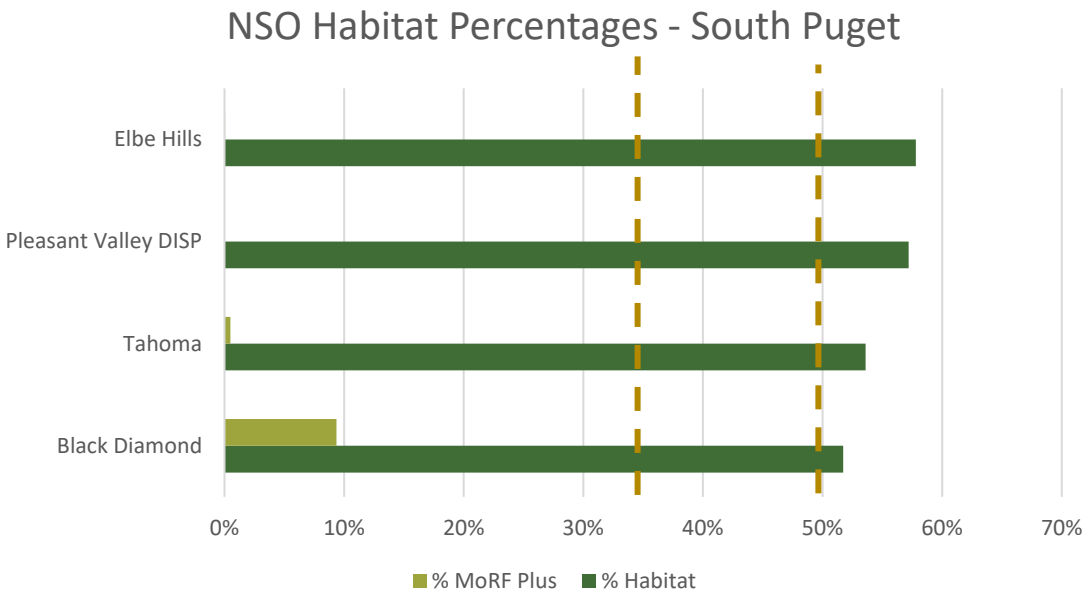


Figure 2.1d: Habitat Percentages by SOMU in the South Puget HCP Planning Unit as of 7/07/2023. Dashed lines represent habitat targets. Habitat has been rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included. Note: in South Puget, there are only two NRF management areas and both are under 1%, therefore only DISP management habitat SOMUs in this planning unit are shown.

NSO Habitat Status: Other HCP Planning Units (Straits, South Coast, eastside)

In the Straits Planning unit, on the northeastern portion of the Olympic Peninsula, DNR chose not to provide specific spotted owl habitat conservation measures. The reasons for this decision are twofold. First, the results of demographic modeling performed and analyzed by the federal Reanalysis Team (Holthausen et al. 1994)¹ suggest that remaining habitat on nonfederal lands on the northeastern portion of the Olympic Peninsula is not crucial to maintaining the spotted owl population on the Olympic Peninsula as a whole. Second, DNR the riparian and marbled murrelet conservation strategies in the Straits HCP Planning Unit are likely to simultaneously provide older forest habitat suitable for northern spotted owls. The indirect contributions from the other conservation strategies provide NSO benefits appropriate for the region.

In the South Coast HCP Planning unit, encompassing most of southwest Washington, DNR also chose not to provide specific conservation measures for NSO demographic support. The federal Reanalysis Team

¹ Holthausen, R. S., M. G. Raphael, K. S. McKelvey, et al. (1994). *The contribution of federal and nonfederal habitat to persistence of the northern spotted owl on the Olympic Peninsula, Washington*. Report of the Reanalysis Team. U.S. Department of Agriculture, Forest Service, Olympia.

report was again important in this decision, finding that DNR-managed land would not play an important role in the long-term persistence of spotted owls in this area.

In the three eastside HCP planning units — Yakima, Chelan, and Klickitat — the conservation strategy for northern spotted owls is based upon the same principles as for the five westside planning units, with NRF and DISP management areas. Some distinctions in the strategies arise due to differences in forest ecology and spotted owl habitat ecology on the east versus west sides of the Cascades. In 2004, DNR adopted [*Amendment No. 1 \(Administrative Amendment to the Northern Spotted Owl Conservation Strategy for the Klickitat HCP Planning Unit\)*](#) for owl management in the Klickitat HCP planning unit due to forest health concerns. Under this amendment, DNR continues to manage for NRF and DISP in Klickitat, and also incorporates targeted strategies addressing forest health.

NSO Effectiveness Monitoring

Appendix: Effectiveness Monitoring for HCP Conservation Strategies

The HCP requires DNR to conduct effectiveness monitoring to determine whether implementation of the conservation strategies results in anticipated habitat conditions. Effectiveness monitoring documents change over time in habitat conditions (e.g., general forest structure, specialized habitat features, and NSO prey populations) following timber harvest and other forest management activities. This monitoring increases DNR’s understanding of how land management activities influence habitat conditions and alerts DNR of any need to modify practices to achieve HCP conservation objectives.

Two primary components of the NSO effectiveness monitoring program include:

Landscape-scale monitoring of habitat indicators across the westside HCP land base.

This objective is to determine whether broad-scale trends in basic habitat features (e.g., tree height, mean tree size, canopy layering) are on track to meet HCP goals. This project examines trends relative to HCP expectations, comparing those trends before and after the 1997 HCP implementation. The lands examined include riparian and upland areas managed under the HCP for NSOs and other species.

As of FY 2023, results indicate that lands managed with both economic (i.e. timber harvesting) and conservation objectives in mind exhibit an increase in quantity of large/complex forest structure and connectivity since HCP implementation. Data shows a distinct change in beneficial forest composition trends (e.g., large live tree density, diversity of live tree diameters) from pre-HCP years. A research paper has been submitted for publication and will be available next year.

Tracking effects of VDT on habitat structure in stands designated as NSO habitat.

Long-term tracking of variable density thinning (VDT) effects was initiated in 2004-07 across five VDT units in three HCP planning units. Staff conducted remeasurement of all five sites between 2013 and 2015. **In FY 2023**, continued conducting a 15–17-year remeasurement cycle on all 5 sites. Data analysis is currently underway to compare various metrics (e.g., tree density, canopy closure and cover, snags, and down wood). For more details on this study, refer to the [*Appendix: NSO Effectiveness Monitoring*](#).

2.2 Marbled Murrelet Conservation

When the HCP was signed in 1997, DNR had insufficient information to create a long-term conservation strategy for the marbled murrelet. Murrelet ecology and habitat use were not well understood at the time, particularly in relation to nesting habitat. Therefore, the HCP specified that an interim strategy be implemented while DNR conducted inventories, surveys, and additional research to support development of a long-term strategy.

Development of the MM Long Term Conservation Strategy (LTCS)

In September 2019, DNR and the USFWS released a [final environmental impact statement](#) (FEIS) on a long-term strategy for marbled murrelet conservation for the six western Washington HCP planning units. Concurrent with the release of the FEIS, DNR published a proposed amendment to the HCP that would replace the interim marbled murrelet conservation strategy with a long-term strategy. The USFWS concurred with the proposed amendment and issued an updated Incidental Take Permit. The Board of Natural Resources approved the amendment in December 2019.

Additional information is on DNR's [Long-Term Conservation Strategy](#) webpages. In the same timeframe, the USFWS published several documents related to the marbled murrelet long-term conservation strategy:

- [Biological Opinion](#)
- [Record of Decision](#)
- [Findings and Recommendations](#)
- [Incidental Take Permit](#)

More detailed history on the development of this conservation strategy can be found on DNR's marbled murrelet webpage at dnr.wa.gov/mmltcs.

Requirements of the MM LTCS

Under this Amendment, DNR will provide forest conditions in marbled murrelet conservation areas that minimize and mitigate incidental take of marbled murrelets resulting from DNR land management activities. All management implemented in marbled murrelet conservation areas must be consistent with the marbled murrelet conservation measures in this Amendment, including:

1. Only 114 adjusted acres² of incidental take of murrelet habitat (p-stage) are expected in special habitat areas, occupied sites, and occupied site buffers through the end of the HCP (2067).
2. Acres of incidental take in these areas must be tracked until the end of the HCP (2067).

² **Adjusted acres:** Acres of marbled murrelet habitat "adjusted" to incorporate habitat quantity and quality into one unit of measurement: raw acres are multiplied by the applicable P-stage value, thereby converting to fewer "adjusted acres." See the Glossary for more detail.

3. During the first decade of implementation (until December 3, 2029), DNR will maintain at least 5,000 adjusted acres of murrelet habitat that have been identified for metering³ on state uplands within the range of the marbled murrelet.
4. Management activities not specifically listed in this Amendment that are implemented within marbled murrelet conservation areas are subject to all applicable terms and conditions of the HCP, the HCP Amendment, and the implementation agreement.

The MM Amendment specifies that:

- Marbled murrelet “habitat” does not solely include actual nest sites or nest trees and their surrounding forests.
- Implementation monitoring of the MM Amendment will periodically describe changes in landscape-level habitat conditions.
- Natural disturbance will be tracked through the reporting of salvage activities.
- During the first decade of implementation, DNR will report on “metered” acres.
- Marbled murrelet reporting will include a summary of the quantity and quality of habitat (P-stage) in occupied sites, occupied site buffers, special habitat areas, and areas of long-term forest cover not included in the previous categories, by HCP planning unit in “gross” and “adjusted” acres.

Information on critical concepts (P-stage, adjusted acres, metered acres, long term forest cover, occupied sites and buffers, and special habitat areas) is provided in [Appendix A.2.2 Marbled Murrelet Conservation](#).

Implementation of the MM Amendment

The MM Amendment Table A-4 (page A-5) describes which activities are allowed and not allowed in the various habitat categories of the Amendment. Allowed activities typically must be performed during limited operating periods if undertaken during the murrelet nesting season, impacts to platform trees must be avoided when possible, and road reconstruction and maintenance must meet Washington State Forest Practices road standards.

Management activities are limited in those areas being managed for conservation in order to minimize disturbance. Some management activities result in limited harvest of murrelet habitat (P-stage) and, as described above, DNR has a budgeted number of acres allocated to these activities in the MM Amendment over the next 50 years.

Marbled Murrelet Reported Data

In compliance with the MM Amendment, DNR has set aside 5000 P-stage adjusted acres for metering. As of 2019 when the MM Amendment was being developed, there were approximately 207,066 raw

³ **Metering:** *Delaying harvest of some murrelet habitat until December 3, 2029. Metering maintains habitat capacity while additional habitat develops under the Marbled Murrelet Long-term Conservation Strategy. See the Glossary for greater detail.*

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acres of marbled murrelet habitat on DNR-managed lands. The Amendment anticipates a gain in acreage due to habitat development over a 48-year period following Amendment implementation. The Amendment also anticipates the loss of some existing habitat due to natural events, yarding, and road construction over the same time period. In addition, cadaster refinements will produce minor acreage adjustments up and down. Overall, the long-term strategy is anticipated to result in a net gain of habitat, resulting in over 272,000 total raw acres of murrelet habitat on DNR-managed lands by 2067 (MM Amendment, page 21, and Table A-5, p A-15).

As of FY 2023, DNR continues to work with the Services to establish reporting protocols for occupied sites, occupied site buffers, special habitat areas, and long-term forest cover.

2.3 Riparian Conservation



Photos: Warren Devine (left), Kayla Swerin (middle, right)

The overall HCP Riparian conservation strategy incorporates multiple strategies, regulations and policies, including:

- the Riparian Conservation Strategy, which applies to the five westside HCP planning units other than the OESF,
- the OESF Riparian Conservation strategy,
- Headwaters Conservation Strategy, and
- the Eastside Forest Practice regulations and policies.

Details on the westside riparian conservation strategy (including the implementation procedures), the OESF riparian conservation strategy, the headwaters conservation strategy, and the monitoring efforts for each of these are described in [Appendix A.2.3: Riparian Conservation Strategy](#).

In FY 2023, there were no changes or updates to the overall riparian conservation strategy. However, the Headwaters Conservation Strategy is being developed and will incorporate emerging knowledge about the relationship between non-fish-bearing streams and downstream fish habitat quality while meeting the original headwaters conservation objectives.

Riparian Conservation Data

DNR tracks timber sales that include riparian and wetland acreage. Prior to FY2019, acreage was reported using data collated from several DNR management tracking systems. Beginning in FY 2019, acreage is reported using data from the Land Resource Manager (LRM). Acreage data reported in this section reflects riparian landclass designations (i.e., “RIPARIAN” or “WETLAND” designations).

In previous years, this data was reported by the fiscal year in which harvests were completed. However, most harvest contracts remain open for two years; as such, the treatment prescribed can take place anytime during the open contract period, leading to changes in reported data for a given fiscal year from one annual report to the next.

Beginning with this FY 2023 annual report, this information is now reported by the fiscal year in which the associated timber sale was sold. This is consistent with DNR’s timber sales program which reports

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volume of timber sold at auction (rather than planned volume prior to auction or volume removed at contract completion). Therefore, to maintain accuracy and consistency, data in this section now uses data from the LRM and reflects the riparian acreage sold in a given fiscal year rather than the year the treatment took place.

Figure 2.3 displays acres of westside riparian or wetland harvest, listed by the fiscal year during which the timber sale was sold. On the eastside, there were no riparian or wetland riparian harvests on HCP-managed lands.

Table 2.3: Riparian and wetland acres conserved, by fiscal year in which the timber sale was sold.

FY TS Sold	Columbia	N. Puget	S. Coast	S. Puget	Straits	OESF	Total
2019	25.76	150.58	18.48	4.62	26.89	7.35	233.68
2020	67.82	308.38	3.39	27.13	19.58	17.32	443.62
2021	34.28	58.25	7.1	17.87	22.13	7.23	146.86
2022	57.05	115.09	12	6.63	53.79	15.04	259.6
2023	5.22	125.36	6.75	-	7.67	16.87	161.87
Total	190.13	757.66	47.72	56.25	130.06	63.81	1245.63

Riparian Implementation Monitoring

DNR employs a variety of forest management strategies to achieve habitat conservation commitments. The HCP directs DNR to modify these strategies when new information indicates a change in strategy is warranted. Implementation monitoring (also known as compliance monitoring) is a means of confirming current strategies are appropriately implemented, identifying gaps, and identifying changing conditions. Implementation monitoring findings inform DNR staff of any need to modify practices to achieve conservation goals. In accordance with section-V of the HCP, DNR committed to an implementation monitoring program in which staff periodically conduct field surveys and assess database integrity.

In FY 2023, DNR completed a multiyear assessment of the implementation of the Riparian Forest Restoration Strategy (RFRS) and tracking of riparian restoration treatments in the Land Resource Manager (LRM) database. DNR monitoring staff visited 37 riparian restoration treatments to determine whether these treatments were implemented according to guidance in the RFRS. Additionally, the spatial delineation of 121 riparian restoration treatments were assessed for accuracy using aerial imagery and timber sale documentation. The full report can be found at [DNR Monitoring and Reporting](#).

Riparian Effectiveness Monitoring

This section provides updates on two effectiveness monitoring programs: Effectiveness Monitoring for Riparian Silviculture and the Status and Trends of Riparian and Aquatic Habitat in the OESF.

2.0 Conservation Strategies

Effectiveness Monitoring Program for Riparian Silviculture

The objective of the DNR Effectiveness Monitoring Program for riparian silviculture is to determine whether various restoration thinning treatments are producing riparian habitat conditions that support salmon recovery efforts and contribute to the conservation of other riparian and aquatic species. Thinning treatments are consistent with the RFRS and are applied in cooperation with the DNR timber sales program. More details can be found in the [Appendix: Effectiveness Monitoring for Riparian Silviculture](#).

During FY 2023, an 18-year post-treatment remeasurement in the OESF of the “Salmon PC” monitoring site was completed. This included measurements of overstory trees, tree regeneration, and down wood. Researchers visited three other monitoring sites, H-1320 (in the OESF) plus Cougarilla and Big Beaver (both in South Puget), to assess current stand conditions, collect GPS data, and take photographs. Researchers anticipate that in FY 2024, they will conduct a 15-year post-treatment remeasurement at the “Pink Flamingo” monitoring site (North Puget), complete the analysis, and publish a report of this project.

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

The key objectives of the Status and Trends project are to provide data used to evaluate progress in meeting the HCP riparian conservation objectives and to reduce uncertainties around the integration of habitat conservation with timber production. The hypothesis is that the HCP riparian conservation strategy for the OESF allows ecological succession and disturbance to improve habitat conditions across managed watersheds over time. More details can be found in the [Appendix: Status and Trends Monitoring](#).

In FY 2023, DNR and collaborators from the USDA Forest Service (USFS) Pacific Northwest Research Station continued field sampling and data management for nine habitat indicators, including riparian vegetation, stream temperature, stream shade, stream channel morphology, and in-stream wood. Stream surveys were completed at 17 streams in FY 2023, and stream temperature was monitored continuously at 61 streams. Automated stream flow monitoring stations recording continuous flow measurements at 10 streams were maintained and calibrated.

The Status and Trends project is meeting the OESF goal of developing, using, and distributing information on aquatic and riparian ecosystem processes and their maintenance in commercial forests. The project has thus far produced multiple peer-reviewed scientific publications, a



Rough skinned newt (*Taricha granulosa*). Photo: Kayla Swerin.

series of reports, field tours, and public presentations. Project findings have informed new experimental research and have provided data on ecological conditions and relationships that inform HCP priorities.

Riparian Validation Monitoring

The Riparian Validation Monitoring Program (RVMP) tests the hypothesis that forest management practices implemented under the HCP will restore and maintain habitat capable of supporting viable salmonid populations within the OESF. The RVMP seeks to evaluate cause-and-effect relationships between DNR management activities, riparian habitat, and salmonids. If negative trends are detected in salmonid conditions (abundance, biomass, species composition, age structure, and/or number of spawning redds), DNR can use this information to evaluate the underlying mechanisms and then adapt management practices. More details can be found in the [Appendix: Riparian Validation Monitoring](#).

In FY 2023, RVMP lead fish biologist, Kyle Martens, represented DNR on technical review groups with the [Quinault Indian Nation Lead Entity](#), and the [North Pacific Coast Lead Entity](#). These groups coordinate salmon habitat restoration on the Washington coast, providing scientific expertise to inform and prioritize potential restoration projects.

Seasonal staff of the RVMP completed fieldwork focusing on four primary efforts:

- Multiple-pass removal of resident and juvenile salmonid abundance sampling in the annual and odd-year panel of watersheds,
- Adult coho redd surveys in the annual panel as a measure of adult abundance,
- Snorkeling and habitat surveys over a 12-kilometer stretch of the Clearwater River, and
- Salmonid and habitat sampling for the riparian component of the T3 Watershed Experiment.

Results from this monitoring have shown that salmonid populations have been relatively high within the annual panel of watersheds over the last three years, primarily driven by age-0 trout and juvenile coho salmon. However, there was an overall decrease in biomass compared to 2021, mainly due to a decrease in age-1 or older cutthroat trout and steelhead. This trend may indicate increased recruitment into OESF streams, but the decrease in older fish warrants continued monitoring. An increase in age-0 fish (trout and coho) without a corresponding increase in older fish could be an indicative of limited rearing habitat. Further data collection and exploration is required to determine if this is a habitat effect or a response to the previous year's recruitment of age-0 fish.

Also in FY 2023, the RVMP program concluded a culvert removal study in Bear Creek. The culvert would have been classified as a 33 percent passable culvert using the WDFW fish passage criteria. No significant differences were observed in fish composition, density, or biomass before or after the culvert removal or between the upstream and downstream sites. This study underscores uncertainties of fish response to partial-barrier culvert removals in cases where there is some level of fish passage and similar fish species present above and below the culvert.

More information on the RVMP can be found in the [2022 RVMP Annual Report](#).

2.4 Multispecies Conservation



The Quinault fawn lily (*Erythronium quinaultense*) is a threatened species found only in five locales on the Olympic Peninsula. Photo: USFS.

In addition to protections for ESA-listed species, conservation objectives developed for the HCP also provide appropriate habitat protection for many native species not currently listed or protected under the ESA. The multispecies conservation strategy involves identification and protection of uncommon habitat types for unlisted species, specifically caves, cliffs, talus slopes, wetlands, balds, mineral springs, snags, oak woodlands, and large, structurally unique trees. These habitats provide nesting, roosting, hiding, and foraging opportunities for many species. Implementation is conducted through the Implementation Monitoring Program. No tracking is required for this conservation strategy.

In FY 2023, there were no changes or updates to this strategy.

3.0 Adaptive Management

Appendix A.3: Adaptive Management

Since the HCP was adopted in 1997, there have been advances in understanding the ecology of northern spotted owl, marbled murrelet, other species protected by the HCP, and how land management affects them. New scientific information helps identify changes in practices that could improve habitat conditions. For this reason, the HCP includes provisions for a dynamic, science-based adaptive management process that allows for continual improvement of management strategies and practices.

Examples of adaptive management are amendments to the HCP for a revised strategy for North Spotted Owl habitat in the southeast portion of the owl's range and in the South Puget HCP Planning Unit, a Riparian Forest Restoration Strategy that covers most of Western Washington, and an amendment for marbled murrelet long term conservation strategy. Such changes to the HCP must be approved by the Federal Services.

Adaptive management is implemented through two processes:

- the State Lands Adaptive Management Program (including lands not covered by the HCP), and
- the OESF adaptive management process (activities in the OESF).

These processes are closely linked, though they differ in scope and level of formalization. The DNR State Lands Adaptive Management Program continues to develop links between scientific research and management. Ongoing projects and results are frequently published in technical reports and peer-reviewed journals (refer to the *Publications and Presentations* section of this report).

The OESF adaptive management process is guided by an administrative procedure adopted in FY 2017 after development and publication of the [OESF Forest Land Plan](#).

In FY 2023, OESF research focused upon implementation of the T3 Watershed Experiment (see *Research* section of this report). Olympic region staff worked with external researchers to finalize layout of the 13 timber sales implementing the study, plan the related silviculture activities, and perform pre-treatment monitoring. In addition, DNR stakeholders engaged in the T3 experiment through learning groups are developing sub-studies helping increase collective adaptive capacity.

Adaptive management is dependent upon information gleaned from monitoring and research efforts. To inform adaptive management decision, three types of monitoring are employed:

- **Implementation monitoring** (aka compliance monitoring) determines whether the HCP is being implemented properly on the ground.
- **Effectiveness monitoring** determines whether the HCP strategies are producing the desired habitat conditions.
- **Validation monitoring** verifies whether a certain species responds to the desired habitat conditions as anticipated.

3.1 Research on HCP-Covered Lands

DNR continually conducts research on its forestlands to examine how forest management practices affect habitat conditions and forest productivity. This section describes DNR research projects on HCP-covered lands that address the three research priorities defined in the HCP (p. V.6):

- **Priority 1 Research** is “research that is a necessary part of a conservation strategy.”
- **Priority 2 Research** is “research needed to assess or improve conservation strategies or to increase management options and commodity production opportunities.”
- **Priority 3 Research** is “research needed to improve general understanding of the animals, habitats, and ecosystems addressed by the HCP.”

Table 3.1 summarizes current DNR research projects and associated priorities on HCP-covered lands. Some projects address multiple research priorities and monitoring commitments.

Table 3.1: DNR’s Current Research and Monitoring Projects on HCP-Covered Lands.

Project Name	Priority			Monitoring
	1	2	3	
A Rare Opportunity: Gaining Insights into Current and Future Forest Resilience to Wildfire in the Western Cascade Mountains			x	
Eastside NSO Habitat and Fire Risk Evaluation	x	x		
Experiment in Long-Term Ecosystem Productivity		x	x	
Influence of Repeated Alternative Biodiversity Thinning on Young Stand Development Pathways		x		
Landscape-Scale Effectiveness Monitoring of Western Washington HCP Lands		x		x
T3 Watershed Experiment on the OESF	x	x	x	x
Mind the Gap: Developing Ecologically Based Guidelines for Creating Gaps in Forest Thinnings on the Olympic Peninsula		x		
NSO Effectiveness Monitoring	x	x		x
Riparian Silviculture Effectiveness Monitoring	x	x		x
Riparian Validation Monitoring	x	x	x	x
Status and Trends Monitoring of Riparian and Aquatic Habitat on the OESF	x	x	x	x
Tracking Natural Tree Regeneration in Eastern Washington Forests Following Large Wildfires			x	
Using Passive Acoustic Monitoring to Evaluate Sustainability of Forest Management			x	x
Westside Individuals, Clumps, and Openings		x	x	

Research Project Descriptions

A Rare Opportunity: Gaining Insights into Current and Future Forest Resilience to Wildfire in the Western Cascade Mountains

The Norse Peak Fire burned more than 50,000 acres near Mount Rainier National Park in 2017. It was one of the largest fires affecting the West Cascades since the early 1900s. Several additional fires have

also burned in the West Cascades in the past several years. These events provide a unique opportunity to enhance knowledge of fire ecology in forest types commonly found on DNR-managed land on the west side and track how increasing disturbance and a warming climate affect these systems. The objectives of the study are to:

- Examine landscape patterns of burn severity in the westside fires and compare them to regional historical fire regimes.
- Test how post-fire vegetation responds to the interaction of burn severity and past disturbance history (including forest management) under a warming climate.

As of FY 2023, researchers have established and collected data in dozens of 2.5-acre permanent plots. Data collected includes tree overstory conditions, post-fire seedling regeneration, and understory response. Data are currently being analyzed and prepared for publication to address questions pertaining to forest resilience and recovery across different fire severities, pre-fire stand structures, and forest zones. Researchers will also examine aboveground carbon changes due to fire, develop a natural range of variability in complex early seral conditions, and identify locations where huckleberry (an important species for tribes) is more or less likely to persist and positively respond to wildfire. This research is being conducted in collaboration with the University of Washington and the Mount Baker-Snoqualmie National Forest. For more information, contact Joshua Halofsky at Joshua.Halofsky@dnr.wa.gov.

Eastside NSO Habitat and Fire Risk Evaluation

This project assesses historic, current, and future NSO habitat across all available lands in the eastern Washington Cascades. Results from this project will help DNR determine the degree to which the current approach for managing eastside NSO habitat under the HCP is likely to be sustainable for the life of the HCP. This research will also help inform other DNR priorities, such as sustainable harvest calculations and forestland planning efforts.

DNR hopes to answer two fundamental questions with this project:

1. How much late-successional, complex-structure habitat can likely be sustained in these fire-prone landscapes?
2. Where is such habitat most likely to develop and persist the longest?

To examine Question 1, researchers have analyzed nearly 300,000 acres of DNR's original mapped inventory (circa 1960) to estimate potential NSO habitat abundance in the near past. As a second line of evidence, DNR has also conducted extensive modeling to estimate likely ranges in historical NSO abundance prior to Euro-American settlement.

To answer Question 2, researchers examined more than 200 known NSO nest site locations using LiDAR to examine how the amount and configuration of habitat used by nesting owls differ from locations where owls are not known to nest. This analysis was used to derive an NSO structural suitability map.

As of FY 2023, researchers have developed maps of current forest zones and projected zonal shifts due to a changing climate. Once combined, the two maps will identify locations where the structures and

types of forest used by NSO are likely to persist through mid-century, areas that are currently habitat but less likely to persist, and areas that are not currently habitat but are more likely to become future habitat. This project is a collaboration between DNR, the University of Washington (UW), and USFS. Two manuscripts from this project were submitted to peer-reviewed journals at the end of calendar year 2023. For more information, contact Joshua Halofsky [mailto: at Joshua.Halofsky@dnr.wa.gov](mailto:Joshua.Halofsky@dnr.wa.gov).

Experiment in Long-Term Ecosystem Productivity

Models suggest that intensively harvested conifer plantations experience long-term degradation of productivity due to a slow drain of nutrients, especially nitrogen. This project, a collaborative effort between the University of Washington, the Pacific Northwest Research Station, Oregon State University, Western Washington University, and DNR, tests the influence of stand composition and the level of wood removal on tree and soil productivity, soil structure, and plant species diversity.

This cooperative, multiple-decade study has been replicated at four sites in the Pacific Northwest: three national forests in Oregon (Willamette, Siskiyou, and Siuslaw) and the OESF. The OESF permanent plot installation in Sappho was established in 1995 and was re-measured in 2000 and 2016. For more information, visit the [OESF webpage](#) or contact Teodora Minkova at Teodora.Minkova@dnr.wa.gov.

Influence of Repeated Alternative Biodiversity Thinning on Young Stand Development Pathways: This project was initiated in the late 1990s and stemmed from DNR's interest in testing pre-commercial thinning (PCT) as a way to set young stands on development pathways to increase forest structural complexity and habitat diversity. In 1998, five treatments were replicated at five sites on the OESF. Treatments included one control plus two different PCT densities, with or without gaps. In 2017, the sites were thinned again, with additional gaps installed to explore the influence of gap timing on structural complexity. Information gained from this project will inform DNR decisions about the value of different treatment options in meeting multiple management objectives under the biodiversity pathways approach. For more information, visit the [OESF webpage](#) or contact Warren Devine at Warren.Devine@dnr.wa.gov.

Landscape-Scale Effectiveness Monitoring of Western Washington HCP Lands

The goal of this project is to determine how landscape-scale habitat conditions have changed since the implementation of the HCP. For more information, contact Dan Donato at Daniel.Donato@dnr.wa.gov.

T3 Watershed Experiment (Large-Scale Integrated Management Experiment on the OESF)

This project aims to inform state and other land managers how alternative forest management practices compare to the current ones in providing environmental, economic, and social benefits. The project is a collaboration between DNR, the UW Olympic Natural Resources Center, and researchers from multiple organizations.

In FY 2023, DNR foresters laid out and auctioned all 13 timber sales implementing the study – about 2,100 acres of upland and riparian areas in 16 experimental watersheds in the Coast District of the Olympic region. Road work and logging have started in several timber sales. DNR foresters and T3 researchers coordinated timber sale compliance and silviculture planning. Pre-treatment monitoring continued for the fourth year in the riparian and upland portions. All environmental monitoring data to

date have been organized in databases and procedures developed for quality control, and data archiving and sharing. Ecological models were developed to predict the response of the aquatic food web and the upland forest stands to the T3 experimental treatments. Project staff continued to implement the vision for learning-based collaboration through learning groups, which include DNR stakeholders, tribes, researchers, natural resource practitioners, and other community members. Each group focuses on a separate topic, such as carbon, invasive species, or cedar and has specific goals set by the members, such as augmenting the T3 study monitoring or conducting additional research. Legislative funding for partial implementation of the project was secured for FY 2024 and FY 2025. Implementation report for the first 6 years of the study was developed and published on DNR website. For more information, contact Teodora Minkova at Teodora.Minkova@dnr.wa.gov.

Mind the Gap: Developing Ecologically Based Guidelines for Creating Gaps in Forest Thinnings on the Olympic Peninsula

The goal of this DNR-funded project is to better match silvicultural gap treatments with the late-successional forests they aim to emulate. This study has three phases:

- Phase I: Retrospective study of 10-year-old silvicultural gaps.
- Phase II: Observational study of natural gap structures in primary (never-managed) old-growth forests to establish reference information.
- Phase III: Replicated silvicultural experiment to test novel gap treatments (informed by the structures found in primary forests) within a variable density thinning treatment.

DNR is tracking tree recruitment, understory vegetation response, branching/crown responses, decadence (dead wood) creation around gap edges, and post-treatment dynamics of gap contraction and expansion (i.e., blowdown). Results from this study help inform management of structural diversity and habitat. The project was initiated and peer-reviewed in 2014, with data collection for Phase I completed that summer. Data analysis for Phase II was completed enough to inform treatments for Phase III, which was installed and measured pre- and post-treatment.

As of FY 2023, this study is in a waiting period until the next set of measurements are taken, which are planned for 5–10-year intervals (likely mid 2020s depending on funding and staff resources). A summary of this project is available on the [OESF webpage](#). For more information, contact Dan Donato at Daniel.Donato@dnr.wa.gov.

NSO Effectiveness Monitoring

The NSO Effectiveness Monitoring Program evaluates whether the HCP strategies and associated silvicultural treatments maintain or enhance nesting, roosting, and foraging, and dispersal habitat. More detailed project information can be found in the Effectiveness Monitoring section of this report. For more information, contact Dan Donato at Daniel.Donato@dnr.wa.gov.

Riparian Silviculture Effectiveness Monitoring

Since 2006, DNR has documented site responses to silvicultural treatments designed to meet the management objectives specified in the RFRS. More detailed project information can be found in the

3.0 Adaptive Management

Riparian Effectiveness Monitoring section of this report. For more information, contact Dan Donato at Daniel.Donato@dnr.wa.gov.

Riparian Validation Monitoring

The RVMP determines whether DNR's current forest management practices restore and maintain habitat capable of supporting viable salmonid populations. For more information, contact Kyle Martens at Kyle.Martens@dnr.wa.gov.

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

This project evaluates changes to riparian and aquatic habitat conditions in managed watersheds of small fish-bearing streams across the OESF. More detailed project information can be found in the Riparian Effectiveness Monitoring section of this report. For further information, contact Teodora Minkova at Teodora.Minkova@dnr.wa.gov.

Tracking Natural Tree Regeneration in Eastern Washington Forests Following Large Wildfires

Between 2012 and 2015, more than 2.1 million acres burned in Washington, primarily east of the Cascade crest. Many projections suggest fire activity will increase and catalyze ecosystem change under a warming climate. Limited reforestation funds and expanding burn acreage means that natural regeneration will determine the capacity of many eastside forests to provide goods, services, and management options over the long term.

DNR is conducting one of the first region-wide studies of post-fire regeneration in eastern Washington, focusing on all large fires on public forestlands that burned during 2012-17. Objectives are to quantify the rate, density, and composition of tree and non-tree vegetation regeneration (influenced by burn severity and environmental setting), and to evaluate the potential for regeneration failure in warm, dry sites near lower treelines. The study was initiated in 2016 with the establishment of approximately 60 field plots. Fifty additional plots were established in 2017, and another 80 plots were established in 2018.

In FY 2023, sampling continued through the 2023 field season and now includes nearly 400 field plots. Analysis is ongoing. For more information, contact Dan Donato at Daniel.Donato@dnr.wa.gov.

Using Passive Acoustic Monitoring to Evaluate Sustainability of Forest Management

This project assesses the response of indicator bird species to habitat changes caused by forest management. Results will help DNR compare the effectiveness of current upland habitat conservation strategies to alternative approaches. The study is implemented across the 16 watersheds designated for the T3 Watershed Experiment described above. The project was partially funded by a grant from the EarthWatch Institute in 2019-2022 and included a citizen science component.

In FY 2023, DNR researchers and a UW graduate student continued pre-harvest acoustic monitoring and habitat surveys and sampled the first post-harvest monitoring site. Portions of the audio recordings have been screened for the presence of 10 indicator bird species. A new analytical approach has been added – evaluating the bird community through acoustic indices. For more information, contact Teodora Minkova at Teodora.Minkova@dnr.wa.gov.

Westside Individuals, Clumps, and Openings

Adapting recently developed methods for restoration thinnings on the eastern slopes of the Cascades, this study aims to characterize patterns of stems in old forest reference stands (focusing on known NSO nest sites and territories) and evaluate the degree to which these patterns can be emulated in variable density thinning treatments. DNR is conducting this project in partial collaboration with UW.

As of FY 2023, stems in three pilot early old growth stands and three thinned second growth stands in westside planning units have been mapped, and researchers are identifying additional qualified stands. For more information, contact Daniel Donato at Daniel.Donato@dnr.wa.gov.

3.2 The Olympic Experimental State Forest (OESF)

Appendix: OESF Research and Monitoring Program



Olympic Region Manager Bill Wells and scientist Dan Donato discuss implementation of the T3 Watershed Experiment. Photo: Teodora Minkova.

In FY 2023, the OESF Research and Monitoring Program continued implementing two HCP monitoring projects: (1) Status and Trends Monitoring of Aquatic and Riparian Habitat and (2) Riparian Validation Monitoring. These are described in the Riparian Conservation chapter of this report (Chapter 2). The OESF also continued with two major research projects: (1) the T3 Watershed Experiment, a large-scale integrated management experiment in cooperation with UW’s Olympic Natural Resources Center (ONRC) and other research institutions, and (2) Passive Acoustic Monitoring to Evaluate Sustainability of Forest Management. Information about these projects can be found in the previous section of this report (Chapter 3.4 Research on HCP-Covered Lands) and on the [OESF webpage](#).

The sixth annual OESF Science Conference took place in-person in Forks in May 2023 with over 100 attendees. New this year was a discussion panel on adaptive capacity for land management changes and information tables of organizations conducting research and monitoring on the peninsula.

The OESF Research and Monitoring Program and the ONRC continued to publish the joint, biannual electronic newsletter *The Learning Forest* in the spring and fall. All issues are available on the [OESF website](#). The publication is distributed to the internal networks of DNR and UW, plus more than 200 email subscribers.

The OESF program manager was invited on a research exchange trip to Finland in May 2023 as part of American delegation from three U.S. states. Discussion topics ranged from ecological forestry and logging technology to environmental policy and bioproducts.

The program continued to work with capstone students, summer interns and graduate and undergraduate students. The 2023 field crew included DNR field technicians, interns from UW's [ONRC](#) and [Program on the Environment](#), and a volunteer from Humbolt University. Field work included [acoustic monitoring](#), [Riparian Status and Trends monitoring](#), [fish monitoring](#), soil mapping, water quality sampling, and drone LiDAR sampling for the [T3 Watershed Experiment](#). Significant time and effort of program staff was devoted to coordination with DNR foresters, silviculturists, and timber sale purchasers and loggers for implementation of the T3 Watershed Experiment.

In FY 2023, program funding came from a legislative budget proviso to coordinate with the Olympic Natural Resource Center on four research projects.

3.3 2023 Publications and Presentations

DNR staff conduct scientific research on DNR-managed forestlands and work cooperatively with regional partners on other forestlands in the Pacific Northwest. Publications and presentations relevant to these studies during the 2023 calendar year are listed here. DNR authors are denoted in bold text.

2023 Publications

Buonanduci, M.B., **Donato, D.C.**, **Halofsky, J.S.**, Kennedy, M.E., and B.J. Harvey. 2023. Consistent spatial scaling of high-severity wildfire can inform expected future patterns of burn severity. *Ecology Letters*. 10.1111/ele.14282

Buonanduci, M.B., **Donato, D.C.**, **Halofsky, J.S.**, Kennedy, M.E., and B.J. Harvey. 2023. Scaling severe fire patterns across fire sizes yields insights for data-sparse and infrequent fire regimes. *Ecosphere*. In review.

Davis, K.T., et. al. including **Donato, D.C.**, **Halofsky, J.S.** 2023. Reduced fire severity offers near-term buffer to climate-driven declines in conifer resilience across the western United States. *Proceedings of the National Academy of Sciences*. 120(11): e2208120120

Donato, D.C., **Halofsky, J.S.**, et. al. 2023. Does large area burned mean a bad fire year? Comparing contemporary wildfire years to historical fire regimes informs the restoration task in fire-dependent forests. *Forest Ecology and Management*. 546.121372.

- Halofsky, J.S.** and **D.C. Donato**. Assessing the efficacy of a large-scale habitat conservation plan in western Washington, USA. *Northwest Science*. In review.
- Harvey, B.J., S.J. Hart, P.C. Tobin, T.T. Veblen. **D.C. Donato**, M.S. Buonanduci, A.M. Pane, H.D. Stanke, K.C. Rodman. 2023. Emergent hotspots of biotic disturbances and their consequences for forest resilience. *Frontiers in Ecology and the Environment* 21(8): 388-396.
- Keleher, K., Bigley, R., **Devine, W.** 2023. Drivers of forested riparian microclimate on the Olympic Peninsula of Washington State. *Northwest Science*. 96(1-2): 22-37.
- Laughlin, M., Rangel-Parra, L.K., Morris, J.E., **Donato, D.C.**, **Halofsky, J.S.**, and Harvey, B.J. 2023. Patterns and drivers of conifer regeneration following stand-replacing wildfire across northwestern Cascadia, USA. *Forest Ecology and Management*. 549.141491.
- Minkova, T., W. Devine, K. Martens.** (2023). T3 Watershed Experiment in the Olympic Experimental State Forest: 2016-2023 Implementation Report. *Washington State Department of Natural Resources, Forest Resources Division, Olympia, WA*.
- Morris, J.E., M.S. Buonanduci, M.C. Agne, M.A. Battaglia, **D.C. Donato**, B.J. Harvey. 2023. Fuel profiles and biomass carbon following bark beetle outbreaks: Insights for disturbance interactions from a historical silvicultural experiment. *Ecosystems* 26: 1290-1308.
- Rocchio, F.J., T. Ramm-Granberg,** et. al. 2023. *Sphagnum*-dominated Peatlands in the Puget Lowlands: Ecology and Response to Adjacent Land Use. Implications for Conservation, Management, and Restoration. *Natural Heritage Report 2023-01*. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA. Online: https://www.dnr.wa.gov/publications/amp_nh_puget_lowland_bog.pdf
- Schneider, B.O.** 2023. Washington Natural Heritage Program Data Explorer User Guide. Online Data Explorer: <https://www.dnr.wa.gov/NHPdataexplorer>. *Natural Heritage Report 2023-02*. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA. User Guide: https://www.dnr.wa.gov/publications/amp_nh_gis_dataexpl_userguide.pdf

2023 Presentations

- Buonanduci, M.S., **Donato, D.C.**, **Halofsky, J.S.**, et. al. February 2023. *Examining wildfires from other regions and fire regimes yields insights into future patterns of burn severity in western Cascadia*. Post-fire research and monitoring symposium, Corvallis, OR.
- Buonanduci, M.S., **Donato, D.C.**, **Halofsky, J.S.**, et. al. August 2023. *Scaling burn severity patterns across regions and fire regimes yields insights into historically climate-limited fire regimes*. Ecological Society of America, Portland, OR.
- Devine, W., Donato, D., Minkova T.** 2023. *Adding a complex early-seral stage to production forestry*. Annual Meeting of the Northwest Scientific Association, Bellingham, WA. In-person poster presentation.

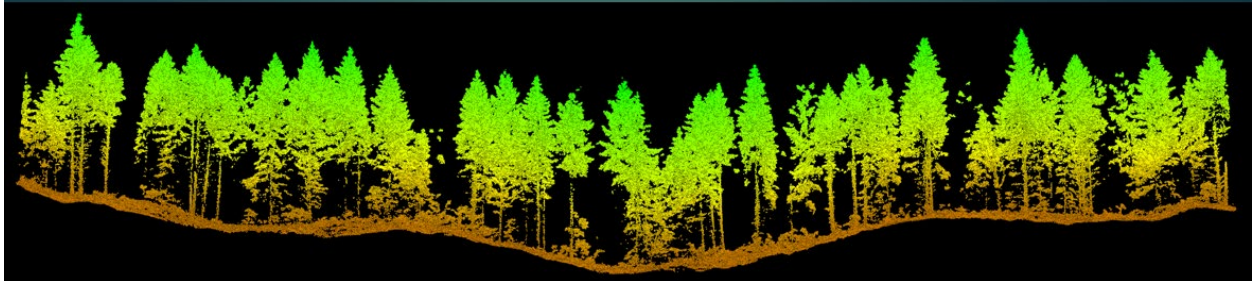
3.0 Adaptive Management

- Devine, W., Minkova, T., Martens, K., Foster, A.** 2023. *Status and trends of riparian and aquatic habitat in the OESF: recent results.* OESF Science Conference, Forks, WA. In-person oral presentation.
- Devine, W., Minkova, T., Martens, K., Foster, A.** 2023. *Status and trends monitoring of riparian and aquatic habitat in the OESF.* Meeting of Cooperative Monitoring, Evaluation, and Research Committee Riparian Scientific Advisory Group, 11 January 2023. Virtual oral presentation.
- Donato, D.C., Halofsky, J.S., Harvey, B.J. and M.J. Reilly.** August 2023. *When the Black Swan shows up: the unprecedented but totally precedented 2020 Labor Day fire event in the West Cascades.* Ecological Society of America, Portland, OR.
- Gonzales, A., **Donato, D.C., Halofsky, J.S.,** and B.J. Harvey. August 2023. *Drivers of post-fire tree regeneration across gradients of climate and burn severity in eastern WA, USA.* Ecological Society of America, Portland, OR.
- Halofsky, J.S.** November 2023. *Eye of the beholder: viewing wildfire through an ecological and social lens across Washington State.* Guest lecture, Evergreen State College.
- Halofsky, J.S.** November 2023. *Too much or not enough fire? Promote spotted owl habitat or disturbance resilience?* Region 6 seminar, US Fish and Wildlife Service.
- Halofsky, J.S.** October 2023. *Unraveling dry forest management contradictions.* Washington State Department of Fish and Wildlife seminar series.
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- Harvey, B.J., Buonanduci, M.S., **Donato, D.C., Halofsky, J.S.,** and M.J. Reilly. February 2023. *Spatial patterns of burn severity in Western Cascadia: characteristics, drivers, and implications for post-fire landscapes.* Post-fire research and monitoring symposium, Corvallis, OR.
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4.0 Forest Inventory

Appendix A.4: RS-FRIS Comprehensive Review



Drone Lidar Image: Bob McGaughey, USDA

RS-FRIS relies largely on remotely sensed data instead of only using field plots. With the adoption of RS-FRIS, DNR’s inventory coverage has expanded considerably, and a new inventory is produced approximately every two years using newly acquired remotely sensed data rather than relying on growth and yield models to grow data forward in time.

The current iteration of RS-FRIS (version 4.0), published in February 2022, covers approximately 99.9 percent and 98.3 percent of DNR-managed forestlands in western and eastern Washington, respectively. RS-FRIS 4.0 reports conditions using remotely sensed data collected in 2019 and 2020.

The fifth iteration of the inventory (RS-FRIS 5.0) will be constructed in FY2024 using remotely sensed data that was collected in 2021 and 2022. The release of RS-FRIS 5.0 is pending completion of the installation of field plots used to train predictive computer models, and processing of the remote sensing to construct the photogrammetric data sets used as input to the models. A comprehensive review of DNR’s RS-FRIS is in [Appendix A.4](#) of this report.

FY 2023 Forest Inventory Accomplishments

FY 2023 forest inventory program accomplishments include:

- Quarterly updates to RS-FRIS 4.0 data sets to reflect completed harvest activities.
- Manual editing of several thousand forest inventory unit boundaries to better reflect ground conditions, including data collected using UAS (drones) to construct post-harvest “as-built” boundaries for the precise location of harvest extent. Division and region staff flew approximately 30 completed harvest units for the as-built program. Traditional statewide aerial imagery is collected at two-year intervals; these UAS flights provide the only-post harvest remote sensing for timber harvests completed between aerial imagery acquisitions.
- Manual and automated quality assurance review of photogrammetric data sets used in construction of RS-FRIS models. These data sets, known as DAP (digital aerial photogrammetry), are high-resolution 3-dimensional point clouds built from stereo imagery. DAP data sets are

produced in-house by DNR's photogrammetry department and reviewed by inventory staff in preparation for model building.

- Construction of high-resolution statewide raster data sets using photogrammetric data. These derivative data sets provide a time series of canopy-surface elevation, canopy-surface hillshade, and canopy height models at 3-foot resolution for each remote-sensing acquisition. To date, these data sets have been produced for the 2015, 2017, 2019, 2020, 2021, and 2022 acquisitions.
- Ongoing installation of forest inventory field plots on a statewide systematic grid spanning DNR-managed lands. DNR and contract field crews installed 1,272 forest inventory plots for use in model building and 68 validation blocks (each containing 10 validation plots) for use in model validation. Forest inventory field plots are installed on a systematic grid spanning DNR-managed lands statewide. The sampling framework is a panelized design. Panels 5,6,7 and 8 are nearing completion and will be used to construct RS-FRIS 5.0.
- Completion of field data collection for the Stand-based Forest Inventory System (SFIS), a corollary to RS-FRIS using traditional-forest inventory methods without remote sensing. SFIS data provides a means of comparing and contrasting traditional to remotely sensed forest inventory methods. Contract crews installed 19,636 traditional forest inventory plots across 1,223 stands in western WA.
- Completion of stand development stage classification system for use in western Washington. The classification system was completed under contract, using a combination of field-collected and remotely sensed data. The classification system is intended to provide a science-based empirical classification of stand structural characteristics. The classification was designed such that it may be applied to both current and future conditions, using forest inventory data and growth and yield tables, respectively).

5.0 Land Transactions

Appendix 5.0: Land Transactions

FY 2023 Transactions by HCP Planning Unit

Land transactions occur in the form of acquisitions, dispositions, Trust Land Transfers (TLTs), or State Forest Transfers (SFTs). In FY 2023, there were no dispositions, TLTs, or SFTs. Acquisitions completed in FY 2023 are listed by HCP planning unit below. Data in this section is rounded to the nearest whole acre.

Westside Planning Units

Columbia: DNR acquired 2 acres of conservation land for Lacamas Prairie NRCA, in Clark County.

DNR acquired 38 acres of conservation land for Washougal Oaks NRCA, in Clark County.

North Puget: DNR acquired 569 acres of forest land for Mount Si NRCA in King County.

OESF: No applicable transactions during the fiscal year.

South Coast: DNR acquired 40 acres of conservation land for Mima Mounds NAP in Thurston County.

South Puget: DNR acquired 5 acres of conservation land for Kennedy Creek NAP in Mason County.

DNR purchased 5 acres of forest for Stavis NRCA in Kitsap County.

Straits: No applicable transactions during the fiscal year.

Eastside Planning Units

Chelan: No applicable transactions during the fiscal year.

Klickitat: No applicable transactions during the fiscal year.

Yakima: No applicable transactions during the fiscal year.

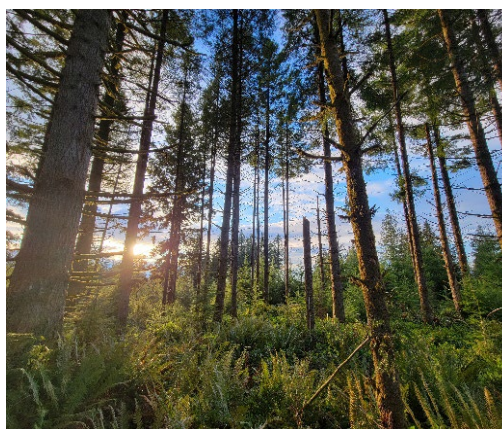
6.0 Silviculture

Appendix 6.0: Silviculture

Information and analyses provided in this section are based upon activities designated as “complete” in DNR’s forest management activity tracking database, LRM. LRM is a tabular database that integrates Geographic Information System (GIS) and enables spatial tracking of individual forest management activities on the landscape.

Five major silviculture activity types are discussed in this report: harvest, site preparation, forest regeneration, vegetation management, and PCT. These activities typically occur sequentially in the order listed. In Section 6.1, data for each of the major silviculture activity types are reported below. In section 6.2, narrative summaries of each silvicultural activity type follow the data tables.

DNR silviculture and nursery staff continually research and assess new strategies to meet the objectives of the HCP and concurrently fulfill the obligations of the trust mandate. This chapter concludes (section 6.3) with a synopsis of some silviculture-related research currently underway.



Douglas-fir wildlife retention clump, initially harvested in 2010 in the Columbia HCP planning unit demonstrates forest regeneration. Photo: Florian Deisenhofer

6.1 Silviculture Activity Data

Table 6.1a shows completed silvicultural activity acres for FY 2023 by regional HCP grouping (eastside, westside, OESF) and by HCP Planning Unit.

Table 6.1b compares acres of salvage harvest completed in FY 2023 to the five-year mean by harvest type. Data is presented by HCP regional grouping (eastside, westside, OESF).

Data in both tables are from LRM as of December 21, 2023. All data is rounded to the nearest whole acre. Data tables include the mean annual completed acres of each activity for the last five fiscal years (2019-2023). Tables do not include silviculture activities for which both the completed acreage in FY 2023 and the five-year mean are below 50 acres (e.g., ground mechanical, shelterwood removal).

Table 6.1a: Acres of silviculture activities completed in FY 2023 by planning unit. Data is from LRM as of December 21, 2023, and has been rounded to the nearest whole acre. This table does not include any silviculture activities for which both the completed acreage in FY 2023 and the five-year mean are below 50 acres. Note: There were no completed silviculture activities in the Chelan planning unit in FY 2023.

6.0 Silviculture

FY 2023 Totals (Five-year Mean FY2019 – 23)											
	East			West					OESF	Total	
	Klickitat	Yakima	East Totals	Columbia	N. Puget	S. Coast	S. Puget	Straits	West Totals		OESF Totals
Timber Harvest											
Commercial Thinning			0 (138)	156	14	680	16		866 (1,197)	0 (100)	866 (1,436)
Land Use Conversion			0 (0)	10	92	23	18	1	145 (62)	8 (9)	154 (72)
Shelterwood Int. Cut		231	231 (46)						0 (0)	0 (0)	231 (46)
Uneven-aged Management		669	669 (442)						0 (23)	0 (0)	669 (466)
Variable Density Thinning	505		504 (265)	10	221	40	189		459 (1,175)	758 (1,010)	1,722 (2,451)
Variable Retention Harvest		630	629 (327)	2,118	2,336	1,991	1,186	628	8,258 (11,098)	2,029 (1,613)	10,917 (13,039)
Total	505	1,530	2,035 (1,220)	2,293	2,663	2,734	1,410	629	9,729 (13,557)	2,797 (2,734)	14,561 (17,512)
Forest site preparation											
Aerial Herbicide			0 (0)	1,662		1,404			3,066 (3,194)	0 (0)	3,066 (3,194)
Ground Herbicide			0 (0)	323	2,121	2,239	1,853	1,424	7,959 (6,246)	1,831 (808)	9,790 (7,054)
Total			0 (0)	1,985	2,121	3,643	1,853	1,424	11,025 (9,440)	1,831 (808)	12,857 (10,248)
Forest regeneration											
Hand planting	45	176	220 (309)	2,690	2,591	2,659	1,496	1,010	10,445 (11,118)	1,256 (1,708)	11,922 (13,136)
Natural regeneration			0 (98)						0 (75)	0 (1)	0 (174)
Total	45	176	220 (407)	2,690	2,591	2,659	1,496	1,010	10,445 (11,194)	1,256 (1,709)	11,922 (13,311)
Vegetation management											
Ground Herbicide			0 (0)	1,789	1,148	5,192	1,880	3,348	13,356 (4,505)	1,133 (406)	14,490 (4,912)
Hand Cutting			0 (0)	349	2,257	1,204	17	717	4,544 (4,216)	1,689 (658)	6,233 (4,874)
Hand Pulling			0 (0)						0 (248)	0 (0)	0 (248)
Underburning	108		107 (21)						0 (0)	0 (0)	107 (21)
Total	108		107 (21)	2,137	3,405	6,396	1,897	4,066	17,901 (8,971)	2,822 (1,065)	20,832 (10,057)
Pre-commercial thinning											
Total		1,992	1,992 (1,589)	1,383	2,744	4,421	1,503	1,867	11,917 (6,607)	1,212 (955)	15,122 (9,152)
Grand Total	657	3,698	4,355 (3,239)	10,488	13,524	19,853	8,158	8,996	61,019 (49,770)	9,920 (7,273)	75,296 (60,283)

Data is from LRM as of December 21, 2023 and has been rounded to the nearest whole acre.

This table does not include any silviculture activities for which both the completed acreage in FY 23 and the five-year mean are below 50 acres.

No completed activities in Chelan planning unit in FY23.

Table 6.1b: Acres salvaged by harvest type in FY 2022 and five-year mean (FY 2019–23).

FY 2023 (five-year mean FY 2019–2023)				
Harvest Type	East	West	OESF	Total
Variable Density Thinning	0 (0)	0 (59)	0 (0)	0 (59)
Variable Retention Harvest	440 (57)	0 (53)	0 (20)	440 (55)
Total	440 (57)	0 (112)	0 (20)	440 (114)

Data Summaries by Silviculture Type

Timber Harvest

The rights to harvest timber from state trust lands are purchased at regional public auctions held each month. A timber sale contract allows the purchaser to remove timber, typically over a one- to two-year period. Therefore, the number of timber sales sold may stay relatively stable from year to year while timber removals or levels of completed activities may vary based on when purchasers choose to harvest (and thus complete) the sale.

Across all HCP planning units, acres of VRH completed in FY 2023 were 16 percent below the five-year mean, acres of VDT were 30 percent below the five-year mean, and acres of commercial thinning were 40 percent below the five-year mean. In the eastside planning units in FY 2023, acres of completed VRH and VDT were 92 percent and 90 percent above the five-year mean, respectively, primarily driven by an increased rate of post-wildfire salvage efforts.

Forest Site Preparation

Total acreage of forest site preparation completed in FY 2023 was 25 percent higher than the five-year mean. In westside planning units, not including the OESF ground herbicide treatment acres, acreage was 17 percent above the mean. In the OESF, acreage was 127 percent above the mean as this unit implements a higher rate of regeneration harvests in recent years. In eastside planning units, there were no acres of chemical or mechanical site preparation; these activities are generally rare in eastside planning units.

Forest Regeneration

Total acreage of forest regeneration completed in FY 2023 was 10 percent below the five-year mean. There were zero acres of natural regeneration completed in FY23 – this type of regeneration is rarely implemented. There was a 26 percent decrease in the rate of hand-planting in the OESF, compared to the five-year mean, but this was following an 80 percent increase in the rate of planting in FY22. There were 220 acres of hand planting completed in eastside planning units in FY 2023, a decrease of 29 percent from the five-year mean.

Vegetation Management

Acres of completed vegetation management in FY 2023 were 107 percent above the five-year mean. In westside planning units including the OESF, ground herbicide release and hand slashing treatment acreage was 195 percent and 28 percent above the five-year mean, respectively, as funding for these activities have increased.

Pre-Commercial Thinning

The total acreage of PCT completed in FY 2023 was 65 percent above the five-year mean. Completed PCT acres in westside planning units, including the OESF, was 73 percent higher than the five-year mean. New funding sources for silvicultural activities continue to allow for a greater amount of PCT to be completed in westside planning units. PCT acreage was 25 percent above the the mean in eastside planning units.

Salvage

Across all HCP planning units, the total acreage of salvage harvest was 690 percent above the five-year mean. The increase can be attributed to post-wildfire salvage in eastside planning units, where there was 440 acres of completed salvage harvest in FY23. There were zero acres of completed salvage harvest in westside planning units.

6.2 Silviculture Highlights

Webster Nursery and Meridian Seed Orchard

Sustainable Seedling Propagation: Webster nursery staff are experimenting with using Elle pots, a specially developed paper pot system, for seedling propagation. Elle pots have potential for reducing or eliminating dependence on tough-to-recycle Styrofoam, plastic pots, and plastic bags.

Webster Biopesticide Alternatives Research: A current industry standard is to use methyl bromide, an ozone-depleting soil fumigant, to control pests and pathogens. Webster nursery scientists are undertaking research to explore practical and economic alternatives to methyl bromide.

Webster Nursery Seedling Inoculation Research: Deeper understanding of the plant microbiome has led Webster nursery staff to study intentional nursery inoculation of beneficial fungi and bacterial symbionts. These symbionts might promote host seedling disease resistance, drought hardiness, and improved nutrient uptake in stressful conditions.

Seed Source Selection Trials: Meridian Seed Orchard staff worked with regional cooperators to install and plant 11 Douglas-fir seed source trials across the PNW to study the impacts of transferring seed on tree survival and performance. Results from these trials will help inform how we source our tree seed for reforestation in the face of a changing climate.

Planning for Future Conditions

Fire-Impacted Area Research: The silviculture program initiated a study in spring 2023 to evaluate alternatives to effectively and economically reforest fire-impacted areas. The study will assess seedling survival and growth across a range of site conditions, represented by three 2022 westside fires in the PC and SPS regions (Nakia Creek, Black Hole, and Eight Road fires). The reforestation regimes will examine combinations of vegetation management treatments (i.e., site prep versus release treatments), Douglas-fir seedling stock types (bareroot 1+1, Styro15 container, and Elle pots), planting seasons (fall versus spring), and plant timing (immediately post-fire and up to two years delayed).



Planting after the Nakia Creek fire.

Seed Orchard Restoration Project: The USDA Forest Service (USFS) has several dozen seed orchard sites in Washington that need restoration. The DNR and USFS are collaborating to restore them over the next 3-4 years so that both organizations have access to a reliable seed supply. The goal is to maintain genetic diversity while concurrently selecting genotypes for potential future climate conditions.

Forest Genetics Research: DNR is currently undertaking several forest genetics studies including one study examining how seed sources adapt to changing climates. Starting with 23 different sources for Douglas fir seeds, samples will be planted in a variety of “climate spaces” from northern California to southern British Columbia. This will give scientists a window into the future: how does a seed source from cool and wet Thurston County, Washington fare when planted in drier and hotter central Oregon? This project also explores “assisted migration” — taking seed sources from a region where they are well adapted and planting the seedlings on sites where a suitable climate is predicted to occur in the future.

7.0 Forest Roads Program

Appendix 7.0: Forest Roads Program



Bridge installation over Steep Creek in Skamania County. Photo: Brett Freeman

The Forest Roads Program continuously improves DNR's forest road infrastructure across the state. Most roadwork is subject to a hydraulic work window which limits in- or near-stream work to the summer (typically June 15 through September 30). Therefore, unlike most activities described in this report, DNR reports road management activities by calendar year instead of fiscal year because the end of the fiscal year occurs during the height of the construction season.

As of calendar year 2023, the Forest Roads Program is actively replacing structurally deficient bridges throughout the state using Capital Funds and our Access Road Revolving Act (ARRA). Many of these structures, as described below, were originally constructed with creosote timber. Removal and replacement of these structures ultimately improves water quality, reduces the potential for sediment and chemical transport to streams, and improves bridge weight capacity.

To meet HCP annual reporting requirements, the Forest Roads Program tracks and reports the total number of fish barriers identified, corrected, and removed. The Forest Roads program also tracks and reports the total number of active forest road miles and the number of road miles that are:

- constructed (newly built),
- improved or reconstructed (existing roads improved to a timber-haul standard),
- decommissioned (roads stabilized and made impassable to vehicular traffic), and
- abandoned (roads stabilized and abandoned to forest practices standards).

Fish Barrier Identification, Correction, and Removal

DNR completed the removal or correction of all fish barriers and culverts identified in our Road Maintenance and Abandonment Plan (RMAP) in 2022, thereby completing all of Washington State trust lands RMAP obligations. Through continual land transactions and inspections, DNR discovers and identifies new (i.e., “newly identified”) fish barriers, adding them as needed to DNR’s fish-barrier worklist for correction. DNR is committed to inspecting each fish passage culvert every 10 years and prioritizes replacement of new fish barriers within six years of their identification (i.e., discovery).

Fish Barrier Identification

In calendar year 2023, inspection activities identified ten new fish passage barriers that need correction. Combined with one fish passage barrier identified over the previous several years, this totals eleven newly discovered fish barriers on DNR-managed lands that require correction.

Fish Barrier Remediation

Also in calendar year 2023, ten previously identified barriers were corrected and therefore removed from the fish-barrier worklist, requiring an investment of more than \$305,000. Of these barriers:

- Nine barriers were removed or replaced, opening an estimated 0.3 miles of fish habitat on DNR-managed lands.
- One barrier was removed from the work list because the stream designation was downgraded from “fish” to “non-fish” following protocol survey requirements and consultations with an Interdisciplinary Team which included DNR Forest Regulations staff and tribal representatives.



A fish passable culvert which does not require correction.
Photo: Alex Nagygyor

Road Management Activities

Table 7-1a summarizes DNR’s road management activity in calendar year 2023 on both HCP-covered and non-HCP-covered lands.

Table 7-1a: Road Management activity for calendar year 2023. Mileage is rounded to the nearest mile.

HCP Lands	Road Miles					Fish Barriers
	Constructed	Reconstructed	Abandoned	Decommissioned	Inventoried ¹	Removed
Chelan	0	0	0	1	35	0
Columbia	12	11	6	0	1,295	5
Klickitat	1	1	0	1	604	0
North Puget	12	5	15	0	1,488	2
OESF	3	0	0	1	1,845	2
South Coast	15	3	3	0	1,787	0
South Puget	1	3	5	3	1,369	1
Straits	4	1	4	0	929	0
Yakima ²	1	1	1	4	1,362	0
Total	49	25	34	10	10,714	10
Non-HCP Lands	Road Miles					Fish Barriers
	Constructed	Reconstructed	Abandoned	Decommissioned	Inventoried	Removed
Non-HCP	11	8	2	1	3,221	0
Teaway	0	0	0	10	29	0
Total	11	8	2	11	3,250	0
Grand Total	60	33	36	21	13,964	11 (new)³

¹ Inventoried road includes forest roads (according to [WAC 222-160-010](#)) and decommissioned roads. It does not include abandoned or orphaned roads.

² Data for the Yakima HCP Planning Unit does not include roads on land co-managed by DNR and WDFW in the Teaway Community Forest because this land is not covered by the HCP.

³Total of fish barriers remaining on the fish barrier worklist. In calendar year 2023, 11 new barriers were identified.

Easements & Road Permits

DNR grants easements across state trust lands to individuals, private organizations, and other public agencies for a variety of purposes, including road and utilities access. DNR also acquires easements across private or public lands to gain access to DNR-managed lands. In addition to granting and acquiring easements, DNR occasionally acquires new lands that are subject to existing easement rights.

DNR is digitally mapping all existing and new easements in the Road Easement GIS data set, with continuous progress over the past decade. In FY 2023, DNR continued to make progress on the Spatial NaturE project that maps encumbrances on state lands that are not connected to DNR’s road system, such as utility corridors, communication sites, commercial leases, weather monitoring systems,

7.0 Forest Roads

irrigation infrastructure, water rights, agriculture and grazing leases, railroads, recreation sites, special use permits, and land use restrictions.

Table 7.1b reports easements granted in FY 2023 that created a new footprint (i.e., timber was cut to create a new open space).

Table 7.1b: Road Easements and Road Use Permits (New Footprint) Granted in FY 2023.

Unit of Measurement	Columbia	North Puget	OESF	South Coast	Straits	Klickitat	Chelan	Yakima	South Puget	Total
Miles	0.4	1.81	0	.03	0.34	0	0	0	0	2.58
Acres	2	14.08	0	4.68	1.15	0	0	0	0	21.91

8.0 Non-Timber Management

8.1 Natural Areas

Appendix: Natural Areas Program



A Lewis woodpecker (*Melanerpes lewis*) takes advantage of a handy perch. Photo: Daniel Munzing.



The native white spotted sawyer beetle (*Monochamus scutellatus*) does not attack healthy trees — unlike other non-native beetles. Photo: Kayla Swerin.

Restoration and Research

DNR is actively working to restore and enhance habitat for special-status species at a number of Natural Area Preserves (NAPs) and Natural Resource Conservation Areas (NRCAs). At Mima Mounds and Rocky Prairie NAPs, for example, DNR is using prescribed fire, invasive species control, and seeding of native grassland plants to restore native prairie habitats that have been heavily fragmented and degraded over most of their range. The Natural Areas Program is restoring and enhancing oak woodland habitat at several sites (Washougal Oaks NAP/NRCA, Bald Hill NAP, Lacamas Prairie NAP, and Oak Patch NAP) by removing competing conifer trees, planting oak seedlings, and replanting native understory species. In addition, DNR is restoring and enhancing San Juan Island grasslands, mountain meadows, and arid forests to benefit rare species such as the Island marble butterfly and Wenatchee Mountains checkermallow.

Natural Areas Expansion

In FY 2023, the Natural Areas Program protected an additional 776.5 acres in NAPs and NRCAs, including 689.8 acres within the area covered by the HCP. These protection efforts added to seven existing natural areas. The most significant of these are the following:

Mt. Si NRCA: This 600-acre parcel added an important in-holding to the NRCA, providing long-term protection of connectivity to adjacent US Forest Service lands for a variety of wildlife, including northern

8.0 Non-Timber Management

spotted owl. The acquired lands support mature and regenerating mid-elevation forest, as well as talus, cliffs, streams, and riparian areas.

Mima Mounds NAP: 39.6 acres of Garry oak woodland and prairie were added to this NAP, the second phase of a key addition to the site. This purchase adds some of the highest quality remaining prairie-oak habitat adjacent to the original preserve and expands on the first phase of this acquisition project.

Washougal Oaks NAP/NRCA: 38.0 acres were added to this natural area, including oak woodland and forest edges and adjacent fields that provide buffer. A portion of the parcel is scheduled to be restored to upland prairie over the next several years, including establishing a population of the federally threatened Kincaid’s lupine.

Table 8.1a lists acreage added to Natural Area Preserves located within the HCP boundary.

Table 8.1a: Acres added to NAPs and NRCAs within HCP-covered lands by county in FY 2023. Acreage data comes from the Land Transactions Program, determined through surveys at the time of transaction and might not exactly match the “GIS acres” of transacted land in the DNR GIS system. Natural areas in bold text are composed primarily of mature and/or late-seral forests.

Designation	Natural Area	County	Acres Added	Total Current Acres
NAP	Camas Meadows NAP	Chelan	-	2,017.8
	Carlisle Bog NAP	Grays Harbor	-	310
	Chehalis River Surge Plain NAP	Grays Harbor	-	4,493.6
	Goose Island NAP	Grays Harbor	-	12
	North Bay NAP	Grays Harbor	-	1,214.9
	Sand Island NAP	Grays Harbor	-	8
	Whitcomb Flats NAP	Grays Harbor	-	5
	Admiralty Inlet NAP	Island	-	79.5
	Clearwater Bogs NAP	Jefferson	-	504.1
	Crowberry Bog NAP	Jefferson	-	321.3
	Charley Creek NAP	King	-	1966
	Kings Lake Bog NAP	King	-	309.2
	Snoqualmie Bog NAP	King	-	110.5
	Kitsap Forest NAP	Kitsap	-	571.9
	Monte Cristo NAP	Klickitat	-	1151
	Trout Lake NAP	Klickitat	-	2,014
	Hamma Hamma Balds NAP	Mason	-	957
	Ink Blot NAP	Mason	-	183.6
	Oak Patch NAP	Mason	-	17.3
	Schumacher Creek NAP	Mason	-	498.8
	Skookum Inlet NAP	Mason	-	142.6
Bone River NAP	Pacific	-	2,799.7	
Gunpowder Island NAP	Pacific	-	152	
Niawiakum River NAP	Pacific	-	1,097.8	

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	Willapa Divide NAP	Pacific	-	587
	Point Doughty NAP	San Juan	-	56.5
	Cypress Highlands NAP	Skagit	-	1,072.4
	Olivine Bridge NAP	Skagit	-	148
	Skagit Bald Eagle NAP	Skagit	-	1,546
	Columbia Falls NAP	Skamania	-	1,233.8
	Bald Hill NAP	Thurston	-	313.7
	Mima Mounds NAP	Thurston	39.6	759.2
	Rocky Prairie NAP	Thurston	-	35
	Dailey Prairie NAP	Whatcom	-	228.8
Total		Total Acres	39.6	26,918.0
NRCA	Shipwreck Point NRCA	Clallam	-	471.8
	Merrill Lake NRCA	Cowlitz	-	114.2
	Elk River NRCA	Grays Harbor	-	5,560
	Clearwater Corridor NRCA	Jefferson	-	2,323
	Devils Lake NRCA	Jefferson	-	80
	Queets River NRCA	Jefferson	-	601
	South Nolan NRCA	Jefferson	-	213
	Middle Fork Snoqualmie NRCA	King	-	9,224.3
	Mount Si NRCA	King	600.0	14,374.9
	West Tiger Mountain NRCA	King	-	3,915.5
	Stavis NRCA	Kitsap	5.0	3,025.4
	White Salmon Oak NRCA	Klickitat	-	551.2
	Tahoma Forest NRCA	Lewis	-	230
	Ellsworth Creek NRCA	Pacific	-	557
	Naselle Highlands NRCA	Pacific	-	327.7
	South Nemah NRCA	Pacific	-	2,439.5
	Teal Slough NRCA	Pacific	-	8.4
	Ashford NRCA	Pierce	-	78.4
	Cattle Point NRCA	San Juan	-	112.1
	Blanchard Core NRCA	Skagit	-	661.5
	Cypress Island NRCA	Skagit	-	4,157.4
	Granite Lakes NRCA	Skagit	-	603.2
	Hat Island NRCA	Skagit	-	91.2
	Stevenson Ridge NRCA	Skamania	-	752.3
	Table Mountain NRCA	Skamania	-	2,836.5
Morning Star NRCA	Snohomish	-	37,841.9	
Woodard Bay NRCA	Thurston	-	922.5	
Hendrickson Canyon NRCA	Wahkiakum	-	159	
Skamokawa Creek NRCA	Wahkiakum	-	503.9	

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	Lake Louise NRCA	Whatcom	-	137.7
	Lummi Island NRCA	Whatcom	-	671.5
	Klickitat Canyon NRCA	Yakima	-	2,335.2
Total			605.0	95,881.2
NAP/NRCA	Lacamas Prairie NAP/NRCA	Clallam	2.0	213.1
NAP/NRCA	Washougal Oaks NAP/NRCA	Clark	38.0	356.5
NAP/NRCA	Dabob Bay NAP/NRCA	Jefferson	-	3,293.6
NAP/NRCA	Kennedy Creek NAP/NRCA	Mason	5.2	1,126.5
Scenic Area	Rattlesnake Mtn Scenic Area	King	-	1,875.7
Total			45.2	6,865.4
Grand Total			689.8	129,664.6

Management of Natural Areas

In addition to land acquisitions, the Natural Areas Program continued to actively manage and enhance habitat on natural areas in FY 2023 to benefit federally listed species such as Wenatchee Mountains checker-mallow (Camas Meadows NAP), Island marble butterfly (Cattle Point NRCA), Oregon spotted frog (Trout Lake NAP), and Puget Sound/Hood Canal salmon runs (Dabob Bay NAP/NRCA). Golden paintbrush (Admiralty Inlet NAP, Mima Mounds NAP, Rocky Prairie NAP) was recently removed from the federal endangered species list due in part to conservation efforts on DNR natural areas.

Listed, Candidate, and Sensitive Species

Statewide, Washington’s natural areas protect nearly 168,000 acres in 58 NAPs and 39 NRCAs. Over 129,000 of those acres fall within the area managed under the HCP, protecting habitat for 14 species listed as threatened or endangered under the ESA and another 37 special status species. This total includes 84,113.0 acres that DNR has added to the program since the HCP was signed in 1997. An additional 18,186.7 acres have been added to the program since 1997 in areas not managed under the HCP. Outside of HCP-managed areas, the Canada lynx (*Lynx canadensis*) is found in the Loomis NRCA. In addition, the Loomis NRCA and Chopaka Mountain NAP support substantial populations of whitebark pine (*Pinus albicaulis*) (recently listed under the Endangered Species Act), and several natural areas provide habitat suitable for grizzly bears (*Ursus arctos horribilis*).



Wenatchee Mountains checkermallow (*Sidalcea oregana var. calva*) in Camas Meadows NAP. Photo: Dave Wilderman.

Listed Species

As of 2023, federally listed species living on natural areas include:

- the largest and most viable population of Wenatchee Mountains checker-mallow (*Sidalcea oregana var. calva*),

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- the second-largest population and Washington’s highest-quality native habitat for the Oregon spotted frog (*Rana pretiosa*),
- one occurrence of the Tenino subspecies of the Mazama pocket gopher (*Thomomys mazama tumuli*),
- more than 15 established territories for the northern spotted owl (*Strix occidentalis caurina*), and
- waters that contain listed runs of Lower Columbia and Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*).

Ten of DNR’s natural areas contain occupied marbled murrelet (*Brachyramphus marmoratus*) sites. At South Nemah NRCA, more than 30 marbled murrelet occupancies have been recorded, including a confirmed murrelet nest site.

Table 8.1b lists federally threatened and endangered species found in natural areas covered by the HCP.

Table 8.1b: Federally Threatened and Endangered Species in Natural Areas Covered by the HCP.

Species	Federal Status	Natural Area
Northern Spotted Owl	Threatened	Camas Meadows NAP, Granite Lakes NRCA, Skagit Bald Eagle NAP, Morning Star NRCA, South Nemah NRCA, Stevenson Ridge NRCA, Table Mountain NRCA, Teal Slough NRCA, Trout Lake NAP
Marbled Murrelet	Threatened	Ashford NRCA, Bone River NAP, Clearwater Bogs NAP, Clearwater Corridor NRCA, Dabob Bay NAP/NRCA, Elk River NRCA, Morning Star NRCA, Naselle Highlands NRCA, Niawiakum River NAP, Queets River NRCA, Skamokawa Creek NRCA, South Nemah NRCA, South Nolan NRCA, Teal Slough NRCA, Willapa Divide NAP
Bull Trout	Threatened	Chehalis River Surge Plain NAP, Carlisle Bog NAP, Olivine Bridge NAP, Skagit Bald Eagle NAP, Morning Star NRCA, Clearwater Corridor NRCA
Chinook Salmon – Puget Sound	Threatened	Dabob Bay NAP/NRCA, Kitsap Forest NAP, Mt. Si NRCA, West Tiger Mountain NRCA, Olivine Bridge NAP, Skagit Bald Eagle NAP, Stavis NRCA
Chinook Salmon – Lower Columbia	Threatened	Klickitat Canyon NRCA
Steelhead – Lower Columbia	Threatened	Klickitat Canyon NRCA, Table Mountain NRCA, Washougal Oaks NAP/NRCA
Steelhead – Puget Sound	Threatened	Dabob Bay NAP/NRCA, Stavis NRCA
Coho Salmon – Lower Columbia/ SW Washington	Threatened	Washougal Oaks NAP/NRCA
Chum Salmon – Hood Canal	Threatened	Dabob Bay NAP/NRCA
Island Marble Butterfly	Endangered	Cattle Point NRCA
Oregon Spotted Frog	Threatened	Trout Lake NAP
Eulachon	Threatened	Dabob Bay NAP/NRCA
Mazama Pocket Gopher	Threatened	Rocky Prairie NAP
Wenatchee Mountains Checker-Mallow	Endangered	Camas Meadows NAP

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Other Sensitive Species

Natural areas provide habitat for other sensitive species (federal species of concern, state-listed, state candidate) identified in the HCP. Examples include:

- insects like the June’s (formerly Makah) copper butterfly (*Lycaena mariposa junia*), Beller’s ground beetle (*Agonum belleri*), and Hatch’s click beetle (*Eanus hatchi*) that are found only in bog habitats,
- amphibians like the Larch Mountain salamander (*Plethodon larselli*) which depend upon forested talus slopes,
- birds like the harlequin duck (*Histrionicus histrionicus*) associated with mountain streams and rivers,
- bats that depend on maternal colonies like the colony found at Woodard Bay NRCA, and
- mammals like the California bighorn sheep (*Ovis canadensis sierrae*) in Loomis NRCA which depend upon high-elevation rocky outcrops and alpine communities.

Table 8.1c lists other species of concern in Natural Areas covered by the HCP.

Table 8.1c: Special Status Species Located in Natural Areas Covered by the HCP.

Federal Species of Concern	
Species	Natural Area ¹
Bald Eagle	Numerous sites
Beller’s Ground Beetle	Snoqualmie Bog NAP, Kings Lake Bog NAP
Cascades Frog	Morning Star NRCA
Columbia Torrent Salamander	Ellsworth Creek NRCA
Fringed Myotis	Camas Meadows NAP
Golden Paintbrush	Rocky Prairie NAP, Admiralty Inlet NAP, Mima Mounds NAP
Gorge Daisy	Columbia Falls NAP
Harlequin Duck	Morning Star NRCA
Hatch’s Click Beetle	Kings Lake Bog NAP
Howell’s Daisy	Columbia Falls NAP, Table Mountain NRCA
Larch Mountain Salamander	Table Mountain NRCA, Columbia Falls NAP
June’s Copper Butterfly	North Bay NAP, Carlisle Bog NAP, Clearwater Bogs NAP, Crowberry Bog NAP
Northern Goshawk	Clearwater Corridor NRCA, Morning Star NRCA
Northern Red-Legged Frog	Carlisle Bog NAP, North Bay NAP, Table Mountain NRCA, Morning Star NRCA, Ellsworth Creek NRCA, Kings Lake Bog NAP
Olive-Sided Flycatcher	Numerous sites
Oregon Sullivantia	Columbia Falls NAP
Pale Blue-Eyed Grass	Trout Lake NAP
Peregrine Falcon	Table Mountain NRCA, Cypress Highlands NAP, Mount Si NRCA, Elk River NRCA, Hat Island NRCA, Lummi Island NRCA, North Bay NAP
Puget Sound Coho Salmon	Dabob Bay NAP/NRCA
Slender-Billed White-Breasted Nuthatch	Washougal Oaks NAP/NRCA, Lacamas Prairie NAP/NRCA

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Federal Species of Concern	
Species	Natural Area ¹
Suksdorf's Desert-Parsley	White Salmon Oak NRCA
Tailed Frog	Table Mountain NRCA, Morning Star NRCA
Tall Bugbane	Washougal Oaks NAP, Columbia Falls NAP
Valley Silverspot	Mima Mounds NAP
Van Dyke's Salamander	South Nemah NRCA, Ellsworth Creek NRCA
Wenatchee Larkspur	Camas Meadows NAP
White-Top Aster	Rocky Prairie NAP, Mima Mounds NAP
Yuma Myotis	Woodard Bay NRCA
State Listed – No Federal Status	
Olympic Mudminnow (State Sensitive)	Carlisle Bog NAP, Chehalis River Surge Plain NAP, West Tiger Mountain NRCA
Sandhill Crane (State Endangered)	Trout Lake NAP, Klickitat Canyon NRCA
State Candidate – No Federal Status	
Cascade Torrent Salamander	Table Mountain NRCA
Dunn's Salamander	Teal Slough NRCA, South Nemah NRCA
Puget Blue	Rocky Prairie NAP
Sand Verbena Moth	Cattle Point NRCA
Townsend's Big-eared Bat	Blanchard Core NRCA
Western Toad	Dabob Bay NAP/NRCA, Morning Star NRCA, Oak Patch NAP, Stavis NRCA
White-headed Woodpecker	Camas Meadows NAP

¹Location information was determined by consulting the Washington Natural Heritage database and the following WDFW databases: Animal Occurrences, Northern Spotted Owl Site Centers, Priority Habitat, and Streamnet.

8.2 Permits, Leases, and Sales

8.2a Special Forest Products

Special forest products include holiday and floral greens, medicinal plants, mushrooms, or other items that can be harvested from forested state trust lands but are not categorized as traditional timber or fiber. DNR selectively allows commercial and/or recreational harvest of special forest products when doing so will benefit the trusts and have an insignificant, or *de minimis*, environmental impact.



Salal gathering under a DNR gathering permit. Photo: with permission from SalalNW.com

Three of DNR’s upland regions – South Puget Sound, Olympic, and Pacific Cascade – offer opportunities to gather special forest products in the South Puget, OESF, Straits, South Coast, and Columbia HCP planning units. Leases, direct sales, and permits provide small businesses and individuals access to gather a variety of valuable non-timber forest products, including brush, boughs, beargrass, evergreen huckleberry, moss, salal, and sword fern, though not every lease/sale or permit authorizes all products.

In all three regions, DNR sells individual permits for multiple designated brush harvest areas. Applicants can buy one permit per harvest area annually. These regions might also offer direct sales of some of these special forest products. In South Puget Sound and Pacific Cascade, direct sales are made for products gathered from areas too small to be offered under a lease. The South Puget Sound Region also holds an annual auction for special forest product leases, awarded to the highest qualified bidders for five-year terms.

Table 8.2a summarizes FY23 sales of special forest products on HCP-covered forestlands. Note that the acreages listed in this table often overlap; multiple permits or leases are sometimes granted on the same parcel. Therefore, the composite (affected) acreage is less than the sum of acreage for all permits or leases.

Table 8.2a: Sales of special forest products on HCP-covered forestlands in FY 2023.

Region	Permits		Leases		Direct Sales	
	Occurrences	Acres	Occurrences	Acres	Occurrences	Acres
South Puget	91	76,198	24	83,025	1	319
Olympic	52	303,157	0	0	0	0
Pacific Cascade	56	223,873	0	0	0	0
Total	199	603,228	24	83,025	1	319

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8.2b Communication Site Leases

Communication site leases allow private and public entities to build new towers or attach communication equipment to existing towers (e.g., cellphone towers). These sites typically are located on non-forested mountaintops or along second-growth highway corridors and are less than one acre in size. They are accessed by the same road systems used for forest management activities and are subject to the same management practices.

In FY 2023, 81 telecommunication sites were leased within the HCP-managed area, totaling about 90 acres. There were 193 leases from individual tenants on the 81 telecommunication sites. This is a slight increase over FY 2022, in which there were 79 sites, with 295 leases spanning 88 acres.

8.2c Grazing Leases and Range Permits

Most grazing on DNR-managed land takes place on non-forested state trust lands east of the Cascade crest on lands that are not managed under the HCP. Some grazing is selectively allowed on state trust lands managed under the HCP in both eastern and western Washington.

- In eastern Washington, state trust lands are grazed under grazing permits or range leases.
- In western Washington, state trust lands are grazed only under a few leases (no permits) that cover a very small total area.

Table 8.2c summarizes grazing permits and grazing leases for FY 2023.

Table 8.2c: Grazing leases and range permits on forested HCP lands in FY 2023 by HCP planning unit. There are no range permits offered on westside forested HCP lands.

HCP PU		Grazing Lease acres	Range Permit acres
Westside	Columbia	0	-
	North Puget	0	-
	OESF	0	-
	South Coast	89	-
	South Puget	0	-
	Straits	0	-
Eastside	Chelan	3,590	0
	Klickitat	9,558	35,203
	Yakima	65,036	48,911
Total		78,274	84,114

8.2d Oil and Gas Leases

Oil and gas leases allow a lessee to reserve the right to explore for underground deposits. They also give the lessee the sole and exclusive right to drill, extract, or remove oil and gas. Any proposed on-the-ground activities must undergo State Environmental Policy Act (SEPA) review, and the lessee must have a DNR-approved plan of operations and the proper drill permit. Regulations exist to protect water and

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air quality, and any exploration holes must be plugged following use. In 1996, there was one active oil and gas lease involving drilling on lands that are now managed under the HCP; the well was abandoned and plugged, and **as of FY 2023** there have not been any since that time.

8.2e Mineral Prospecting Leases and Mining Contracts

Like oil and gas leases, mineral prospecting leases are exploration agreements that allow a lessee to search for mineral deposits. They are allowed for a period of up to seven years and may encompass up to 640 acres. A mineral prospecting lease must be converted to a mining contract before the lessee can begin active mining operations. Before any surface-disturbing work is conducted, the lessee must submit a plan of operations for review and approval and may be subject to SEPA review, depending on the type of exploration activity proposed. When the HCP was written in 1996, there were no active mining operations (i.e., mineral extraction) on lands managed under the HCP, and **as of FY 2023**, there have been none since that time.

8.2f Special-Use Leases

Special-use leases are issued for a wide variety of uses on state trust lands and are a “catch-all” for leasing activity that does not fall under other program leasing categories. Examples include commercial recreation facilities, colleges or schools, minor non-commercial recreational activities, and governmental or public use facilities. Special use leases rarely include major urban commercial development or aquatic lands. These leases are sometimes utilized for “interim uses,” and, in those instances, might contain language that allows early termination should DNR identify a “higher and better use” of the land. **There were no special use leases in FY 2023.**

8.2g Valuable Materials Sales

DNR sells rock, sand, and gravel (valuable materials) through public auctions and direct sales. Contracts awarded through the public auction process are subject to review and approval by the Board of Natural Resources. DNR maintains many small rock pits on state land that are primarily used to construct forest roads during timber sales. Companies that purchase DNR timber sales may be permitted to use existing rock pits or develop new ones according to specifications in each contract.

In FY 2023, DNR had four active sand, gravel, and rock contracts continuing on lands managed under the HCP, totaling approximately 669 acres¹. One of these, Livingston Quarry (with approximately 346¹ acres of HCP-covered land), is in the process of final reclamation, and is no longer actively mined. The majority of the disturbed area of Livingston Quarry is outside of the HCP area. These contracts are approved by the Board of Natural Resources and awarded through a public auction process. All contracts that include HCP lands contain provisions for HCP compliance and protection.

In addition to the four FY 2023 contracts listed in Table 8.2.G, DNR occasionally sells valuable material through one-time direct-sale agreements, which allow removal of a small amount of a resource. Any material of value that can be removed from the property may be sold per RCW79.15.050 via direct sale, if the appraised value is under \$25,000. This includes timber, biomass, firewood, or other resources in

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which a purchaser is interested. Direct sales are typically negotiated by each region and do not require Board of Natural Resources approval.

Table 8.2g: Sand, gravel, and rock contracts active in FY 2023.

Lease Name	HCP PU	Commodity	Acres ¹	Estimated Volume Sold (tons)
Jordan Road	North Puget	Sand, gravel	40.85	10,000,000
Livingston Quarry	Columbia	Rock, Sand, & Gravel	345.59	0 (reclamation only)
Kilowatt Quarry	Klickitat	Rock, Sand, & Gravel	13.67	135,000
High Rock	North Puget	Rock, Sand, & Gravel	268.71	12,200,000
Total			668.82	22,335,000

¹ Acreage is determined by intersection of GIS polygons from "Spatial NaturE – Current Uplands Encumbrances (with NaturE Data)" and "HCP Lands" layers loaded from agency core QDL. Some encumbrance polygons in GIS might differ from what is in contracts, however HCP land area is not included in contracts. Values determined by this method differ from those in the prior year's summary for the same agreements. Furthermore, total contract area is greater than actual areas of disturbance. The actual values are not readily determinable given the available resources. Therefore, total acreage likely does not accurately reflect the impact to HCP lands.

8.3 Recreation

Appendix: Recreation and the HCP

Public recreation is allowed on forested state trust lands so long as it is compatible with state laws, the objectives of the [Policy for Sustainable Forests](#), and the HCP. Sanctioned recreational activities include activities such as hiking, biking, horseback riding, off-road vehicle use, hunting, fishing, and camping.

DNR develops recreation plans for many of the areas it manages to select appropriate sites and activities that are compatible with conservation objectives and have *de minimis* impact on species of concern (HCP, IV. 199). Plans are developed with the extensive involvement of local recreation groups and the public, many of whom also volunteer to help maintain recreation sites.

In calendar year 2023, recreation staff began developing an Outdoor Access & Responsible Recreation (OARR) Strategic Plan. The Commissioner of Public Lands directed the recreation program to create the plan in response to a 21% increase in recreation use on DNR lands during the COVID-19 pandemic (from 2019 to 2020; [report by Earth Economics](#)). Recreation field staff continue to observe increasing recreation each year use post-pandemic. The OARR Strategic Plan is estimated to be complete by the end of 2024. Information on the plan is available at the [OARR website](#).

Table 8.3a provides links to all current and expired recreation plans.

Table 8.3a: Recreation Plans by HCP Planning Unit

Recreation Plan	Status	Year Adopted	Plan Duration (years)	HCP Planning Unit
Baker to Bellingham Non-Motorized Recreation Plan	Active	2019	10-15	North Puget
Morning Star Trails Plan	Active	2018	10-15	North Puget
Snoqualmie Corridor Recreation Plan	Active	2015	10-15	South Puget
Teanaway Community Forest Management Plan	Active	2015	10	Yakima
Naneum Ridge to Columbia River Recreation and Access Plan	Active	2015	10-15	Yakima
Green Mountain and Tahuya State Forests Recreation Plan	Active	2013	10-15	South Puget
Reiter Foothills Forest Recreation Plan	Active	2010	10-15	North Puget
Ahtanum State Forest Recreation Plan	Active	2010	10-15	Yakima
Western Yacolt Burn Forest Recreation Plan	Expired	2010	10	Columbia
Capital State Forest Recreation and Public Access Plan	Expired	2005	10	South Coast, South Puget

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The recreation program manages 180 sites (including 80 campgrounds), maintains more than 1,200 miles of designated trails, and annually adds more trails and improves recreation sites. Table 8.3b lists the acreage of sanctioned recreation area by DNR upland region.

*Table 8.3b: Sanctioned Recreation Acreage by DNR Upland Region. *Southeast region acreage includes an estimated 31,000 acres in the Manashtash Ridge dispersed recreation area.*

Region	Acres
Northeast	742
Northwest	241
Olympic	115
Pacific Cascade	158
South Puget Sound	987
Southeast	32,422*

Recreation Highlights

Highlighted recreation related projects for each management region in calendar year 2023 are summarized below.

Northwest Region

With an increase in garbage dumping over the past several years, staff are dedicated to keeping state lands clean and safe. Abandoned vehicles and trailers, trash, and human and equine waste were removed from the Harry Osborne Forest and Les Hilde Trailhead weekly to reduce the impact of pollution on nearby creeks and improve recreationalist’s experience.



NW Region staff remove an abandoned trailer full of garbage and drug paraphernalia from the Harry Osborne Forest roadway in 2023. Photo: Dan DeVoe.

Olympic Region

The recreation team worked with DNR’s maintenance and operations crew (RCO funded), the Washington Conservation Crew (WCC), and adopt-a-trail volunteers to complete safety projects and promote environmental stewardship. For instance, at the Lyre River Campground, staff completely rebuilt an ADA platform adjacent to the Lyre River. The platform was reconstructed with TREX style composite decking which lasts longer and requires almost no maintenance, eliminating the need for cleaning chemicals and preservatives.



Olympic Region TREX ADA platform at the Lyre River CG. Photo: Justin Zarzeczny.

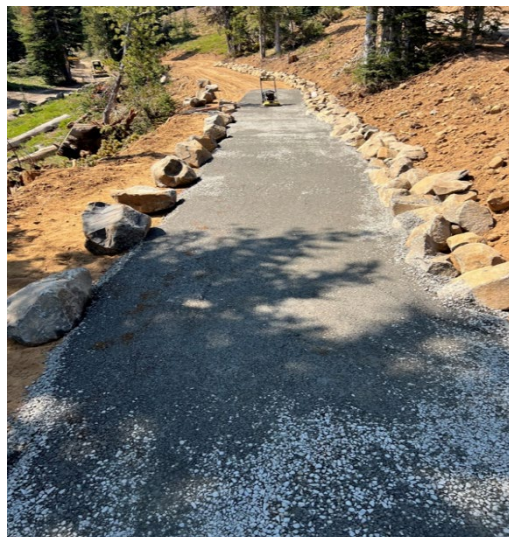
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Pacific Cascade Region

Pacific Cascade Region's Recreation Program replaced two aged outhouse structures and two new outhouses were installed at [Winston Creek Campground](#) in Lewis County. Outhouses were built by Cedar Creek Corrections and installed by PC Region Recreation Staff and WCC.



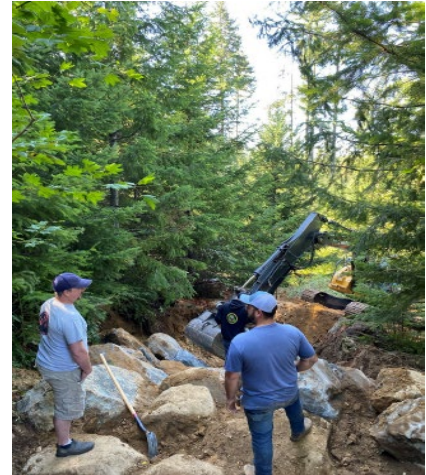
WCC and PC Recreation Staff install new outhouses at Winston Creek. Photo: Sharon Steriti



Construction of the new ADA-accessible trail to Eagle Nest Vista viewpoint. Photo: Jeff Jones

South Puget Sound Region

In partnership with Washington Off Highway Vehicle Alliance and Watch This Fourwheelerz, South Puget Sound Region's Recreation Program completed maintenance at Elbe ORV Campground and Trails. They conducted routine maintenance on 7 bridges and 13 miles of ORV trail including fallen tree removal, brushing, tread and drainage maintenance, and signage. A total of 1,387 tons of rock and gravel were used: 575 tons of gravel were placed on campground overflow/day use parking area, 240 tons of gravel were placed in 7 campsites and parking areas, and 572 tons of trail hardening rock on trail segments.



Volunteers place rocks on ORV segments. Photo: Joe Chavez

Southeast Region

Southeast Region's Recreation Program built and installed kiosks at all 24 major land block entrances across 5 counties (Skamania, Klickitat, Yakima, Kittitas and Chelan) and completed a directional sign plan into Bird Creek and Island Camp Campgrounds and Island Camp Cabin. Staff also assembled and installed 12 kiosks (4 in Glenwood, 6 in Buck Creek, 2 in Trout Lake) and developed a sign plan, ordered signs, and installed new directional signage and recreation site entrance signs. It was a group effort by Noel Kruse, Jarod Whaley, Ryan Schreiner and Klickitat District Staff.

Appendix

A.1 State Trust Lands HCP Overview

What is the State Trust Lands Habitat Conservation Plan (HCP)?

Washington's [*State Trust Lands Habitat Conservation Plan \(HCP\)*](#) is an ecosystem-based forest management plan that helps DNR develop and protect habitat for at-risk species while carrying out forest management and other activities on the state trust lands it manages. This long-term plan outlines how DNR will provide habitat for species such as the northern spotted owl, marbled murrelet, and riparian-dependent species like salmon and bull trout, which are listed as threatened or endangered under the federal Endangered Species Act. Strategies range from passive (i.e., protecting unique habitats such as cliffs and springs) to active (e.g., thinning forests to speed habitat development). Each strategy is written as an integrated management approach, in which commercial forest stands are managed to provide both revenue and ecological values.

An HCP is required to obtain an incidental take permit. Incidental take means harming or killing individuals of a listed species "if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity," such as a timber harvest ([*16 U.S. Code 1539 \(a\)\(1\)\(B\)*](#)).

By meeting the terms of the HCP and incidental take permit, DNR fulfills obligations under the Endangered Species Act (ESA). The HCP and incidental take permit provide DNR the stability and flexibility needed to meet fiduciary and ecological responsibilities as a trust lands manager, which include providing a perpetual source of revenue to beneficiaries concurrent with developing a healthy, resilient forest ecosystem capable of supporting native species. The HCP was signed in January 1997.

Lands Covered by the HCP

DNR manages approximately 2.4 million acres of forestland statewide. Of this, the HCP guides management of approximately 1.9 million acres of forestland within the range of the northern spotted owl (*Strix occidentalis caurina*). To manage these areas more effectively and efficiently, DNR divided this area into nine planning units (Figure A.1) primarily based upon large watersheds.



Figure A.1: HCP-covered lands are divided into 9 planning units based upon large watersheds. Lands marked “outside of owl range” are not covered under the State Trust Lands HCP.

Implementation of the HCP conservation objectives for these nine planning units is often grouped into three broad areas based upon regional ecological considerations and management objectives. These general groupings are:

- five westside planning units except the OESF (HCP, p. IV.3) (North Puget, South Puget, Straits, South Coast, and Columbia planning units)
- the OESF, also located west of the Cascades (HCP, p. IV.86), and
- three eastside planning units (HCP, p. IV.19) (Chelan, Yakima, and Klickitat planning units).

DNR provides [GIS data for lands covered by the HCP](#) to allow for public analysis and to facilitate comparisons with relevant GIS layers maintained by the Services.

What does this HCP protect?

The core of the State Trust Lands Habitat Conservation Plan is its four detailed conservation strategies for (i) northern spotted owls, (ii) marbled murrelets, (iii) riparian areas, wetlands and salmon, and (iv) other species of concern and uncommon habitats. Through these conservation strategies, the HCP outlines protection for habitat for northern spotted owls, marbled murrelets, and riparian-dependent species like salmon, habitat for other animal and plant species listed as threatened or endangered by federal or state governments, habitat for unlisted plant or animal species declining in number that could be listed at some future time, uncommon habitats and habitat elements (talus fields, caves, cliffs, oak woodlands, large snags, balds, mineral springs, and large, structurally unique trees) that support the various species dependent upon them, old growth forests in the five habitat conservation planning units in western Washington, and unstable slopes.

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A.2 Conservation Objectives for ESA-Listed and Other Species

The HCP includes habitat conservation strategies for the northern spotted owl, the marbled murrelet, riparian areas, and other species of concern. These four strategies are individually described in the HCP, but each is linked to and benefits from the other strategies.

A.2.1 Northern Spotted Owl Conservation Strategy

NSO Types of Management Areas

DNR is committed to providing habitat to help maintain nesting and foraging areas for northern spotted owls and to facilitate the owl's movement through the landscape. When the HCP was developed, DNR identified DNR-managed lands that were most important to northern spotted owl conservation. Through HCP research and monitoring commitments, DNR is working to develop a better understanding of what constitutes functional northern spotted owl habitat and to learn which silvicultural techniques create owl habitat.

Currently, NSO management areas include the following types:

Nesting, roosting, and foraging (NRF) management areas: Areas likely to provide demographic support and contribute to maintaining species distribution. Demographic support is the contribution of individual, territorial northern spotted owls or clusters of northern spotted owl sites to the stability and viability of the entire population. Maintenance of species distribution supports the continued presence of a northern spotted owl population in as much of its historic range as possible (HCP, p. IV.1). Nesting, roosting, and foraging management areas on the westside were identified in the North Puget, South Puget, and Columbia planning units.



Northern spotted owl. Photo: Teodora Minkova

Dispersal management areas: Areas important for facilitating northern spotted owl dispersal (movement of young owls from nesting sites to new breeding sites). Dispersal management areas on the westside were identified in the North Puget, South Puget, and Columbia planning units.

OESF management area: DNR-managed lands in the OESF. Refer to [NSO Conservation in the OESF Planning Unit](#) later in this section for more information.

Owl area: In 2006, DNR designated an additional type of NSO management area called an "owl area." Owl areas are intended to sunset when the commitments of the Settlement Agreement are met. Owl areas are lands outlined in section I.C.1 of the Settlement Agreement *Washington Environmental Council, et al. v. Sutherland, et al.* (King County Superior Court No. 04-2-26461-8SEA, vacated April 7, 2006). Owl Area management ended on December 3, 2019 when the BNR approved Resolution #1560, adopting a new sustainable harvest level, thus terminating the Settlement Agreement.

Each type of NSO management area is managed for specific habitat classes, and each habitat class includes specific habitat types. Table A-2.1a provides habitat classifications and types for each westside NSO management area.

Table A-2.1a: Habitat Classifications and Types for Westside NSO management areas.

NSO Management Area		Habitat Class	Habitat Type
NRF		NRF habitat	High-quality habitat
			High-quality nesting
		Sub-mature habitat	Sub-mature
Dispersal	All westside planning units except S. Puget	Dispersal habitat	High-quality nesting
			High-quality habitat
			Sub-mature habitat
		Dispersal habitat	
		Dispersal	
	South Puget HCP Planning Unit only	Dispersal habitat	Movement, roosting, and foraging (MoRF) plus habitat
			High-quality nesting
		Movement plus habitat	Young forest marginal
			Movement
			Sub-mature
OESF	Old forest habitat	Old forest	
		High-quality nesting	
		Type A	
		Type B	
	Young forest habitat	Sub-mature	
		Young forest marginal	

With the adoption of RS-FRIS, queries were slightly modified to account for the higher precision of RS-FRIS data and match wording in the HCP (HCP p. IV.11-12).

Table A-2.1b includes the definitions of each habitat type, as well as the queries DNR uses to identify it using RS-FRIS data. Updated queries include:

- In Type A and Type B habitat, canopy closure has been updated to “>70” (from “≥70”) because the wording of the HCP is “greater than” (not greater than or equal to).
- In Type A and Type B habitat, “Primary species >10% and primary species ≤80% (multispec=yes)” has been updated to “Secondary species is not null.”
- The height requirement for snags has been removed because RS-FRIS does not contain individual tree data.

- “Canopy layers ≥ 2 ” now comes directly from RS-FRIS data instead of an FVS derivation.

Table A-2.1b: NSO Habitat Types, Definitions, and Data Queries.

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used
High-Quality Nesting	At least 31 trees per acre are greater than or equal to 21 inches diameter at breast height (dbh) with at least 15 trees, of those 31 trees, per acre greater than or equal to 31" dbh	(Live trees $\geq 21"$ diameter class) ≥ 31 trees per acre and (Live trees $\geq 31"$ diameter class) ≥ 15 trees per acre and
	At least 12 snags per acre larger than 21" dbh	(Snags $\geq 21"$ diameter class) ≥ 12 trees per acre and
	A minimum of 70% canopy closure	Canopy closure ≥ 70 and
	A minimum of 5% ground cover of large woody debris	(Down wood $\geq 4"$ diameter class) $\geq 2,400$ ft. ³ per acre
	At least three of the 31 trees $\geq 21"$ dbh have broken tops	Not in query
Type A	A multi-layered, multispecies canopy dominated by large ($\geq 30"$ dbh) overstory trees (typically 15–75 trees per acre)	Canopy layers ≥ 2 and Secondary species is not null and (Live trees $\geq 30"$ diameter class) ≥ 15 trees per acre and ≤ 75 trees per acre and
	Greater than 70% canopy closure	Canopy closure > 70 and
	More than two large snags per acre, 30" dbh or larger	(Snags $\geq 30"$ diameter class) ≥ 2.5 trees per acre and
	Large accumulations of fallen trees and other woody debris on the ground	(Down wood $\geq 4"$ diameter class) $\geq 2,400$ ft. ³ per acre
	A high incidence of large trees with various deformities such as large cavities, broken tops, and dwarf mistletoe infection	Not in query
Type B	Few canopy layers, multispecies canopy dominated by large (greater than 20" dbh) overstory trees (typically 75–100 trees per acre, but can be fewer if larger trees are present)	Canopy layers ≥ 2 and Secondary species is not null and (Live trees $\geq 20"$ diameter class) ≥ 75 trees per acre and ≤ 100 trees per acre and
	Greater than 70% canopy closure	Canopy closure > 70 and
	Large (greater than 20" dbh) snags present	(Snags $\geq 20"$ diameter class) ≥ 1 tree per acre and
	Accumulations of fallen trees and other woody debris on the ground	(Down wood $\geq 4"$ diameter class) $\geq 2,400$ ft. ³ per acre
	Some large trees with various deformities	Not in query
MoRF	Forest community dominated by conifers, or in mixed conifer/hardwood forest, community composed of at least 30% conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)	(Live conifers $\geq 4"$ diameter class) $\geq 30\%$ of all live trees per acre and
	At least 70% canopy closure	Canopy closure ≥ 70 and

Appendix

Conservation Objectives

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used
	Tree density between 115 and 280 trees greater than 4" dbh per acre	(Live trees ≥ 4" diameter class) ≥ 115 and ≤ 280 trees per acre and
	Dominant and co-dominant trees at least 85' tall	(Largest 40 live trees per acre) ≥ 85' tall and
	Minimum of 5% ground cover of large down woody debris	(Down wood ≥ 4" diameter class) ≥ 2,400 ft. ³ per acre and
	At least three snags or cavity trees per acre that are at least 15" dbh	(Snags ≥ 15" diameter class) ≥ 3 trees/acre and
	At least two canopy layers	Canopy layers ≥ 2
Sub-Mature	Forest community dominated by conifers, or in mixed conifer/hardwood forest, community composed of at least 30% conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)	(Live conifers ≥ 4" diameter class) ≥ 30% of all live tree/acres and
	At least 70% canopy closure	Canopy closure ≥ 70 and
	Tree density of between 115 and 280 trees greater than 4" dbh per acre	(Live trees ≥ 4" diameter class) ≥ 115 and ≤ 280 trees per acre and
	Dominant and co-dominant trees at least 85' tall	(Largest 40 live trees/acre) ≥ 85' tall and
	At least three snags or cavity trees per acre that are at least 20"	(Snags ≥ 20" diameter class) ≥ 3 trees per acre and
	Minimum of 5% ground cover of large down woody debris	(Down wood ≥ 4" diameter class) ≥ 2,400 ft. ³ per acre
Young Forest Marginal (Same as Sub-Mature Except for Snag and Down Wood Requirements)	Forest community dominated by conifers, or in mixed conifer/hardwood forest, community composed of at least 30% conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)	(Live conifers ≥ 4" diameter class) ≥ 30% of all live trees per acre and
	At least 70% canopy closure	Canopy closure ≥ 70 and
	Tree density between 115 and 280 trees greater than 4" dbh per acre	(Live trees ≥ 4" diameter class) ≥ 115 and ≤ 280 trees per acre and
	Dominant and co-dominant trees at least 85 feet tall	(Largest 40 live trees/acre) ≥ 85' tall and
	Snags greater than or equal to 2 per acre (greater than or equal to 20 inches dbh and 16" tall) OR ≥ 10% of the ground covered with 4" diameter or larger wood, with 25–60% shrub cover	(Snags ≥ 20" diameter class) ≥ 2 trees per acre or (Down wood ≥ 4" diameter class) ≥ 4,800 ft. ³ per acre
Movement	Canopy closure at least 70%	Canopy closure ≥ 70 and
	Quadratic mean diameter of 11" dbh for the 100 largest trees per acre in a stand	(Largest 100 live trees per acre) ≥ 11" quadratic mean diameter (QMD) and
	Forest community dominated by conifers, or in mixed conifer/hardwood forest, community composed of at least 30% conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)	(Live conifers ≥ 4" diameter class) ≥ 30% of all live trees per acre and
	Tree density no more than 280 trees per acre ≥ 3; 5" dbh	(Live trees ≥ 4" diameter class ≤ 280 trees per acre and
	Top height of at least 85 feet (top height is the average height of the 40 largest diameter trees per acre)	(Largest 40 live trees per acre) ≥ 85' tall
	At least four trees per acre from the largest size class retained for future snag and cavity tree recruitment	Not in query
Dispersal	Canopy cover at least 70%	Canopy closure > 70 and

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used
	Quadratic mean diameter of 11" dbh for 100 largest trees per acre in a stand	(Largest 100 live trees per acre) \geq 11" QMD and
	Top height of at least 85'	(Largest 40 live trees per acre) \geq 85' tall
	At least four trees per acre from the largest size class retained for future snag and cavity tree recruitment	Not in query
Old Forest	Stands classified as the old forest habitat type were identified through implementation of the interim marbled murrelet conservation strategy. As part of the strategy, DNR conducted map and field reviews to delineate remnant patches of older forest to estimate how much potential murrelet habitat was present in the OESF. Although more than 40,000 acres were initially delineated for the purposes of eventually conducting murrelet surveys, the stands also coincided with unknown and suitable NSO habitat. In 2005 and 2006, during the Settlement Agreement negotiations, the Settlement Agreement Partners agreed to include those 40,000+ acres of older forest stands as the old forest habitat type, a fourth habitat type in the old forest habitat class.	

[Back to HCP Report -- 2.1 NSO Conservation](#)

NSO Habitat Thresholds

Within each NSO management area, DNR tracks habitat using spotted owl management units (SOMUs).

In most HCP planning units, SOMUs are derived from 1997 watershed administrative units (WAUs) and in some cases modified, in accordance with the HCP, to improve conservation and management capability. For eastside dispersal management areas, SOMUs are derived from $\frac{1}{4}$ townships.

In the OESF HCP Planning Unit, SOMUs are derived from landscape planning units, not WAUs. (The OESF is divided into 11 landscape planning units, which are administrative areas designated primarily along watershed boundaries.)

In the South Puget HCP Planning Unit, SOMUs are based on designated dispersal management landscapes. Dispersal management landscapes are used only in the South Puget HCP Planning Unit and were defined through forestland planning.

For the Klickitat HCP Planning unit, SOMUs are based on sub-landscapes, which are defined in [HCP Amendment No. 1, April 2004](#). Sub-landscapes are only used only in the Klickitat HCP Planning Unit.

The NSO conservation strategy in the HCP involves maintaining thresholds of habitat in each SOMU. Most designated nesting, roosting, and foraging, and dispersal SOMUs have a 50 percent overall habitat threshold.

For the OESF and South Puget HCP Planning Units, habitat thresholds have two objectives. For example, the OESF has a 40 percent overall habitat threshold objective, which is further defined as restoring and maintaining at least 20 percent of each SOMU as old forest habitat. In the South Puget HCP Planning Unit, dispersal management areas have a 50 percent overall threshold, 35 percent of which is MoRF-plus habitat, and 15 percent of which is Movement-plus habitat.

Table A-2.1c describes habitat thresholds for selected HCP planning units.

Table A-2.1c: Habitat Thresholds by HCP Planning Unit.

HCP Planning Unit	Habitat Threshold		Habitat Classification	Habitat Types
OESF		At least 20%	Old forest Habitat	Old forest

HCP Planning Unit	Habitat Threshold		Habitat Classification	Habitat Types
	40% of each SOMU			High-quality nesting
				Type A
				Type B
	20%	Young forest habitat	Sub-mature	
			Young forest marginal	
South Puget	50% of each NRF SOMU		High-quality habitat	High-quality nesting
				Type A
				Type B
		Sub-mature habitat	Sub-mature	
	50% of each dispersal SOMU	At least 35%	MoRF plus habitat	High-quality nesting
				Type A
				Type B
			MoRF	
		15%	Movement plus habitat	Sub-mature
				Young forest marginal
	Movement			
All Other Westside Planning Units	50% of each NRF SOMU		High-quality habitat	High-quality nesting
				Type A
				Type B
		Sub-mature habitat	Sub-mature	
	50% of each dispersal SOMU		High-quality habitat	High-quality nesting
				Type A
				Type B
			Dispersal habitat	Sub-mature
				Young forest marginal
			Dispersal	

In general, harvest activities must not increase the amount of time required to achieve habitat goals beyond what would be expected in an unmanaged stand. To ensure that procedures are being followed and goals are being met, DNR tracks the types and amounts of silvicultural activities in designated nesting, roosting, and foraging, and dispersal management areas.

NSO Conservation in the OESF Planning Unit

The HCP describes the management approach for the OESF as “unzoned,” meaning that special zones are not set aside for either ecological values or revenue production. The goal behind this experimental management approach is to learn how to integrate revenue production and ecological values across state trust lands in the OESF.

The OESF has fixed geographic features that require special management considerations. Examples include riparian areas, wetlands, potentially unstable slopes, and talus fields. Therefore, DNR currently uses the term “integrated” instead of “unzoned” to describe the management approach for the OESF.

Under this approach, DNR does not designate nesting, roosting, or foraging, or dispersal areas. Instead, in each of the OESF’s 11 SOMUs, DNR restores and maintains the following minimum habitat thresholds: 40 percent northern spotted owl habitat, of which at least 20 percent is old forest habitat, and the

remaining 20 percent is structural habitat or better. This strategy, which restores northern spotted owl habitat capability, is based on working hypotheses concerning the necessary quality, quantity, and distribution of habitat.

In October 2016, DNR adopted the [OESF Forest Land Plan](#), which guides management of more than 270,000 acres of forestland on the Olympia Peninsula. DNR's approach to assessing and mapping the current extent of NSO habitat for the OESF Forest Land Plan involved modeling numerous forest attributes from 2009 to 2109, including the presence of snags and down wood, which had been previously included as static features in NSO habitat models. Modeling snags and down wood allowed DNR to achieve greater accuracy in mapping NSO habitat across the OESF.

NSO Conservation in the Klickitat Planning Unit

In the Klickitat HCP Planning Unit, many stands are overstocked with tree species that are susceptible to stand-replacing fires, drought, disease, and insect infestations. In addition, some lands originally designated as nesting, roosting, or foraging management areas are not — nor will they ever be — capable of sustaining northern spotted owl habitat. This made the original habitat goal for this unit difficult to achieve.

In April 2004, DNR implemented an amended spotted owl conservation strategy ([HCP Amendment No.1](#)) to address these issues in the Klickitat HCP Planning Unit. This amended strategy involves designating four sub-landscapes within the planning unit and using field assessments, forest inventory data, and spotted owl demography data to create habitat targets for each sub-landscape.

In addition, DNR renamed dispersal management areas as desired future condition (DFC) management areas. Klickitat DFC management areas have the same habitat commitments as dispersal management areas, but they are managed by vegetation series with the goal of maintaining 50 percent of each vegetation series, by sub-landscape, in a mature DFC (at least 60 years old). Areas incapable of growing and sustaining habitat and those better suited for a different habitat classification have been reclassified.

DNR also adjusted the Klickitat HCP Planning Unit boundaries to exclude approximately 23,000 acres of dispersal management area. These acres, which are located north of Yakama Nation lands, are now part of the Yakima HCP Planning Unit.

A.2.2 Marbled Murrelet Conservation Strategy

Abbreviated information on critical concepts (P-stage, adjusted acres, metered acres, long term forest cover, occupied sites and buffers, and special habitat areas) is provided here. For full descriptions, see the MM Amendment references provided in each description below.

P-stage

P-stage is a habitat classification system used in the development of the Marbled Murrelet Long-Term Conservation Strategy. It assigns a numeric value to forest stands based on the probability of their use by marbled murrelets for nesting. P-stage is based on a mathematical model of marbled murrelet nesting habitat as it relates to stand development in natural forests and is intended to generalize and classify levels of habitat quality as they relate to forest stand characteristics. P-stage is constructed and

used in a way that incorporates the uncertainty between occupancy and actual nest sites. In the MM Amendment, stands are grouped by varying probabilities of occupancy into six classes: 0.25, 0.36, 0.47, 0.62, 0.89, and 1.0. Refer to MM Amendment Appendix C, Attachment C-3 for a detailed description of the P-stage model.

Adjusted Acres

Adjusted acres refer to a quantity of marbled murrelet habitat (P-stage, in acres) that has been discounted or “adjusted” for factors that might reduce the benefit of that habitat to the marbled murrelet. Examples include considerations such as whether the acres are close to a forest edge that might attract predators, the distance from occupied sites, and whether the habitat is likely to be subject to natural or anthropogenic disturbance.

Total “gross” or “raw” acres of habitat with P-stage values are estimated using DNR forest inventory. The total raw acres within each P-stage category (0.25, 0.36, 0.47, 0.62, 0.89, and 1.0) are then multiplied by their respective P-stage values, converting them to “adjusted acres,” which incorporates habitat quantity and quality, including edge effects, into a single unit of measurement.

Metered Acres

As outlined in the MM Amendment (page 32), DNR will delay (or “meter”) harvest of 5,000 adjusted acres of marbled murrelet habitat that would otherwise be authorized to harvest until the end of the first decade of implementation following the adoption of the MM Amendment (December 3, 2029). Metering was established to maintain habitat capacity while additional habitat develops under the MM Amendment. The specific location and quality of habitat to be metered will be determined at DNR’s discretion as outlined in the MM Amendment (page 32).

Long-term Forest Cover

Long-term forest cover (LTFC) refers to lands on which DNR maintains and grows forest cover for conservation purposes, including habitat conservation for the marbled murrelet, through the life of the HCP. MM Amendment Appendix C, Attachment C-4 provides a focus paper covering LTFC in depth. LTFC includes both murrelet-specific conservation areas and other areas that have multiple conservation objectives. All areas of long-term forest cover outside of occupied sites, occupied site buffers, and special habitat areas are referred to as “other LTFC.” Some elements of other LTFC have been verified in the murrelet GIS layer and do not need to be verified on the ground. These elements will be updated periodically when the marbled murrelet GIS layer is updated, and include:

- Natural Area Preserves and Natural Resources Conservation Areas
- High-quality northern spotted owl habitat, including Old Forest Habitat in the Olympic Experimental State Forest as of November 2018
- Gene pool reserves
- Field-verified old growth
- Northern spotted owl nest patches

Field-verified elements of State Lands (local) Knowledge GIS layer include balds, caves, cliffs, talus

slopes, wetlands, and special ecological features protected under DNR's Policy for Sustainable Forests. Remaining elements of other LTFC need to be verified on the ground. LTFC associated with riparian areas, wetlands, and unstable slopes are examples requiring field inspections to verify boundaries.

Occupied Sites and Buffers

Occupied sites are habitat patches of varying size in which murrelets are assumed to nest, based on field observations. The MM Amendment (page 26) further clarifies that "occupied sites" means those sites that were delineated by the Science Team and described in Section 2.1 of the FEIS and are depicted in MM Amendment, Appendix B, Figure B-2. Occupied sites are recorded in the DNR marbled murrelet GIS layer. Based on the Science Team-delineated marbled murrelet occupied sites, there are 59,331 acres within 388 occupied sites.

As outlined in the MM Amendment (page 27), a 328-foot (100-meter) buffer is placed on the outer extent of all occupied sites. This buffer is recorded in the DNR marbled murrelet GIS layer. The MM Amendment establishes 32,777 acres of buffer around the 388 occupied sites.

Special Habitat Areas

Special habitat areas (SHAs) are designed to increase marbled murrelet productivity by reducing edge and fragmentation (see MM Amendment page 28). Special habitat areas that do not contain occupied sites contain high-quality, current and modeled future murrelet habitat, and non-habitat that may function as security forest. As mentioned in the MM Amendment (page 30), security forest protects habitat from deleterious edge effects, including microclimate change, windthrow, predation, and disturbance.

The SHA network comprises 20 areas that together include 46,925 acres, and all but one of the SHAs contain at least one occupied site (MM Amendment page 29). SHAs range in size from 338 acres to 7,549 acres and average 2,346 acres (MM Amendment, Appendix A, Table A-6). Occupied sites and current habitat comprise 28,823 acres of the total acres within SHAs, another 5,052 acres is future habitat, and all but 1,014 acres of the remaining acreage is either security forest or future security forest.

[Return to HCP Annual Report – 2.2 Marbled Murrelet Conservation](#)

A.2.3 Riparian Conservation Strategy

The overall HCP Riparian conservation strategy incorporates multiple strategies, regulations, and policies, including:

- the Riparian Conservation Strategy, which applies to the five westside HCP planning units other than the OESF,
- the OESF Riparian Conservation strategy,
- Headwaters Conservation Strategy, and
- the Eastside Forest Practice regulations and policies.

Westside Riparian Conservation Strategy

The westside riparian conservation strategy requires restoration and maintenance of riparian ecological processes in support of quality salmonid habitat quality. The westside conservation strategy objectives are (1) to restore and maintain freshwater habitat for salmonids on state trust lands, and (2) to contribute to the conservation of other aquatic and riparian obligate species (HCP, p. IV.55).

Management standards require DNR to designate riparian management zones (RMZs) and wetland management zones (WMZs) which provide clean water, shade, and large logs for streams, and to plan roads and other activities in ways that minimize sediment delivery to streams and wetlands. Protection of salmonid freshwater habitat indirectly protects additional aquatic and riparian obligate species.

Westside Riparian Conservation Strategy Implementation: the Riparian Forest Restoration Strategy (RFRS)

As part of the westside riparian conservation strategy, a [Riparian Forest Restoration Strategy \(RFRS\)](#) was developed by a technical review committee consisting of staff from DNR, NOAA, USFWS, Northwest Indian Fisheries Commission, and WDFW. It was adopted in 2006. The RFRS outlines the implementation procedures for the HCP Riparian Conservation Strategy.

Under the RFRS, DNR designs riparian forest thinnings to restore older forest structure and species composition in areas where historic timber harvest created even aged and overstocked stands. Riparian harvests provide growing space to encourage more complex stand structure, maintain overstory tree growth, enhance understory development, provide large wood to streams, and support hydrologic connectivity of wetlands.

OESF Riparian Conservation Strategy

The OESF riparian conservation strategy was designed specifically to minimize the potential for mass wasting and windthrow events, two of the greatest influences on the OESF, under the hypotheses that protecting riparian areas from these disturbances would also protect other key ecological processes.

This management strategy employs interior-core buffers and exterior wind buffers. The interior-core buffer is stream-adjacent, and the exterior wind buffer is adjacent to the interior-core buffer. Together, they comprise the riparian management zone (RMZ). RMZs are not harvest deferrals; they are areas managed to meet DNR's measurable objectives and minimize the effects of upland management activities on riparian areas. Limited regeneration harvest is allowed inside the interior-core buffer when determined necessary by a tactical model. Other management activities allowed in interior-core include thinning, restoration, herbicide application, brush and bough harvest, pruning, research and monitoring projects, and operation trials.

Headwaters Conservation Strategy

In 2007, DNR collaborated with the Services and the scientific community to develop a draft Headwaters Conservation Strategy to guide forest management near Type 5 streams and complete the HCP riparian conservation strategy. However, completion of the Headwaters Strategy stalled. It is a priority of DNR to complete this strategy.

[Return to HCP Annual Report – 2.3 Riparian Conservation](#)

A.3 Adaptive Management and Conservation Strategies

Monitoring and research provide information necessary to improve the implementation and effectiveness of the HCP conservation strategies and help document the efficacy of implementation. The information gained can be used to adjust or adapt DNR's management practices as needed.

Since the 1997 HCP adoption, scientific understanding of the ecology of northern spotted owl, marbled murrelet, other species protected by the HCP and how land management affects them has advanced and is continually updated. Monitoring and research evaluate strategy implementation and effectiveness, test promising alternatives to current approaches, and contribute to the ecological foundation of habitat management.

The adaptive management process outlined in the HCP allows changes forest management techniques and activities when research and monitoring programs or new information from scientific literature indicate that such changes are warranted. For example, adaptive management has resulted in management modifications such as the [Riparian Forest Restoration Strategy](#), the [HCP Amendment No. 1, April 2004](#), and a [legacy tree procedure for eastern Washington](#) that protects old-growth trees and stands.

A.3.1 Adaptive Management and Conservation Strategies

Adaptive management is a way to manage natural resources when knowledge of ecosystem functions or the effects of human actions is incomplete. New scientific developments and information obtained through research and monitoring can identify changes in DNR management practices that would help address the needs of specific species or improve habitat conditions. For this reason, the HCP includes provisions for a dynamic, science-based adaptive management process that allows for continual improvement of management strategies and practices. The adaptive management process includes setting research priorities, developing study plans, managing research projects, reviewing results, changing DNR's forest management practices if necessary, and monitoring management activities to inform continuous improvement.

Currently, adaptive management is implemented through two processes: the State Lands Adaptive Management Program and the OESF adaptive management process. These processes are closely linked, though they differ in scope and level of formalization. The State Lands Adaptive Management Program includes activities throughout DNR managed lands, while the OESF adaptive management process focuses on activities in the OESF. Unlike the statewide program, the OESF process is guided by an administrative procedure, adopted in FY 2017, which describes the steps of the process and the responsible parties. Development of the OESF Forest Land Plan resulted in the separate OESF adaptive management process, as this process is an integral part of the management of the OESF.

[Back to the HCP Annual Report – Adaptive Management](#)

A.3.2 Implementation, Effectiveness, and Validation Monitoring

A science-informed adaptive management program relies primarily on research and monitoring to provide new, relevant information for increasing confidence in current management or developing new management options. A common organizational framework for forest management monitoring programs consists of three types of monitoring:

- **Implementation monitoring** determines whether the HCP is being implemented properly on the ground, and is sometimes referred to as compliance monitoring.
- **Effectiveness monitoring** determines whether the HCP strategies are producing the desired habitat conditions.
- **Validation monitoring** determines whether a certain species responds to the desired habitat conditions as anticipated.

Implementation Monitoring

The HCP requires DNR to monitor its implementation of the conservation strategies to ensure that the physical outcomes of management activities match DNR's intention as described in the HCP. Conservation strategies are selected for implementation monitoring based on a number of criteria. These criteria may include the level of risk or uncertainty associated with the strategy, the level of management discretion, the cost and timeliness of monitoring results, new information, and input from the Services and DNR managers. Examples of monitoring projects include monitoring large, structurally unique trees left on timber sales following harvest, monitoring for compliance with the northern spotted owl conservation strategy, and monitoring of management activities in Wetland Management Zones (WMZs) and Riparian Management Zones (RMZs).

Effectiveness Monitoring for HCP Conservation Strategies

Effectiveness monitoring documents changes in habitat conditions, including general forest structure and specialized habitat features that result from timber harvest and other forest management activities. Only habitat areas addressed by the conservation strategies are monitored for effectiveness.

Information from this type of monitoring increases DNR's ability to understand the influence of land management on aquatic and upland habitat conditions, and effectively implement conservation strategies to reach HCP goals.

Effectiveness Monitoring for the NSO Conservation Strategy

The objective of northern spotted owl research and effectiveness monitoring is to help DNR better understand the habitat needs of the northern spotted owl and how to effectively manage forest stands and landscapes to create and sustain suitable habitat. The effectiveness monitoring program evaluates whether the HCP strategies and associated silvicultural treatments maintain or enhance nesting, roosting, or foraging, and dispersal habitat. Effectiveness monitoring also supports the adaptive management goals for the northern spotted owl conservation strategy, such as developing better stand- and landscape-level habitat definitions.

The NSO Effectiveness Monitoring Program currently consists of two primary components:

- **Long-term tracking of the effects of variable density thinnings on habitat structure in stands designated as habitat.** This monitoring was initiated in 2004-07 across five VDT units in the North Puget (Whitehorse Flat timber sale), South Puget (Big Beaver and Cougarilla timber sales), Columbia (Lyons Share timber sale), and Klickitat (Loop timber sale) HCP planning units. The study includes an untreated control and two or three replications of treated stands at each site. All stands were measured before and immediately after treatment.

Staff conducted the five- to seven-year remeasurement of all five sites between 2013 and 2015. Data analysis is currently underway to compare various metrics (e.g., tree density, canopy closure and cover, snags, and down wood) to measurements taken before and immediately after treatment. The final stage of this analysis is processing historic aerial images to produce photogrammetric detection and ranging (PhoDAR)-based metrics of canopy cover for the pre- and post-treatment measurements, allowing consistent comparison of canopy cover and closure between pre- and post-treatment measurements, and all subsequent remeasurements.

- Landscape-scale monitoring of basic habitat indicators across the entire westside HCP land base.

DNR is also conducting ongoing research projects related to NSO effectiveness monitoring:

- Measurement of the response of habitat features to small-gap creation within thinned stands.
- Comparison of the spatial structure of both thinned and unthinned stands designated as habitat to late-successional reference stands known to function as NSO habitat.

[Back to the HCP Annual Report – NSO Effectiveness Monitoring](#)

Effectiveness Monitoring for Riparian Silviculture

The objective of the DNR Effectiveness Monitoring Program for riparian silviculture is to determine whether various restoration thinning treatments are resulting in riparian habitat conditions that support salmon recovery efforts and contribute to the conservation of other riparian and aquatic species. Thinning treatments are consistent with the RFRS and are applied in cooperation with the DNR timber sales program.

The Effectiveness Monitoring Program for Riparian Silviculture uses an active study approach in which habitat metrics are measured before and after treatment. Treatments consist of thinning to Curtis relative density 40 (RD40) or 50 (RD50), thinning to RD50 with intentional canopy gaps (RD50 gap), or no thinning (REF). DNR established six monitoring sites between 2003 and 2008 in the OESF, South Puget, and North Puget HCP planning units. To assess changes in riparian habitat conditions, habitat metrics are measured at each monitoring site prior to harvest, after harvest, and periodically thereafter.

[Back to the HCP Annual Report – Effectiveness Monitoring for Riparian Silviculture](#)

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

The key objectives of the Status and Trends Monitoring Program are to provide empirical data to evaluate DNR's progress in meeting the HCP riparian conservation objectives and to reduce uncertainties around the integration of habitat conservation and timber production. The study's main hypothesis is that implementation of the HCP riparian conservation strategy for the OESF allows natural

processes of ecological succession and disturbance to improve habitat conditions across managed watersheds over time. Starting in 2012, DNR has monitored stream reaches and adjacent riparian forests in 50 Type 3 watersheds representative of the OESF and four reference sites in the Olympic National Park. In 2018, DNR added six unmanaged or minimally managed watersheds on the western Olympic National Forest to the network of reference sites.

Nine habitat attributes — including stream temperature, shade, and microclimate — are field-sampled at reach level. Watershed-level disturbances such as windthrow, timber sales, and road management are sampled remotely and through operational records. When integrated with information on management activities in the OESF, the monitoring data from this project will allow DNR to make inferences about the effects of specific forest management operations on habitat, thus helping DNR fulfill its commitments for effectiveness monitoring and implementation of adaptive management under the HCP. The project is conducted and funded by DNR in collaboration with the USFS Pacific Northwest Research Station and the Olympic National Forest.

[*Back to the HCP Annual Report – Status and Trends Monitoring*](#)

Validation Monitoring

The HCP requires that DNR conduct riparian validation monitoring across the conglomeration of state-managed lands in the OESF. Validation monitoring is defined in the HCP as monitoring “to evaluate cause-and-effect relationships between habitat conditions resulting from implementation of the conservation strategies and the animal populations these strategies are intended to benefit (V.2).” The riparian conservation strategy for the OESF in the HCP was designed to protect or improve habitat for viable salmonid populations. The strategy consists of:

- interior-core buffers to protect soils on floodplains and unstable stream banks, incised stream valleys, and adjoining unstable slopes,
- exterior, or wind buffers adjacent to interior buffers, as needed, to protect against blowdown,
- a comprehensive program of road management, maintenance, and improvement including stabilizing and decommissioning particularly risky roads, and
- protecting forested wetlands.

Riparian validation monitoring helps determine whether the riparian conservation strategy is maintaining or improving salmonid habitat and expressing stable or positive effects on salmonids as anticipated in the HCP.

The RVMP is an observational study to monitor 50 fish-bearing watersheds within the OESF plus 10 reference watersheds located in the OESF, the Olympic National Park, and the Olympic National Forest. These 60 watersheds are the same as those studied in the DNR Status and Trends Monitoring of Riparian and Aquatic Habitat project. Due to logistics, not all 60 watersheds can be sampled within a single summer. Instead, 20 watersheds are sampled annually. The remaining 40 watersheds are sampled on a two-year rotation, with 20 of these watersheds sampled in even years, and the other 20 sampled in odd years.). In addition, a section of the Clearwater River, a Type 1 stream, is snorkel-surveyed to assess DNR management on a larger stream of the OESF.

[Back to HCP Annual Report – Validation Monitoring](#)

OESF Research and Monitoring Program

The Olympic Experimental State Forest (OESF) is designated with the objective of learning how to integrate revenue production (primarily through timber harvesting) and ecological values (primarily habitat conservation). New scientific knowledge is applied by DNR to improve land management practices through a formal process of adaptive management. Knowledge gained is expected to benefit other land managers facing similar challenges of meeting multiple objectives in a working forest.

The OESF Research and Monitoring Program has a variety of objectives:

- To implement and coordinate research and monitoring projects on the OESF.
- To facilitate the adaptive management process at DNR.
- To foster science communication and outreach.
- To manage research and monitoring information.
- To establish and maintain research partnerships with universities, colleges, federal agencies and other organizations.
- To collaborate with local land managers, tribes, environmental organizations and regulators on research and monitoring projects.
- To provide educational opportunities.

Current and Past Research and Monitoring in the OESF

Information on research in the OESF can be found on the OESF website. These projects are focused on DNR's needs for revenue generation, environmental protection, and long-term sustainability. The majority of the past research and monitoring activities are listed in the OESF [Research and Monitoring Catalog](#), published by DNR in 2008.

Adaptive Management

Adaptive management is an HCP commitment. In the [OESF Forest Land Plan](#), it is defined as a formal process for continually improving management practices by learning from the outcomes of operational and experimental activities. Adaptive management in the OESF focuses on integration of revenue production and ecological values, and its theoretical foundation, goal, and scope are described in the OESF Forest Land Plan. DNR follows an administrative procedure for adaptive management in the OESF, which describes the systematic process and identifies the parties responsible for implementation.

Communication, Outreach, and Education

DNR shares the scientific knowledge developed in the OESF, builds public confidence in the sustainability of forest management practices and the effectiveness of the HCP conservation strategies through a myriad of communication strategies.

The OESF Research and Monitoring Program and the University of Washington ONRC jointly publish a biannual electronic newsletter ("The Learning Forest") to share scientific knowledge about sustainable

land management on the Olympic Peninsula. The newsletter is distributed in the spring and fall to about 180 subscribers and to DNR and University of Washington students and staff. Current and past issues are posted on the [OESF](#) website.

Each year, the OESF and UW ONRC hold a focused science conference. The purpose of the annual OESF Science Conference is to communicate results of research and monitoring activities taking place in the OESF and relevance to land management uncertainties faced by DNR and other land managers. The conference takes place in the spring season in Forks, Washington, and is attended by natural resource specialists, land managers, students, scientists, and the public.

Several pages on the [OESF](#) website contain information about the OESF, ongoing research and monitoring projects, news, and recent publications. The program's informal outreach and communication activities include presentations at scientific and public forums, scientific publications, project reports, booths at college fairs, field trips, and other activities.

Educational opportunities in the OESF include internships for undergraduate and graduate students, field trips for K-12 and college students, and lectures and presentations at colleges and universities. The topics covered in these activities range from specific ecological questions to descriptions of environmental monitoring and adaptive management.

Information Management

The OESF research tracking database includes metadata on ongoing research and monitoring projects related to natural resource management and ecology conducted by DNR or external parties on the OESF. The database stores all scientific and administrative documents on project implementation, as well as references to project GIS data in DNR's statewide research areas GIS layer.

Individual project data are available upon request. More information, including contacts, can be found on the [OESF](#) website.

Research Partnerships

DNR maintains two formal agreements related to the OESF:

- A memorandum of understanding with USFS Pacific Northwest Research Station for OESF participation in the Experimental Forest and Range Network (a national network of 80 forests and ranches). It encourages collaboration between OESF and USFS scientists and increases the OESF's visibility nationwide.
- A memorandum of understanding between DNR, University of Washington Olympic Natural Resources Center (ONRC), Olympic National Forest, and the USFS Pacific Northwest Research Station. It advances collaboration between the four parties on research, monitoring, and adaptive management of forest ecosystems on the Olympic Peninsula.

Multiple informal partnerships and collaborations are organized and maintained on a project-by-project basis.

[Back to the HCP Annual Report – 3.5 The OESF](#)

[Back to the HCP Annual Report – 3.0 Adaptive Management](#)

A.4 Forest Inventory — RS-FRIS Comprehensive Review

[*Back to the HCP Annual Report – 4.0 Forest Inventory*](#)

DNR’s forest inventory program provides current information about the characteristics of forest resources across approximately 2.1 million acres of DNR-managed forestland. Forest inventory is an important tool in forest management and is fundamental to agency decision-making and revenue generation. It provides key data for a variety of DNR’s core business functions including timber sale planning, habitat classification, and monitoring and research.

DNR’s forest inventory system consists of a suite of geospatial and tabular data at a variety of scales, from measurements of individual trees collected on field plots, to plot- and stand-level summaries of field data, to high-resolution predictive statistical models across DNR’s forested land base. Measured, predicted, and derived attributes include a suite of approximately 40 forest characteristics for both live and dead trees including: species, diameter, height, volume (total and merchantable), basal area, relative density, canopy cover and closure, biomass, carbon, and down and dead woody material.

History

DNR’s forest inventory program began in 1990 when the agency initiated a program known as the Forest Resource Inventory System (FRIS). FRIS was a large-scale field sampling effort intended to sample DNR’s entire forested land base with one plot every five acres, and report conditions at the stand level.

FRIS was designed to sample site-specific forest conditions within designated inventory units. Through a process of aerial photo interpretation, DNR analysts divided the forested land based into areas of homogeneous forest conditions. Approximately 40,000 forest inventory units were manually delineated, each considered a contiguous forest community sufficiently uniform in topography and vegetative characteristics to be distinguishable from adjacent communities. Inventory units were generally limited to areas between 5 and 100 acres.

A systematic grid of sample plots was located within each inventory unit. Using a combination of fixed-area and variable-radius plots and transects, field crews measured site and vegetative characteristics including live and dead trees, plant associations, ground vegetation, and down dead woody material. Plot data were summarized and a suite of over 100 forest inventory attributes were reported for each inventory unit. Both geospatial and tabular data were distributed agency wide through DNR’s corporate GIS and database systems.

FRIS was designed such that each stand would be revisited and re-measured every 10 years. In the intervening decade, DNR released periodic updates at approximately 2–4 year intervals by using the Forest Vegetation Simulator (FVS), a growth and yield model developed by the U.S. Forest Service, to “grow” each stand forward in time.

Field sampling under FRIS continued for more than two decades and provided a wealth of detailed information to its end users. To date, FRIS remains one of the largest-scale forest inventories ever implemented worldwide, representing a considerable investment in both time and resources. The

intended 10-year re-measurement cycle required sampling over 200,000 acres each year, but in the late 2010s, the recession led to budget shortfalls and field sampling efforts were reduced.

With limited staff capacity, DNR was unable meet its sampling targets and only about 60 percent of the total forested land base was measured. To compensate, DNR relied on a statistical method known as imputation to fill the gaps for un-sampled areas. Imputation is a technique by which attributes are transferred from known sites to unknown sites based on available, though often limited, information. In addition, DNR relied on FVS to grow sampled data forward in time beyond the 10-year measurement cycle. For some areas, more than two decades passed since field plots were installed.

The combination of extensive imputation and repeated use of models to grow data forward began to introduce more error, yielding a data set that gradually became less of a measured inventory and more a modeled one. Coupled with the high costs of labor-intensive sampling, DNR sought a more accurate and economically sustainable solution.

Transition to RS-FRIS

In 2013, DNR began developing a new inventory system known as the Remotely Sensed Forest Resource Inventory System (RS-FRIS). RS-FRIS relies largely on remotely sensed data instead of field plots. Although implemented primarily as a cost-saving measure, the use of remotely sensed data has additional benefits:

- (1) it allows the agency to leverage and stay abreast of cutting-edge, emerging technologies, and
- (2) DNR's inventory coverage has expanded considerably, with a new inventory produced every two years using newly acquired remotely sensed data rather than relying on growth and yield models to grow data forward in time.

RS-FRIS combines plot measurements taken in the field with data from remote sensing. The field plots

are similar in nature to the legacy FRIS plots and consist of a series of nested fixed-area plots and transects. They are installed on a statewide, systematic grid but at much greater spacing than FRIS plots. The sampling framework is known as a panel design in which a series of repeated sampling passes or "panels" are conducted each year. As each panel is completed, the plot grid becomes denser. Each panel includes approximately 600 field plots and requires about 18 months to complete. DNR and contract field crews are expected to complete the eighth panel in calendar year 2023, with a resulting plot density of approximately one plot every 450 acres. As of February 2023, 4,375 plots have been installed (Figure A.4a).

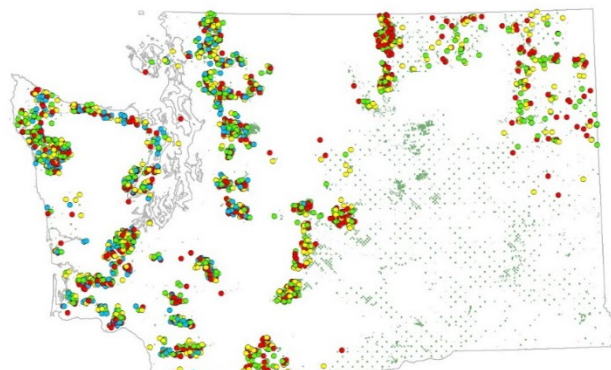


Figure A.4a: Location of RS-FRIS Inventory Plots Completed on DNR-Managed Forest Land. Each plot is color-coded by panel. Map: Jeff Ricklefs.

In contrast with FRIS, which summarized stand-level conditions directly from a dense network of plot data, RS-FRIS uses field data primarily to train statistical computer models. The models predict a suite of

forest attributes at a fine scale across DNR's forested land base where remotely sensed data is available. DNR analysts used what is known as the "area-based approach" to fit a series of regression models that relate measurements from field plots to characteristics of remotely sensed data. The model output is a high-resolution GIS raster file for each inventory attribute with a pixel size of 1/10 acre.

RS-FRIS leverages two types of remotely sensed data: LiDAR and DAP. LiDAR (Light Detection and Ranging) is a type of remote sensing that uses aircraft-mounted, aerial scanning lasers to measure the three-dimensional configuration of the forest in fine detail. DAP (digital aerial photogrammetry) produces a similar three-dimensional product of the forest canopy but relies on stereo imagery instead of laser measurements (Figure A.4b).

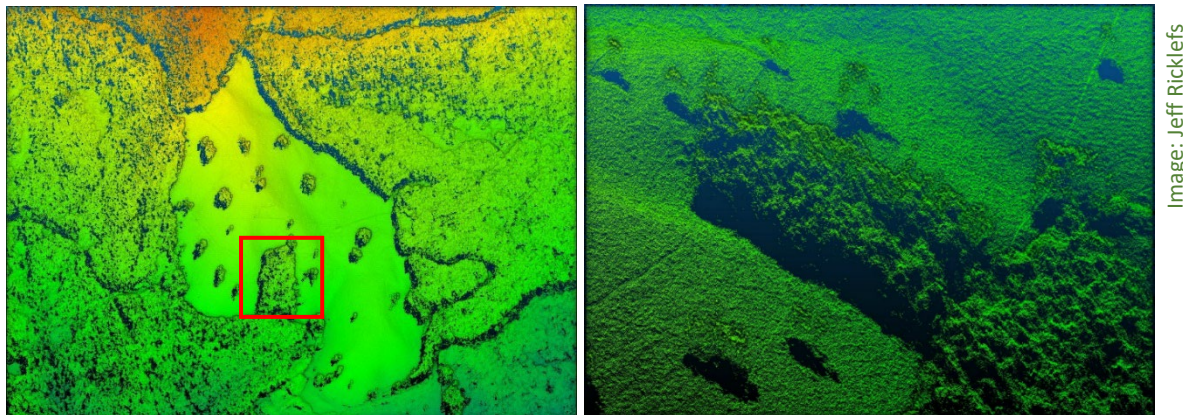


Figure A.4b: Example of Remotely Sensed Digital Aerial Photogrammetry Data Products. A three-dimensional surface model constructed from stereo imagery using photogrammetric software is pictured at left. An oblique view of the area in red is shown at the right. This image depicts a riparian buffer and leaf trees, illustrating the detail revealed in a DAP data set.

In 2022, DNR released the fourth iteration of its inventory, RS-FRIS 4.0, which reports forest conditions as of 2019 and 2020 based on a combination of LiDAR ground models and DAP imagery. Earlier versions of RS-FRIS reported conditions as of 2013 (RS-FRIS 1.0), 2015 (RS-FRIS 2.0), and 2017 (RS-FRIS 3.0). Stereo imagery flown in 2021 and 2022 is currently being processed for use in RS-FRIS 5.0. With each subsequent release, coverage has expanded, and RS-FRIS 4.0 covers approximately 99.9 percent and 98.3 percent of DNR-managed forestlands in western and eastern Washington, respectively.

Data Accuracy and Validation

RS-FRIS relies on the relationship between characteristics of the remotely sensed data and plot-level attributes measured on the ground. Remotely sensed data such as LiDAR and DAP measure height and canopy cover very accurately, and derivatives of these metrics serve as the primary predictors in the RS-FRIS models. In general, RS-FRIS model performance can be characterized as good to excellent. Models for forest attributes that are well correlated with height or canopy cover perform especially well. For example, models for merchantable and total volume, quadratic mean diameter, and basal area have an excellent fit to measured field conditions.

Attributes such as down woody debris and snags are the most difficult to predict with great precision. By nature, these phenomena are somewhat stochastic, patchy in distribution, highly variable, and not well correlated with overstory conditions. Moreover, they present a very small to non-existent signature in

the remotely sensed data. Developing models for these attributes is challenging and model performance can be characterized as moderate.

In addition to the field plots used to train the models, RS-FRIS includes a separate set of validation plots installed across the state used to test the accuracy of RS-FRIS predictions. Validation plots were installed in “blocks” representing areas of contiguous forest conditions and were used to test the performance of RS-FRIS models at the stand scale (Figure A.4c).

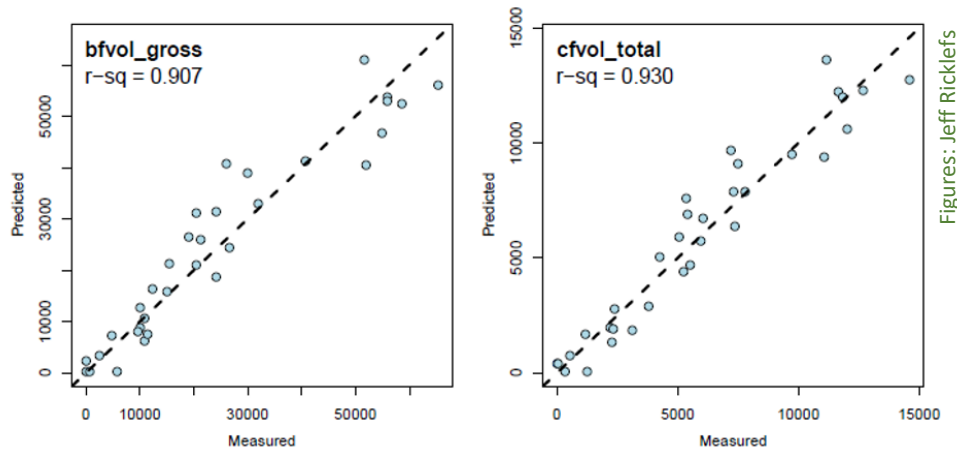


Figure A.4c: Results of RS-FRIS Validation for Merchantable Volume (Left) and Total Volume (Right). Each point shows stand-level summaries from a single validation block. Results from field measurements (x-axis) are compared to RS-FRIS model predictions (y-axis). The r-squared value indicates the correlation between the data sets, on a scale of 0 to 1. An r-squared value over 0.9 indicates excellent performance by these models.

Additional validation efforts include a comparison of cruise data from DNR’s timber sales program with RS-FRIS projections. Data from over one thousand timber cruises was analyzed and was found to correlate well with RS-FRIS. A third party, independent validation effort was also completed which involved installation of 1,800 plots in western Washington by a contractor. Field data was well correlated to projections from RS-FRIS 3.0.

Benefits and Applications

RS-FRIS provides multiple benefits to the agency, including expanded coverage, more frequent updates, and considerable cost savings compared to a traditional ground-based inventory such as FRIS. Large-scale acquisitions of remotely sensed data offer economies of scale, and the transition to an inventory based largely on remotely-sensed data has greatly reduced the amount of field work required. By adopting RS-FRIS, DNR estimates inventory costs have been reduced by at least 80 percent compared to FRIS.

DNR’s inventory program serves a variety of end users, including, but not limited to:

- foresters, who select areas for forest management activities,
- habitat biologists, who identify and classify habitat in accordance with the HCP,
- forest modelers, who make predictions of future forest conditions and calculate long-term decadal harvest volume targets, and

- environmental planners who develop long-term management plans.

DNR's inventory and photogrammetry programs have pioneered the creation and application of DAP for resource management on large scales. Potential future applications of DAP include quantifying biomass and carbon, prioritizing areas for forest health treatments, identifying stands that have experienced disturbance such as wildfire or disease outbreaks, and developing an algorithm for automated stand delineation.

RS-FRIS and NSO Habitat Delineation

When the HCP was developed, DNR identified areas on state-managed lands that were most important to northern spotted owl conservation. These designated NSO management areas are managed for certain habitat classes and types that are defined in the HCP (p. IV11–12) and [WAC 222-16-085](#).

To identify habitat types across state-managed forestland, DNR developed multiple queries that were applied to FRIS data. In 2017, during the transition to RS-FRIS, DNR made minor updates to the queries to reflect the attributes measured in RS-FRIS and better match the habitat definitions in the HCP. A list of updated queries used with RS-FRIS will be included in the FY 2020 HCP Annual Report.

Although the process of identifying NSO habitat based on definitions in the HCP is conceptually very similar between FRIS and RS-FRIS, the higher spatial precision of RS-FRIS data presented a unique challenge. A direct application of the habitat definitions to RS-FRIS data would result in a pixelated scattering of habitat in units as small as 1/10 acre. In order to identify habitat patches of ecologically meaningful sizes and configurations, RS-FRIS data were smoothed, and habitat patches were delineated using a derivation of the [PatchMorph algorithm](#).

RS-FRIS relies largely on remotely sensed data instead of field plots. With the adoption of RS-FRIS, DNR's inventory coverage has expanded considerably, and a new inventory is produced every two years using newly acquired remotely sensed data rather than relying on growth and yield models to grow data forward in time.

RS-FRIS predicts forest conditions using statistical models that relate field measurements to three-dimensional remotely sensed data (PhoDAR and LiDAR point clouds). RS-FRIS includes a combination of raster, vector (polygon), and point data. A suite of approximately 40 rasters report inventory attributes (e.g., volume, dbh, basal area, diameter) at 0.1-acre resolution. Attributes of each polygon (forest inventory unit) were populated using summaries (mean and median) of the underlying RS-FRIS rasters. Point data shows the location of field inventory plots and includes both tabular data and photographs (where available).

Earlier versions of RS-FRIS reported conditions as of 2013 (RS-FRIS 1.0), 2015 (RS-FRIS 2.0), and 2017 (RS-FRIS 3.0). With each subsequent release, coverage has expanded, and RS-FRIS 4.0, published internally in February 2022, covers approximately 99.9 percent and 98.3 percent of DNR-managed forestlands in western and eastern Washington, respectively.

NSO Habitat Queries to RS-FRIS

Under the previous Forest Resource Inventory System (FRIS), DNR developed and applied multiple queries to the Forest Resource Inventory System (FRIS) data to identify northern spotted owl habitat

types across state-managed forestland. With the transition to RS-FRIS complete, DNR made minor updates to the queries to reflect attributes measured in RS-FRIS and match the habitat definitions in the HCP ([HCP p. IV.11-12](#) and [WAC 222-16-085](#)).

The RS-FRIS transition applies only to four westside HCP Planning units (North Puget, South Puget, Columbia, and OESF). The Straits and South Coast do not require an RS-FRIS transition because there are no NSO dispersal or nesting-roosting-foraging management areas.

The timeline for reporting habitat percentages based on RS-FRIS in each HCP Annual Report mirrors the timeline for implementing RS-FRIS within DNR’s timber sales program:

- Prior to FY 2020, timber sales in westside planning units were sold using FRIS data. Similarly, HCP Annual Reports prior to FY 2020 reported NSO habitat percentages using FRIS data.
- In FY 2020, timber sales in the westside planning units (excluding the OESF) (i.e., North Puget, South Puget, and Columbia) were planned using RS-FRIS data. The FY 2020 HCP Annual Report began reporting habitat percentages using RS-FRIS data for the North Puget, South Puget, and Columbia HCP planning units.
- In FY 2021, timber sales sold in the OESF began using RS-FRIS data. The FY 2021 HCP Annual Report also reported habitat percentages with RS-FRIS data in the OESF.
- In FY 2022 and beyond, timber sales and HCP annual reports will all use RS-FRIS data.

Table A-4: RS-FRIS transition for delineation of percentages of NSO habitat

Fiscal Year	Inventory system	HCP Planning Unit
pre-FY 2020	FRIS	North Puget, South Puget, Columbia, OESF
FY 2020	FRIS	OESF
	RS-FRIS	North Puget, South Puget, Columbia
FY 2021	RS-FRIS	North Puget, South Puget, Columbia, OESF

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A.5 Land Transactions

DNR’s Land Transactions Program is designed to reposition state trust lands for better long-term management and increased revenue for each of the trusts. Repositioning simply means disposing of properties that do not fit DNR’s management strategies or objectives and acquiring replacement properties that are more suitable. When DNR sells parcels at public auction or transfers (sells) them to other public owners, the department uses the proceeds to acquire replacement lands for the trusts to keep the trust whole.

Land transactions affect the amount of habitat or potential habitat on state trust lands. Transactions may be carried out to consolidate state trust lands in certain areas. Consolidation allows for more cost-

effective management and offers opportunities to optimize trust revenue while maintaining habitat and allowing public recreation where appropriate. DNR often consolidates state trust lands by working with owners of adjacent lands to trade their properties for scattered parcels of state trust lands elsewhere.

Often, lands identified for disposal are better suited to other public benefits, such as parks or habitat for rare, native species. The department may transfer state trust lands out of trust status into protected status as a NAP or NRCA in the Natural Areas Program. DNR may also transfer state trust lands to other government agencies to be used as parks or open space or for public facilities. When this happens, the department compensates the trust at fair market value and acquires replacement properties to maintain trust assets over time. Acquired lands are assessed to determine if they should be included as HCP permit lands (managed subject to the commitments in the HCP). If they qualify, DNR determines whether they should be designated as northern spotted owl nesting, roosting, or foraging, or dispersal management areas. DNR also assesses their potential role in other HCP conservation strategies.

Some state trust lands have important social or ecological values. These state trust lands are best managed for protection of these special values and uses, rather than for income production. These lands may be candidates for the [Trust Land Transfer \(TLT\)](#) tool, which applies only to Common School trust lands, or the State Forest Trust Land Replacement Program (SFT), which applies only to State Forest trust lands. Through the TLT program, DNR transfers state trust lands to the Washington Department of Fish and Wildlife, the Washington State Parks and Recreation Commission, county governments, city governments, or DNR's Natural Areas Program. The value of the timber (which is not cut) is given to the Common School Construction Account, which helps fund K–12 schools statewide. The value of the land is used to purchase replacement property for the trust. State trust lands transferred to the Natural Areas Program contribute to the objectives of the HCP. State trust lands transferred to entities outside of DNR are evaluated for their HCP conservation value. If their conservation value is high, they are either not transferred or DNR issues a deed restriction stipulating their continued management under the HCP. Through the SFT program, DNR transfers State Forest trust lands in low-population, timber-dependent counties to NRCAs managed by the Natural Areas Program. To be eligible for SFT, the property must be encumbered by harvest restrictions due to species listed under the Endangered Species Act. The value of the uncut timber from each transferred property goes to the county where the land is located, and the land value is held in a replacement account which is used to buy forestlands for the State Forest trust.

[Back to HCP Annual Report – Land Transactions](#)

A.6 Silviculture

Silviculture is the art and science of managing forests to meet objectives. Through silviculture, DNR manages the density and composition of trees in the forest to provide both quality timber for harvest and ecological values such as habitat for threatened and endangered species, healthy watersheds, biodiversity, and resiliency to disease and insects.

DNR implements an array of silvicultural activities (harvest, regeneration, vegetation management, etc.). Which activities are implemented, when, and how often are determined through the silvicultural prescription.

A silvicultural prescription defines desired outcomes (objectives) and how DNR plans to accomplish them in a Forest Management Unit (FMU) over an entire rotation. An FMU is a connected area that is ecologically similar enough to be managed to meet common objectives. A rotation is the length of time between stand replacement harvests.

Silviculture Objectives

When writing a silvicultural prescription, DNR begins by understanding the unit's contribution to landscape-level objectives set by DNR policies, including the HCP and the [Policy for Sustainable Forests](#). Examples of landscape-level objectives include maintaining a certain percentage of the forested landscape as northern spotted owl habitat or maintaining enough hydrologically mature forest in a watershed to prevent periods of peak flow (periods of high stream flow after storm events).

DNR then applies specific "rotational objectives" to the unit in that context. For example, a unit that contributes to northern spotted owl habitat landscape objectives may have a rotational objective to "attain sub-mature nesting, roosting, or foraging habitat." Rotational objectives are based on the biological capability of the site, including the trees suitable to the site, the site's productive capacity, the presence or absence of competing vegetation, insect and disease issues, and other considerations. Financial and budget constraints also play a role in the selection of rotational objectives.

Selecting Silvicultural Activities

Once DNR defines the rotational objectives and threshold targets, the next step is to determine the sequence of silvicultural activities that are necessary to meet them. The frequency and type of activities DNR selects will depend on the biological capability of the site and the complexity of the prescription. Budget allocations and market conditions also influence the timing and extent of silvicultural activities chosen, and activities may be prioritized based on available resources and relative benefits. Other important considerations include market conditions, ecological constraints, operational constraints (like potentially unstable slopes), new and existing policies and procedures, and new scientific discoveries. As the stand grows, DNR periodically reassesses it to ensure it is on track to meet intended objectives.

Tracking Silviculture Activities

Land Resource Manager (LRM)

DNR tracks planned and completed silvicultural activities using a database called Land Resource Manager (LRM). LRM is a tabular database that contains information about the activities that DNR

implements on the landscape. For example, for a timber harvest, DNR uses LRM to track information such as harvest method and land class (riparian vs. upland area), or the density and species composition planted during a regeneration activity. In addition to tracking tabular data, LRM integrates a Geographic Information System (GIS) that allows for the spatial tracking of individual forest management activities on the landscape. The previous system used by DNR (Planning and Tracking, P&T), which supplied data for previous HCP Annual Reports until FY 2018, lacked the functionality to spatially track individual activities.

Year-to-year variation in the volume of timber harvest is common and is typically associated with variation in the level of silvicultural activity. For example, high stand-replacement harvest in one year will typically lead to more site preparation and planting in the next fiscal year, as well as increased levels of other activities in subsequent years. However, because of the possible lag time between when an activity is implemented and when it is recorded in LRM, it may be a year or more before changes in timber harvest volume and other activities are reflected in the number of acres summarized in this report.

Unmanned Aircraft Systems (UAS)

Throughout the life of a stand, DNR periodically conducts field surveys to assess stand conditions and evaluate the need for future treatment. DNR is beginning to use UAS to supplement or replace young stand surveys as UAS can provide a more cost-effective and safer way to collect data. Footage derived from UAS flights includes information on tree height and density, providing foresters with an additional decision-making tool to refine silviculture prescriptions.

Descriptions of Silviculture Activities

Timber Harvest

DNR tracks each of the following types of harvests:

- **Commercial thinning:** Commercial thinning generates revenue and is performed to meet a wide range of objectives, including improving the growth of the stand, enhancing stand health, reducing tree mortality, or accelerating the development of habitat. Regeneration of a stand is not an objective of thinning.
- **Variable density thinning:** Variable density thinning is a type of commercial thinning that creates a mixture of small openings (gaps), unthinned patches (skips), and varying stand densities to achieve specific objectives, such as accelerating development of a complex stand structure. Variable density thinning may also include treatments to create or encourage development of large down wood and snags.
- **Selective product logging:** This type of harvest removes trees of certain species and sizes that are highly valuable, such as trees that function well as utility poles or logs for cabins.



A variable density thinning in the OESF.

- **Seed tree intermediate cut:** A seed tree intermediate cut is the first in a series of harvests that is conducted as part of the even-aged seed tree silvicultural harvest system. The purpose of this harvest type is to provide a desirable seed source to establish seedlings. Typically, about 10 overstory trees per acre may be left following this harvest; once the new trees are established, some of these seed trees may be harvested in a seed tree removal cut.
- **Shelterwood intermediate cut:** This harvest is the first in a series of harvests conducted as part of the even aged shelterwood harvest system. The purpose of this harvest is to provide shelter (typically shade) and possibly a seed source for the seedlings that are regenerating in the stand. Compared to a seed tree intermediate cut, a shelterwood cut typically retains more overstory trees per acre following harvest; retained trees are generally dispersed across the stand. Once the new trees are established, some of these shelter trees may be harvested in a shelterwood removal cut.
- **Seed tree, shelterwood, or temporary retention removal cut:** In these cuts, some overstory trees retained in the earlier harvests are removed.
- **Uneven-aged management:** In uneven-aged management, trees are removed from a multi-aged forest stand while maintaining multiple age classes within that stand. Uneven-aged management is often used on sites with poor soil where intensive management is not cost-effective. This type of management might also be used in fire-prone areas to mimic the effects of periodic, lower-intensity fires that do not remove all trees.
- **Variable retention harvest:** Variable retention harvest is a type of regeneration (i.e., a stand-replacement) harvest. With this type of harvest, DNR removes most of the existing forest stand to make room for regeneration of a new stand, while leaving elements of the existing stand, such as down wood, snags, and live leave trees (trees that are not harvested), for incorporation into the new stand. Variable retention harvest is different from a clear-cut, in which all or nearly all the existing stand is removed.

Forest Site Preparation

After a stand replacement harvest and before planting the new stand, DNR may remove slash (residue of logging, such as tree limbs) and undesirable plants that would compete with seedlings for nutrients, water, and light. Site preparation may be performed during logging – for example, by pulling up and disposing of brush clumps, or after logging by piling and burning slash, manually cutting undesirable vegetation, applying herbicide to undesirable tree and brush species, or a combination of methods.

Forest Regeneration

Following a stand-replacing harvest, DNR establishes new stands by planting seedlings or allowing the site to seed naturally from adjacent stands or trees that are retained within the harvested area. DNR typically only tracks natural regeneration as an activity in LRM when the associated timber harvest Forest Practices Application has a natural regeneration plan; natural regeneration occurs following certain timber harvest methods, such as uneven-aged management, but these trees are tracked using stocking surveys over the life of the stand.

Vegetation Management

After the site has been planted but before the seedlings have become fully established, DNR may remove competing vegetation to give the new seedlings room to grow. Vegetation may be removed by hand, by mechanical means, or through application of herbicide. Vegetation management is done when competing vegetation will have a negative effect on the stand's ability to meet its objectives.

Pre-Commercial Thinning (PCT)

During pre-commercial thinning, DNR removes the less-desirable trees to maintain the growth and stability of the retained trees. PCTs are performed before the trees are large enough to be marketable. This type of thinning does not generate revenue, and cut trees are left on site to decompose.

PCT is needed in some stands to reduce high stem densities. When implemented within the optimal timeframe, this prescription increases the chances that stand development will lead to desired future forest conditions. Proper thinning helps maintain individual tree vigor and accelerates diameter growth, resulting in more rapid attainment of size requirements for product or habitat goals. PCT is a particularly important strategy for addressing forest health concerns, because maintaining lower stand densities with good individual tree vigor is important for making stands more resistant to insect attack. In addition, PCT improves height-to-diameter ratios, a measure of stem stability, reducing risk of windthrow or stem-buckling if partial cutting treatments are applied.

PCT does not immediately create habitat for endangered species such as the northern spotted owl or marbled murrelet. However, it can set thinned stands on a developmental trajectory that is more likely to produce future habitat because thinning accelerates the development of large, live trees with stable tree architecture.

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A.7 Forest Roads Program

Roads that are improperly constructed or maintained can negatively impact habitat in a number of ways. Such roads can increase the rates of slope failure, contribute sediment to streams, and block fish passages, all of which can potentially harm salmon and other aquatic and riparian-obligate species. Current road building and maintenance practices create better roads that minimize impacts while also allowing DNR to abandon or improve poorly built roads.

In 2001, Washington's state Forest Practices rules were updated to reflect the Forests and Fish legislation passed in 1999. This legislation required all large forest landowners to manage forest roads constructed or used for timber harvest and other forest activities after 1974 under an approved Road Maintenance and Abandonment Plan (RMAP) by July 1, 2006. The legislation also stipulated that all forest roads must be improved and maintained to the standards established in WAC 222-24 by 2016 then extended to 2021. DNR completed all of its state uplands RMAP work statewide by the deadline.

Under the HCP, DNR made a commitment to develop and institute a process to achieve comprehensive, landscape-based road network management. This plan is expected to be formalized in the next two years (2026). The major components of this process include the following:

- minimization of active road density,
- site-specific assessment of alternatives to new road construction (e.g., yarding systems) and the use of such alternatives where practicable and consistent with conservation objectives,
- baseline inventory of all roads and stream crossings,
- prioritization of roads for decommissioning, upgrades, and maintenance,
- identification of fish passage blockages caused by stream crossings, and prioritization of retrofitting or removal.

DNR routinely evaluates overall active road density through forestland planning. Forest Roads staff conduct site-specific assessments of alternatives to new road construction at the operational level when planning individual activities. DNR addresses the last three components of this process through implementation of RMAPs and inspection of our existing road network.

Easements and Road Permits

DNR grants access across its lands, and acquires access to its lands, through easements and road use permits.

- Easements are long-term (typically permanent) agreements in which property owners grant the rights to cross their land to another individual or entity. Easements are an interest in real property, and most transfer with the land, serving landowner after landowner. DNR also receives easements when it acquires lands.
- Road use permits are usually short-term rights that do not convey any interest in property and are revocable by the entity that grants them. Permits are generally non-transferrable.

DNR primarily grants easements and road use permits to other governmental entities for public roads and utilities, to forest and agricultural landowners for access to valuable materials such as timber or rock, and for other uses such as irrigation pipelines or railroads. The department acquires easements and road use permits from private individuals and government agencies to allow staff to access DNR-managed lands.

[Back to HCP Annual Report -- Forest Roads Program](#)

A.8 Natural Areas Program

DNR's [Natural Areas Program](#) protects outstanding examples of the state's extraordinary biodiversity. Lands managed under this program represent the finest natural, undisturbed ecosystems in state ownership and often have features unique to this region. The high-quality condition of these sites, and the broad diversity of ecosystems they represent, make them foundational to maintaining the resilience of Washington's natural heritage in the face of climate change.

The Washington State Legislature established the system of Natural Area Preserves (NAPs) in 1972 to protect the highest quality examples of native ecosystems, rare plant and animal species, and other natural features of state, regional, or national significance. The Legislature then established the system of Natural Resource Conservation Areas (NRCAs) in 1987 to protect areas that are a high priority for conservation because they contain critical wildlife habitat, prime natural features, or examples of native ecological communities. Together, these natural areas include Puget prairies, estuaries, native forests, bogs, ponderosa pine forests, shrub-steppe communities, alpine lakes and meadows, scenic vistas, and significant geological features, helping meet statewide conservation priorities. These areas provide opportunities for research, education and, where appropriate, allow low-impact public use.

Native Forests

Many of DNR's natural areas were established because of their high-quality native forest ecosystems, dominated by mature and/or late-seral forests. Late-seral forests and trees with potential nesting platforms are important to the northern spotted owl and the marbled murrelet. These native forests also represent some of the highest quality examples of globally imperiled forest ecosystems.

Estuaries

The Natural Areas Program protects five high-quality estuaries, including three on Washington's coast and two on the shores of the Puget Sound. These sites protect rare tidal wetland communities, providing important foraging and cover habitat for anadromous fish during the critical transition from freshwater to a marine environment. In addition, estuaries help dissipate potentially damaging wave energy, and provide a sink for sediments and waste from land and sea. Estuaries are some of the most biologically productive systems in the world.

Rare Species Protection

NAPs and NRCAs protect a broad representation of ecological communities and contribute to the conservation of many species, both listed and unlisted. For example, Mima Mounds NAP was originally established to protect unusual geologic formations and high-quality prairie habitat. Thirty-five years later, DNR learned that it also has the only known population of the ground-dwelling lichen *Cladonia ciliata* in the United States. Similarly, North Bay and Carlisle Bog NAPs were established to protect high-quality wetlands. It was later discovered that they both contain populations of the rare June's copper butterfly (*Lycaena mariposa junia*), formerly known as the Makah copper butterfly (*Lycaena mariposa charlottensis*).

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A.9 Recreation

When the HCP was published in 1997, DNR and the Services had determined that the impacts of current recreational activities were *de minimus* relative to the impact of timber management and that the development of future recreation sites must adhere to the riparian conservation strategy (HCP, IV. 199). The HCP also guides DNR to provide recreational opportunities that are consistent with the other conservation strategies outlined in the HCP.

The Recreation Program engages in a variety of activities that support compliance with the HCP and limit or reduce the impacts of recreational activities on northern spotted owl, marbled murrelet, and riparian habitats. Those activities include:

- Remove culverts that block fish passage or deliver sediment to streams.
- Install large culverts or bridges that allow fish passage and protect stream bank integrity (Figure 24).
- Remove or reroute both motorized and non-motorized trails away from riparian corridors and out of wetlands.
- Remove or relocate recreation sites in riparian areas.
- Control invasive plant species within designated recreation facilities.
- Locate trails away from wetlands and riparian corridors.
- Design trails to divert water runoff to the forest floor rather than nearby streams.
- Remove or relocate outhouses and restrooms.
- facilities in close proximity to riparian areas or within floodplains.
- Install gravel and regrade recreation facilities to better manage water runoff.
- Design facilities to limit access to environmentally sensitive areas.
- Provide regular maintenance on facilities and trails to minimize the impacts of high-volume use.
- Develop and install signage to educate the public about appropriate use of state trust lands.

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Glossary

A

Abandoned road: A road that is stabilized and removed from use to Washington forest practices standards, including removing water crossings, providing erosion control, and making the road impassable to vehicles.

Adaptive management: A process of periodically reviewing and adjusting management practices based on feedback from internal and external research and monitoring.

Adjusted acres, marbled murrelets: A quantity of marbled murrelet habitat (P-stage, in acres) that has been discounted or “adjusted” for factors that can reduce the benefit of that habitat to the marbled murrelet. Total “gross” or “raw” acres of habitat with P-stage values are estimated using DNR forest inventory. The total raw acres within each P-stage category (0.25, 0.36, 0.47, 0.62, 0.89, and 1.0) are then multiplied by their respective P-stage values, converting them to “adjusted acres,” which incorporates habitat quantity and quality, including edge effects, into one unit of measurement.

Aerial herbicide: Application of herbicides from a helicopter or plane to achieve site preparation or vegetation management objectives.

Age class: A grouping of trees in the same age group used to simplify data that describes age composition for a stand or landscape. Age classes are often divided into decadal groups to portray the distribution of tree ages within a stand or stand origin dates on a landscape.

B

Blowdown (windthrow): A tree that has been knocked over or had its top blown out by wind.

C

Cadaster: An official register of the ownership, extent, and value of real property in a given area, i.e. property lines.

Commercial thinning: Commercial thinning generates revenue and is performed to meet a wide range of objectives including improving stand growth or health, reducing tree mortality, or accelerating the development of habitat. Regeneration is not an objective of thinning.

Curtis relative density: See relative density.

D

dbh: Diameter at breast height, which is the diameter of a tree measured 4.5 feet above the ground on the uphill side of the tree.

de minimis: A legal term for a level of activity that is too small or insignificant to merit consideration.

Decommissioned road: A road made impassible to vehicles.

Desired future condition (DFC): A set of parameters that can be compared to current conditions, showing any management changes needed to achieve specific goals. In the Administrative Amendment to the Northern Spotted Owl Conservation Strategy for the Klickitat Habitat Conservation Plan Planning Unit, DFC habitat represents a sustainable set of stand characteristics (canopy closure level, maximum tree height, etc.) that could realistically be achieved in a 60-year-old stand that has been properly managed.

Direct sale: A one-time agreement which removes only small amounts (a maximum of \$25,000 in value) of a resource (e.g., gravel) from state trust lands and is not subject to public auction or advertisement.

Dispersal: The movement of juvenile, subadult, and adult animals from one sub-population to another. For juvenile spotted owls, dispersal is the process of leaving the natal territory to establish a new territory.

Dispersal Management Area (DISP): A management area designated for dispersal of spotted owls. For more details, see Table A-2.1 in the appendix of this document.

E

Easement: Permission given by one person or business to another, allowing one to access their property by crossing through property owned by the other.

Effectiveness monitoring: A system used to determine whether a management plan and its specific strategies are producing the desired habitat conditions.

Even-aged management: A set of final harvest systems defined as a method to “regenerate a stand with a single age-class” (Society of American Foresters). For purposes of managing forested state trust lands, even aged includes final harvest systems of seed tree, variable retention harvest, and shelterwood.

F

Fertilization: Ground or aerial-based fertilization of forest stands using chemical fertilizers or biosolids to enhance growth.

Forest management unit: A forested area with conditions that are ecologically similar enough to allow it to be managed to obtain specific objectives; the unit for which a silvicultural prescription is written.

Forest Practices: The administrative branch of DNR responsible for regulating forest management activities on all state and private forestlands.

G

Grazing lease: A DNR lease agreement covering smaller areas of land (as compared grazing permits) that includes a resource management plan to protect natural resources. It allows grazing at any time of year under the stipulation that the plan’s guidelines are followed.

Grazing permit: A DNR agreement covering large areas that includes a resource management plan specifically detailing the number of animals allowed and when the animals may be on the land.

Ground herbicide: Ground-based applications of herbicides used to achieve site preparation or vegetation management objectives. Ground herbicides allow application in smaller work areas, thus avoiding spraying areas where herbicides are not desired (e.g., wetlands, adjacent properties).

Ground mechanical: In forestry, using mechanized equipment to achieve site preparation objectives.

H

Habitat conservation plan: A long-term management plan authorized under the Endangered Species Act to conserve threatened and endangered species across a large landscape while allowing activities to occur under specific conditions.

Hand planting: In forestry, planting seedlings of various species or species mixes.

Habitat Conservation Plan permit lands: Lands that are managed subject to the commitments in the State Trust Lands Habitat Conservation Plan.

Headwater stream: A small, first- or second-order stream that forms the beginning of a river. It is often seasonal and forms where saturated ground flow first emerges as a recognizable watercourse.

High Quality Nesting Habitat: A designation of land type for northern spotted owl protection. For more details, refer to the appendix in this document, Table A-2.2.

I

Implementation monitoring: For the State Trust Lands Habitat Conservation Plan, a form of monitoring that determines whether a management plan or its components are implemented as written.

L

Large, structurally unique tree: A tree that is tall and/or has a large diameter and contains structural elements which are important for habitat such as a hollow trunk, broken top, open crown, or large, strong limbs.

Leave tree: A live tree left on a timber sale after harvest, intended to provide habitat and structure in the developing stand.

LIDAR: Light detection and ranging — a remote sensing technology that uses lasers to detect distant objects and determine position, velocity, or other characteristics by analyzing reflections. Uses include measuring tree canopy heights, making topographical maps, and mapping floodplains.

M

Metering, marbled murrelets: Delaying the harvest of some murrelet habitat (P-stage) that DNR otherwise would be authorized to harvest upon amendment of its incidental take permit. Metering maintains habitat capacity while new habitat develops under the Marbled Murrelet Long-term Conservation Strategy. Metered acres become available for harvest after the first decade following implementation (after December 3, 2029). Acres identified for metering can include habitat or non-habitat. Conservation measures for areas identified for metering apply to the entire area, not just murrelet habitat (P-stage) within those areas.

Multiple-pass removal: A field sampling method used to estimate fish populations in a stream. Nets are placed across a stream at the beginning and end of a reach (typically around 100 meters) to confine fish. Then, a backpack electrofisher is used to temporarily stun fish, which are captured, measured, and released.

N

Natural Area Preserve: A state-designated area that protects a high-quality, ecologically important natural feature or rare plant and animal species and their habitat. It often contains a unique feature or one that is typical of Washington state or the Pacific Northwest.

Natural regeneration: Allowing naturally produced seedlings to grow after harvest and produce a new forest without human intervention. DNR assesses success by a thorough regeneration survey of the stand.

Natural Resources Conservation Area: A state-designated area managed to protect an outstanding example of a native ecosystem or natural feature; habitat for endangered, threatened, or sensitive species; or a scenic landscape.

NaturE: The database that keeps track of all contracts and financial data on DNR managed lands.

Near-NRF, eastside: Mature forest condition in each vegetation series, but lacking a component such as canopy closure, top height, or snags, with respect to existing HCP NRF definitions. An expectation of the near-NRF definition is that this missing component will be created within 30 years from the date of the Klickitat Amendment (April 2004). Additional eastside-specific definitions can be found in the Klickitat Amendment at https://www.dnr.wa.gov/publications/lm_hcp_amendment1.pdf

Nesting platform, marbled murrelet: Any large limb or other structure at least 50 feet above ground and at least 7 inches in diameter. In DNR's HCP, platforms are counted in conifer trees only, and only if located within the live crown.

Nesting, roosting, and foraging (NRF) habitat: A management area comprising habitat with the forest structure, sufficient area, and adequate food source to meet the needs of a nesting pair of spotted owls. The forest structure consists of stands at least 70 years old that include a three-layer canopy of very large diameter trees (200+ years old) from the previous stand, large diameter trees (70+ years old), and small understory trees, along with snags and large down woody debris. For more details, see Table A-2.1 in the appendix of this document.

Next-best stands, westside except OESF and South Puget planning units: Within spotted owl management units that are below the habitat threshold, next-best stands are considered non-habitat, but are predicted to attain the structural characteristics that define northern spotted owl habitat either through passive or active management relatively sooner than other non-habitat stands. Next best stands count towards the target amount of suitable habitat but are still considered non-habitat. Remaining stands not identified as habitat or next best are available for the full range of silvicultural activities.

No-role lands: A term used by DNR's Land Transactions Program to refer to lands not designated as a nesting, roosting, and foraging, dispersal, or desired future condition management area and thus having no role in northern spotted owl management under the State Trust Lands Habitat Conservation Plan.

O

Oil and gas lease: An agreement that allows the leaseholder to reserve the right to explore for underground oil and/or gas deposits on state trust land. Before active drilling or thumping can occur, the proposal must undergo State Environmental Policy Act review and have an approved plan of operations.

Old Forest Habitat: A designation of habitat class in the OESF for northern spotted owl protection. This land class includes “high quality nesting”, “Type A”, and “Type B” habitat designations. Full details on the definition, and differences between this and “sub-mature forest” habitat, can be found in this document (Appendix Table A-2.2), or in the OESF land plan (Table 3.3, page 3-9).

Owl Area: In 2006, DNR designated a type of NSO management area called an “owl area.” Owl areas are intended to sunset when the commitments of the Settlement Agreement are met. Owl areas were lands outlined in section I.C.1 of the Settlement Agreement *Washington Environmental Council, et al. v. Sutherland, et al.* (King County Superior Court No. 04-2-26461-8SEA, vacated April 7, 2006). These areas were (a) designated in HCP Implementation Memorandum No. 1 (January 12, 1998), (b) located within WDFW Status 1-R (reproductive) owl circles, and (c) located within the four areas identified in DNR’s Standard Practice Memorandum 03-07 (*Management of Northern Spotted Owl Circles and the Identification of Northern Spotted Owl Habitat in Southwest Washington*). Owl Area management ended on December 3, 2019 when the BNR approved Resolution #1560, adopting a new sustainable harvest level, thus terminating the Settlement Agreement.

P

Planning unit: In the State Trust Lands Habitat Conservation Plan, a management unit based on large watersheds. The acres managed under the Habitat Conservation Plan are divided into nine planning units to allow for more efficient planning and management.

Pre-commercial thinning: Removal of less desirable trees to maintain the growth and stability of retained trees. Pre-commercial thinning is performed before trees are large enough to be marketable. Cut trees are left on site to decompose.

Prospecting and mining lease: An exploration agreement that allows the holder to search for mineral deposits on state lands. If the leaseholder wants to begin active mining operations (extraction and removal of valuable materials) that could alter habitat, they must convert the lease to a contract that includes a plan of operations and undergoes State Environmental Policy Act review.

Q

Quadratic mean diameter: The measure of average tree diameter, conventionally used in forestry. The quadratic mean diameter is the diameter of a tree with average stand basal area.

R

Rain-on-snow zone: Generally, an elevation band in which it is common for snowpack to be partially or completely melted during rainstorms several times during the winter.

Reclassified habitat: There are two classes of marbled murrelet habitat, which are identified using a predictive model:

1. **Marginal habitat:** Lands expected to contain a maximum of 5 percent of the occupied sites on state trust lands within each HCP planning unit. These areas are available for harvest. All known occupied sites were deferred from harvest and not included in this habitat designation.
2. **Higher-quality habitat:** Lands expected to contain at least 95 percent of the occupied sites on state trust lands within each HCP planning unit. This habitat is frequently referred to as “reclassified habitat.”

Recreation plan: A plan for a forest block or landscape outlining what types of recreation are appropriate in what portions of that block or landscape, as well as what facilities are needed. It includes broad management guidelines and a plan to implement them.

Regeneration: The act of renewing or reestablishing tree cover in a forest through natural seeding or hand planting, typically on sites that were harvested or burned in a wildfire.

Relative density: A mathematically derived parameter that indicates the level of intra-stand competition between trees, and a theoretical optimal range for thinning. Relative density guidelines for thinning vary by species and by other factors such as climate zones. A commonly used version of relative density is formally known as Curtis’ RD.

Riparian desired future condition: In the Riparian Forest Restoration Strategy, the riparian desired future condition refers to six measurable target stand conditions that are targeted for eventual development into the fully functional stand development stage.

Riparian management zone: A buffer of trees and shrubs applied along a stream to protect the stream and habitat for salmon and other species.

Road abandonment: The permanent closure of forest roads in compliance with DNR guidelines and state forest practices standards. Abandonment work includes placing road barriers to prevent vehicle traffic, removing culverts and bridges, and vegetating exposed soils to prevent erosion and sediment delivery to surface waters. In some circumstances, the road prism is rehabilitated to resemble the conditions that existed prior to road building. Abandoned roads are exempt from further maintenance.

Road maintenance and abandonment plan: A plan that covers all forest roads constructed or used for forest practices after 1974. It is based on a complete inventory that shows streams and wetlands adjacent to or crossed by roads. The plan includes a strategy for maintaining existing roads to meet state standards and shows areas of planned or potential road abandonment.

Road reconstruction: A process of bringing existing roads back to drivable conditions in compliance with DNR policy and state forest practices standards.

Rotation: The length of time between when a stand of trees is planted or naturally regenerates and when a final harvest occurs.

S

Salvage cut: A type of timber harvest used to harvest trees that are dead, dying, or deteriorating due to fire, insect damage, wind, disease, or injuries.

Seed tree intermediate cut: The first timber harvest in a series conducted as part of the even-aged seed tree silvicultural harvest system. The purpose is to provide a desirable seed source to establish seedlings. Typically, about 10 trees per acre may be left following this harvest. Once the new trees are established, some of the seed trees might be harvested.

Selective logging: A timber harvest that removes only specific species from certain size classes that are highly valuable (i.e., trees that function well as poles or logs for cabins).

Seral: Relating to the stages of an ecological sere.

Sere: The sequential stages in forest succession; the gradual replacement of one community of plants by another.

Shelterwood intermediate cut: The first harvest in a series of harvests conducted as part of the even-age shelterwood harvest system. The purpose of this harvest is to provide shelter (typically shade) and possibly a seed source for the seedlings regenerating in the stand. Compared to a seed tree intermediate cut, a shelterwood typically retains more trees per acre following harvest and retained trees are generally dispersed across the stand.

Shelterwood removal cut: The second or final harvest in a series of harvests conducted as part of the even aged shelterwood harvest system. The purpose is to remove overstory trees that create shade levels that are too high to allow the new understory to thrive.

Silviculture: The art and science of managing or cultivating trees and forests to achieve goals and objectives.

Site preparation: Activities performed to increase the probability of successful regeneration in a harvested unit by reducing slash and/or undesirable plants that would compete with seedlings for nutrients, water, and light. Site preparation might be performed concurrently with logging (e.g., pulling and disposing of brush, piling, or burning slash), through broadcast- or under-burning logging slash, by manually cutting undesirable vegetation, by applying herbicide (aerial or ground) to undesirable tree and brush species prior to planting, or by other methods or combinations of methods.

Slash: The residue (e.g., treetops and branches) left on the ground after logging or following a storm, fire, girdling, or de-limbing.

Spatial NaturE: The update process to digitize (spatially) current NaturE contracts.

Special forest products: Items that can be harvested from forests but do not fall in traditional timber or fiber categories, such as holiday greenery or medicinal plants.

Special use lease: A DNR lease for state trust lands that is issued for one of a wide variety of commercial or other uses (e.g., golf courses, paragliding landing sites, or public use facilities).

Stand: A group of trees similar enough in composition, structure, age, spatial arrangement, or condition to distinguish it from adjacent groups of trees.

Stand development stage: A developmental phase of a forest, defined using a classification system based on the structural conditions and developmental processes occurring within a forest stand.

State Environmental Policy Act: A state law that provides a process for reviewing proposals that require permits or other forms of agency approval. It requires government agencies to consider the potential environmental consequences of their actions and incorporate environmental values into their decision-making processes. It also involves the public and provides the agency decision-maker with supplemental authority to mitigate identified impacts.

State Forest Transfer (State Forest Trust Replacement): A program in which State Forest Trust lands (formerly known as Forest Board) in timber-dependent counties are transferred from trust status to natural areas. The state Legislature provides funds to pay for the land and timber on certain properties considered not harvestable due to the presence of federally listed endangered species. The timber value is distributed to the counties as revenue, and the land value is placed in an account for purchasing replacement property for the State Forest Trust.

State trust lands: DNR-managed lands held as a fiduciary trust and managed to benefit specific trust beneficiaries (e.g., public schools and universities, capitol buildings, and local services such as libraries).

Sub-mature Habitat: A habitat type for northern spotted owl protection. This is a forest community typically dominated by conifers with at least 70% canopy closure. Full details on the definition, and differences between this and “young forest marginal” habitat, can be found in this document (Appendix Table A-2.2), or in the OESF land plan (Table 3.3, page 3-9).

Suitable northern spotted owl habitat: Each NSO management area is managed for certain habitat classes that include specific habitat types. Habitat types include high-quality nesting, Type A or B, movement roosting and foraging, sub-mature, young forest marginal, movement, dispersal, and old forest. Forest stands that meet the definition of habitat types within the specific management area are considered suitable habitat.

T

Take: As used in the Endangered Species Act, refers to harming, hunting, wounding, collecting, capturing, or killing an endangered or threatened species or disturbing habitat in a way that disrupts members of a species’ normal behavior.

Trust Land Transfer program: A program in which Common School state trust land is transferred from DNR to another public agency or conservation program. The state Legislature provides the value of the timber (which is not cut) to the Common School Construction account to build K-12 public schools. The value of the land is placed in an account used to purchase replacement property for the school trust. Land can be transferred to the State Parks and Recreation Commission, Washington Department of Fish and Wildlife, a county or city government, or DNR’s Natural Areas Program.

Trust: A legal term for a relationship in which one person, company, or entity (the trustee) holds title to a property and/or manages it for the benefit of another person, company, or entity (the beneficiary).

Type A Habitat: A habitat type for northern spotted owl protection. Full details on the definition can be found in this document (Appendix Table A-2.2).

Type B Habitat: A habitat type for northern spotted owl protection. Full details on the definition can be found in this document (Appendix Table A-2.2).

U

Uneven-aged management: Removal of trees from a multi-aged forest stand while maintaining multiple age classes within that stand. Uneven-aged management is often used on sites with poor soil where intensive management is not cost-effective. This type of management also might be used in fire-prone areas to mimic the effects of periodic, lower-intensity fires that do not remove all trees.

V

Validation monitoring: A form of monitoring that determines whether certain species respond as expected to habitat conditions created by following a management plan and its strategies.

Variable density thinning: Thinning to create a mosaic of different stand densities, with canopy openings generally between 0.25 and 1 acre which capitalizes on landforms and stand features. DNR uses variable density thinning to encourage development of structural diversity in areas where spotted owl habitat is needed or to meet other objectives. Diversity is created by thinning to different residual tree densities, retaining large trees, and, in some cases, adding down woody debris and snags.

Variable retention harvest: An approach to harvesting based on the retention of structural elements or biological legacies (e.g., trees, snags, or logs) from the harvested stand for integration into the new stand to achieve ecological objectives. The following threshold targets apply under the HCP:

- Retention of at least eight trees per acre. Of these:
 - At least two per acre are suitable for wildlife, and are from the largest size class,
 - At least three per acre are snag recruits, and
 - At least three per acre are snags, provided that safety requirements are met; if snags are not available, then three live trees will be retained.
- There are at least two down logs per acre of largest size class (at least 12” on small end by 20’ long).

Vegetation management: Using hand-cutting, herbicide, mechanical, or other means to remove competing vegetation in a stand after planting but before seedlings become fully established.

W

Washington Administrative Code: Administrative regulations, or rules, adopted by state agencies to enact legislation and the [Revised Code of Washington \(RCW\)](#).

Windthrow (blowdown): A tree that has been knocked over or had its top broken by wind.

Y

Young Forest Habitat: A designation of habitat class in the OESF for northern spotted owl protection. This land class includes “sub-mature habitat” and “young forest marginal” designations.

Young Forest Marginal: A habitat type for northern spotted owl protection. This is a forest community typically dominated by conifers with at least 70% canopy closure. Full details on the definition, and

differences between this and “sub-mature forest” habitat, can be found in this document (Appendix Table A-2.2), or in the OESF land plan (Table 3.3, page 3-9).