State Trust Lands Habitat Conservation Plan

Annual Report

For Fiscal Year 2022

Prepared in March 2023

WASHINGTON STATE DEPT OF NATURAL RESOURCES

A field technician collects data as part of the Status and Trends Monitoring of Riparian and Aquatic Habitat project in the Olympic Experimental State Forest

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Acronyms

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

1.0 Introduction

Appendix A.1: Background on the State Trust Lands HCP

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 HCP, including monitoring and research efforts and conservation strategy progress. Unless otherwise noted, information about DNR programs included in this report covers fiscal year (FY) 2022 (July 1, 2021 – June 30, 2022). In some cases, significant program activities that occurred in FY 2023 are also reported, including DNR's continuing collaboration with the Services on implementation of the Marbled Murrelet Long-Term Conservation Strategy.

Highlights

In FY 2022, DNR continued progress on and accomplished several objectives affecting lands managed under the HCP. Some highlights include:

- **RMAP completion:** In October 2021 (fiscal year 2022), DNR completed the removal or corrections of all fish barrier culverts under its Road Maintenance and Abandonment Plans (RMAP), as required by the Timber, Fish, and Wildlife Agreement and forest practices rules. RMAP was established in 2001 as a forest practices rule following adoption of the Forest and Fish Report into the Salmon Recovery Act of 1999. Since then, RMAP has been carried out by large landowners, in collaboration with DNR Forest Practices, tribes, and the Departments of Ecology and Fish and Wildlife to the benefit of public resources, including salmon and clean water. This work has minimized or eliminated sediment delivery to live waters, corrected fish passage barriers, disconnected ditch water from live streams, and creatively applied best management practices to upgrade forest roads.

  Successful completion of RMAP obligations and the resulting improvements are among the greatest successes within the Washington forest practices arena over the last 20-plus years.

- **Silviculture Research:** The silviculture team is engaged in a variety of climate change and wildfire resilience activities. One such endeavor is the ***PNW Seed Source Project***. In order to adapt to a changing climate, DNR is establishing a testing program to examine survival of 23 Douglas-fir seed sources across small, inexpensive sites in order to model the effects of seed movement and to serve as demonstrations where people can observe local seed source performance.

  Although most experimental sites will likely be on large ownerships managed by foresters, the installation and measurement protocols are such that "citizen science" landowners can

participate as well. This program is starting with enough seedlings currently growing in the nursery to plant the first five sites. DNR will continue to grow more seedlings each year, and provide installation "kits" that can be distributed to citizen science collaborators who agree to plant and measure sites over time. Although this effort is currently focused on Douglas-fir, the hope is to extend the model to other species over time.

PNW Seed Source Project planting. Photo: Stu Olshevski.

- **Completion of the RS-FRIS Transition:** 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. In FY 2022, DNR completed a transition from the Forest Resource Inventory System (FRIS) to the Remote Sensing Forest Resource Inventory System (RS-FRIS) to better identify northern spotted owl habitat types across DNR-managed forestland. During the transition to RS-FRIS, DNR also made updates to database queries to accurately reflect the attributes measured in RS-FRIS and better match the habitat definitions in the HCP (*HCP p. IV.11-12* and *WAC 222-16-085*).

- **Olympic Experimental State Forest**: The Type 3 (T3) Watershed Experiment will explore alternative forest management practices that could add environmental, economic, and social benefits on HCP-covered lands. The study takes place on 20,000 acres across 16 watersheds in the OESF. New treatments include small gaps and thinning to increase riparian forest diversity and improve salmon habitat, an alder-cedar polyculture to increase cultural and economic benefits, and regeneration practices that create complex early-seral habitat. In 2022, there was significant progress toward several T3 objectives:

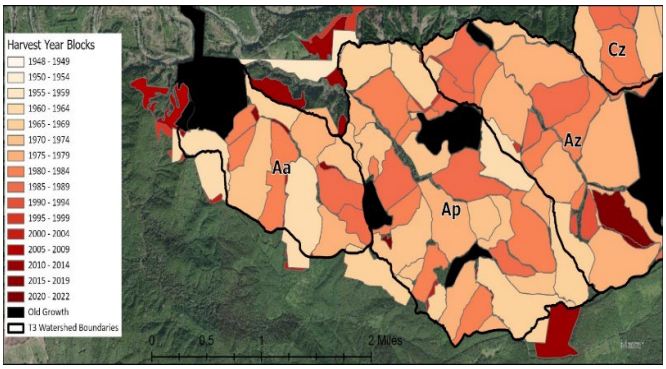


Figure 1: Harvest year decadal blocks in four of the T3 Watersheds (Aa, Ap, Az, and Cz) will assist in future analysis of data from the T3 watershed experiment. Map: Karena Iliakis, UW.

  - Completion of the T3 Upland Study Plan, available on the *ONRC* website.
  - Completion of a third year of pre-harvest monitoring including state-of-the-art LiDAR flights.
  - Two major modeling efforts are underway: an aquatic trophic productivity model will simulate food web responses, and a forest growth and yield model will project stand development.

- Seven stakeholder Learning Groups (LGs) were established. Of these, the Cedar-Browse LG developed a *sub-study plan* to explore methods to prevent over-browsing of seedlings. The History LG is collating and mapping data about conditions and events from the 1950s onward to inform future analyses. The Invasive Species LG is exploring ways to monitor Scotch broom using remote sensing.

- **Recreation:** More than 250 miles of existing trail received maintenance, an additional 12 new miles of trail were developed, and five new kiosks clarifying e-bike policy were installed. Campsites, picnic and rest areas, and corrals were also added or upgraded. A comprehensive report of recreation-related projects in FY 2022 is included in the appendix.

2.0 Progress toward Conservation Objectives

The HCP established numerous conservation strategies designed to minimize and mitigate the adverse effects of land management activities. In particular, for the land base covered by the HCP, the HCP addresses potential negative impacts 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*.

Conservation Strategy Updates

The HCP conservation strategies are occasionally updated in response to research findings, plan development, regulatory changes, and/or adjustments to DNR administrative procedures. In 2022, conservation strategies for NSO and marbled murrelet were updated.

Update: NSO Conservation Strategy RS-FRIS Transition

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 (*Appendix: RS-FRIS and NSO Habitat Delineation*). The DNR FRIS has now been replaced byRS-FRIS. A comprehensive review on this topic is in the appendix.

Additionally, during the transition to RS-FRIS, 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 noNSO dispersal or nesting-roosting-foraging management areas.

The timeline for reporting habitat percentages based on RS-FRIS in the HCP Annual Reports (Table 2-1) 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 2-1: 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

Update: Marbled Murrelet Long-Term Conservation Strategy

In FY 2020, the Board of Natural Resources adopted a long-term conservation strategy for the marbled murrelet to replace the interim conservation strategy. The Marbled Murrelet section of this document (below) contains summary information for the long-term conservation strategy. Additional background information on the history and development of this conservation strategy update is in the appendix and on DNR's marbled murrelet webpage at *dnr.wa.gov/mmltcs*.

Conservation Strategy: Northern Spotted Owl

Appendix A.2: NSO Habitat Classes and Types

When the HCP was developed, the most important areas on DNR-managed lands to NSO conservation were identified. These designated NSO management areas are managed for certain habitat classes and types defined in the HCP (p. IV.11–12) and *WAC 222-16-085*. More information about habitat classifications and types for each westside NSO management area can be found in the appendix.

The DNR NSO conservation strategy west of the Cascades involves maintaining thresholds of habitat in each spotted owl management unit (SOMU). Most designated nesting, roosting, and foraging and dispersal SOMUs have a 50 percent overall habitat target. The Olympic Experimental State Forest (OESF) and South Puget HCP Planning Units each have two-tiered habitat threshold targets that are described later in this section.

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

1. Land is acquired or disposed through a land transaction.
2. Stands are inventoried and their boundaries are refined and/or their habitat type is updated due to growth or an enhancement thinning.
3. A variable retention harvest is conducted within habitat in a SOMU that is over the habitat threshold target.
4. Refinements are made to cadastre data across the state.
5. 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. Figures 2.2a-2.2d show NSO habitat percentages, by HCP planning unit, as they existed on July 17, 2022, when the data was extracted from RS-FRIS.

SOMUs below their habitat thresholds have areas of non-habitat designated as "next best" to ensure each SOMU is on a trajectory to meet the habitat target. The sum of habitat and next best equals the SOMU habitat threshold target. SOMUs above their habitat thresholds do not have next best. Candidate stands in the OESF are described fully in the *OESF Forest Land Plan*.

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 percent of nesting, roosting, and foraging and dispersal SOMUs as habitat. Percent habitat for SOMUs in the Columbia and North Puget HCP Planning Units are shown in Figures 2.2a and Figure 2.2b, respectively. Only SOMUs with more than 1 percent habitat are included in the figures.

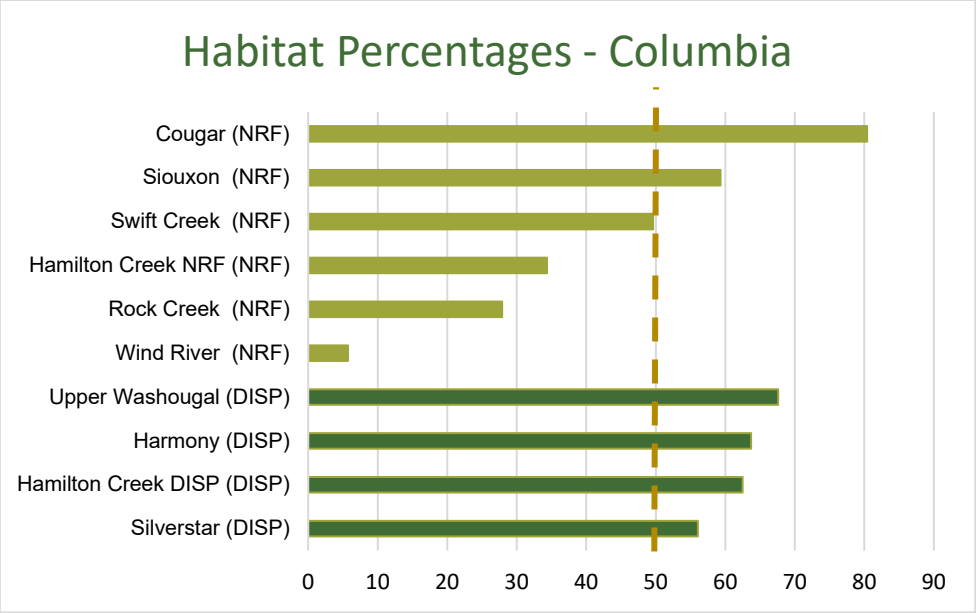


Figure 2.2a: Habitat Percentages by SOMU in the Columbia HCP Planning Unit as of 7/17/2022. The dashed line represents the habitat target. Habitat percentages are rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included.

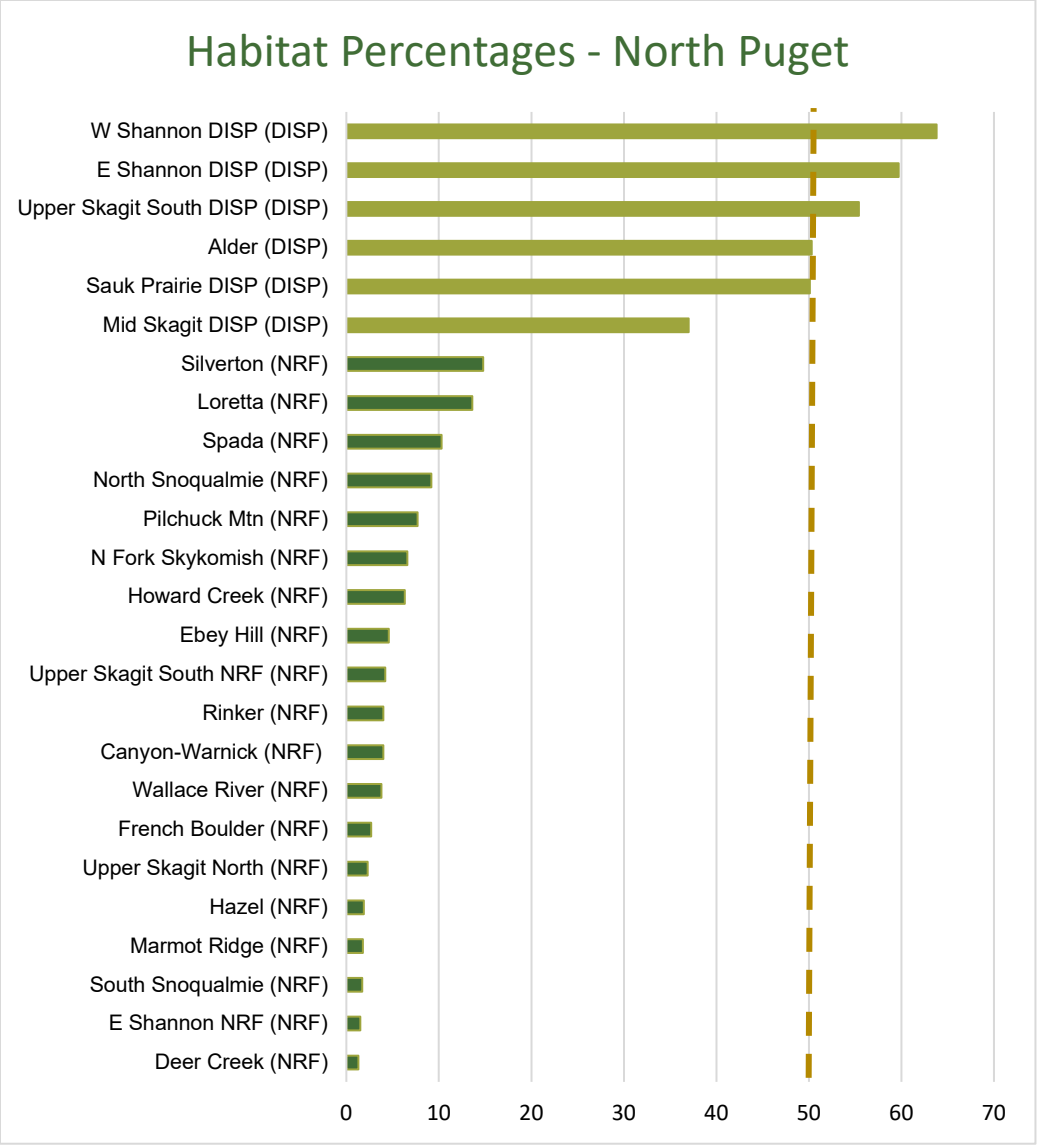


Figure 2.2b: Habitat Percentages by SOMU in the North Puget HCP Planning Unit as of 7/17/2022. The dashed line represents the habitat target. Habitat percentages have been rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included.

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). DNR does not designate nesting, roosting, or foraging, or dispersal areas in the OESF. In each SOMU, the HCP habitat goal is to restore and maintain a minimum of 40 percent NSO habitat. Of that 40 percent, at least half (i.e., 20 percent) of the SOMU, must be Old Forest Habitat, and the remaining habitat must be Structural or better. Figure 2.2c shows current total percent NSO habitat in OESF Planning Unit SOMUs.

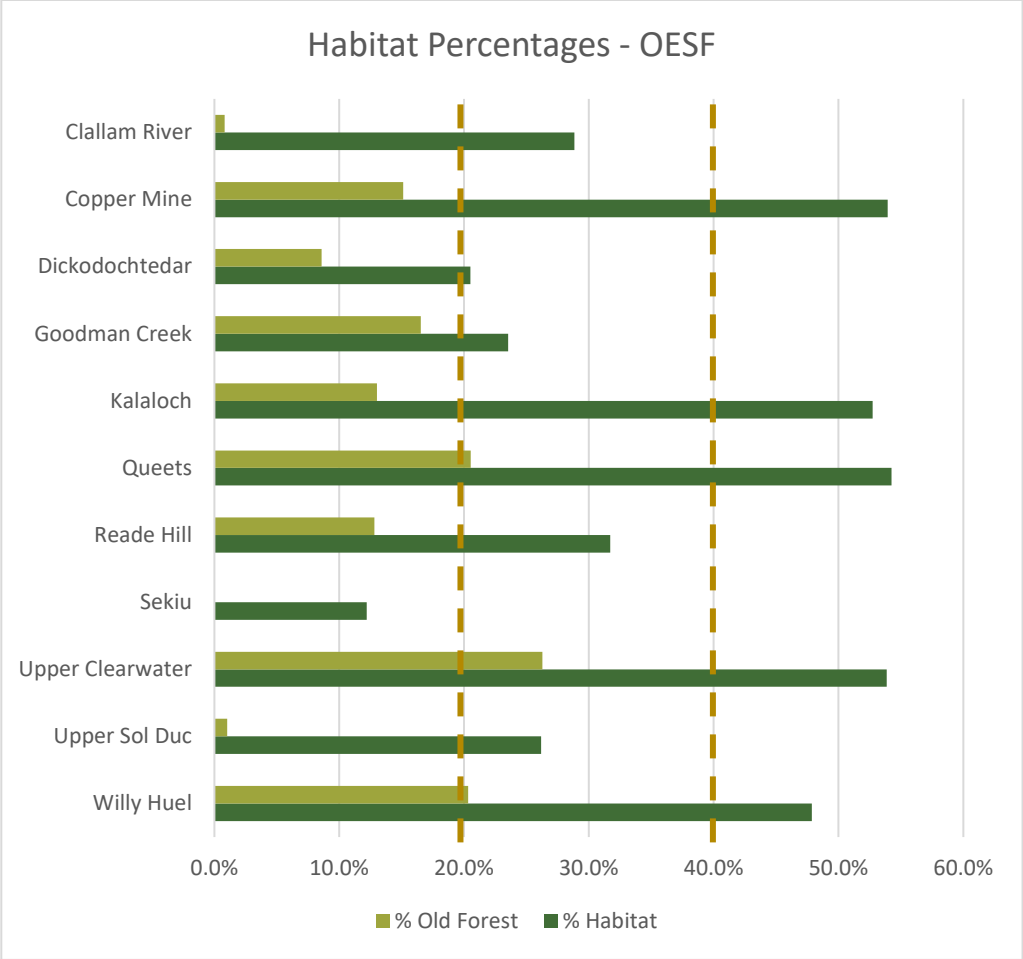


Figure 2.2c: Habitat Percentages by SOMU in the Olympic Experimental State Forest as of 7/17/2022. Dashed lines represent habitat targets. Habitat has been rounded to the nearest percent. NSO habitat data in the OESF HCP Planning Unit transitioned to RS-FRIS in FY 2021.

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 percent for each SOMU. Dispersal management areas have an additional target that at least 35 percent 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 identified in the 2010 *South Puget HCP Planning Unit Forest Land Plan Final EIS*.

The two nesting, roosting, and foraging (NRF) management areas (Pleasant Valley NRF and Green NRF) within the South Puget HCP Planning Unit share the same habitat targets as other westside nesting, roosting, and foraging management areas. Both of these nesting, roosting, and foraging management

areas are currently under 1 percent, therefore Figure 2.2d shows only the dispersal management habitat in the South Puget HCP Planning Unit.

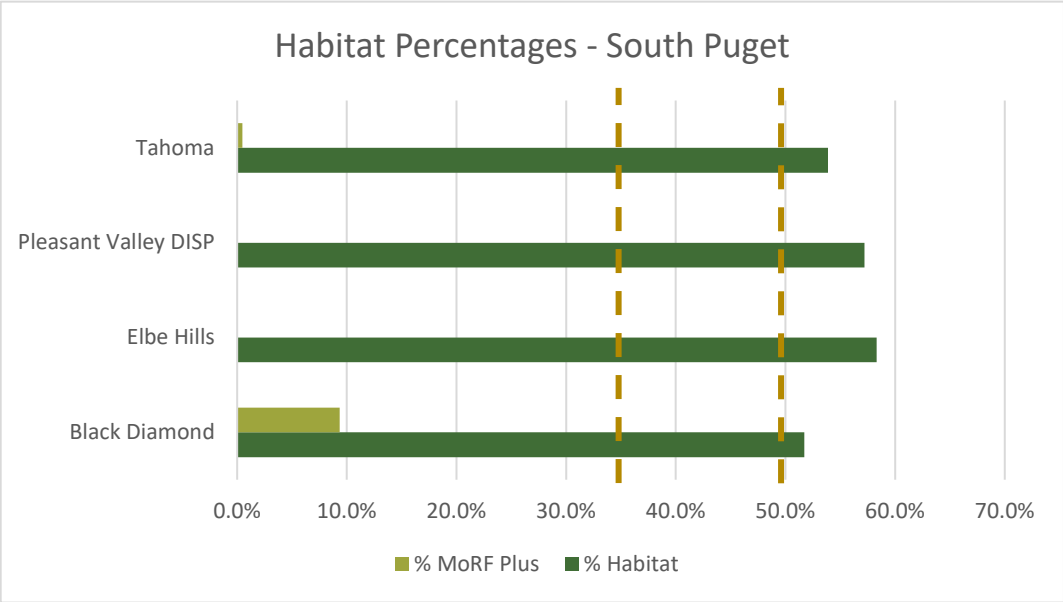


Figure 2.2d: MoRF Plus and Total (Movement Plus) Habitat Percentages by SOMU in the South Puget HCP Planning Unit as of 7/17/2022. Dashed lines represent habitat targets. Habitat has been rounded to the nearest percent. SOMUs with less than 1 percent habitat are not included.

Conservation Strategy: Marbled Murrelet

Appendix: Marbled Murrelet Conservation Strategy

The Marbled Murrelet Long-Term Conservation Strategy is an amendment to the HCP that replaced the interim marbled murrelet conservation strategy outlined in the HCP (hereafter called MM Amendment). The MM Amendment was developed in close cooperation with the U.S. Fish and Wildlife Service (USFWS). As part of this process, USFWS issued DNR an amended incidental take permit for the marbled murrelet and other species covered by the amended 1997 HCP.

Marbled murrelet. Photo: Rich MacIntosh.

The Board of Natural Resources (Board) voted to approve the *MM Amendment* through *Resolution No. 1559* in December 2019. Following Board approval, DNR began to implement the strategy, including developing administrative procedures, training staff, and developing methods to track and report on implementation.

How habitat is reported was initially outlined in detail in the FY 2020 HCP Annual Report. That information is now contained here in the appendix. Due to the complexity of summarizing a large new dataset, reporting for FY 2021 and FY 2022 will be presented in the FY 2023 HCP Annual Report.

Riparian Conservation Strategy

Appendix: Background on Riparian Conservation Strategy

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. Restoration treatments in riparian management zones in westside planning units outside the OESF are conducted under guidance from the *Riparian Forest Restoration Strategy (RFRS)*. The RFRS outlines the 2006 updated implementation procedures for the HCP Riparian Conservation Strategy.

Activities within wetland management zones (WMZs) and riparian management zones (RMZs) that are outside RFRS-covered areas continue to be guided by the HCP Riparian Conservation Strategy. DNR plans riparian treatments to ensure that stand conditions are appropriate for treatment and that active management will expedite attainment of long-term management objectives. Figure 2.4 displays acres of riparian harvest associated with sold or completed timber sales in fiscal years 2018-2022.

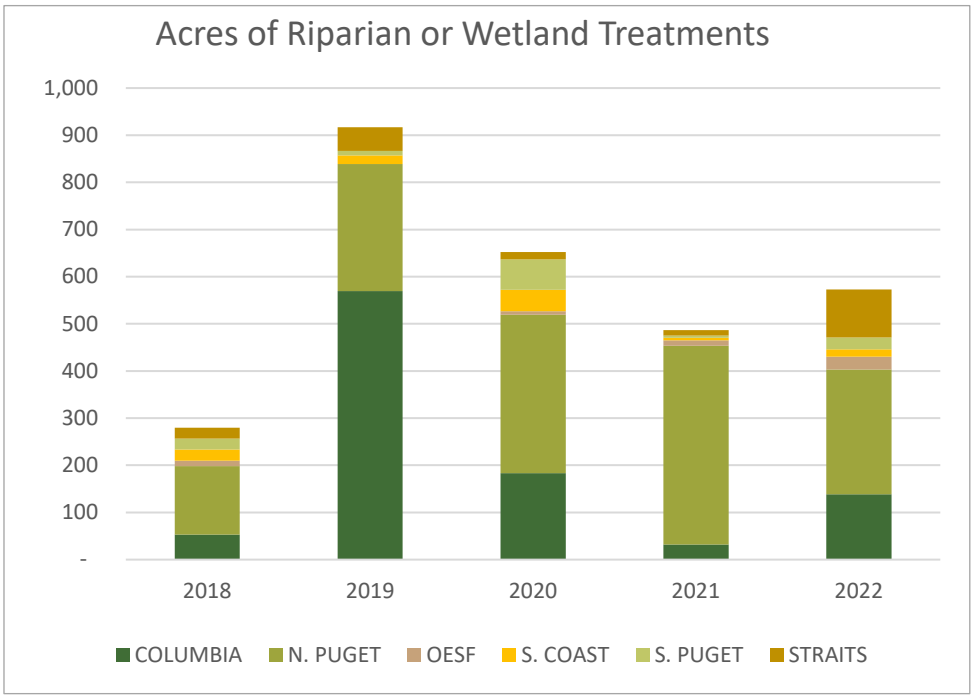


Figure 2.4: Acreage of Riparian Treatments by HCP Planning Unit. Data includes timber harvest units with a riparian landclass designation ("RIPARIAN" or "WETLAND") associated with sold and completed timber sales in fiscal years 2018-2022.

2.5 Multispecies Conservation Strategy

The multispecies conservation strategy involves identification and protection of uncommon habitat types for unlisted species. These habitats include caves, cliffs, talus slopes, wetlands, balds, mineral springs, snags, oak woodlands, and large, structurally unique trees. Uncommon 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.

There were no changes or updates to this strategy in FY 2022.

Grassy bald on Jones Island. Photo: Kailey Schillinger-Brokaw, WWU.

3.0 Adaptive Management

Appendix A.3: Adaptive Management, Monitoring, and Research

The OESF adaptive management process, described in an administrative procedure adopted after the publication of the *OESF Forest Land Plan*, indicates how DNR managers and scientists identify priority research questions and report project findings and their management implications.

The focus of the OESF adaptive management in FY 2022 was on the uplands components of the T3 Watershed Experiment (see *Research* section). DNR Olympic region foresters and managers worked with DNR and external researchers to finalize the T3 silviculture study plan, and collaborated to allocate the experimental treatments into operational-scale timber sale units and to accommodate pre-treatment monitoring. The project is evolving in the adaptive management study envisioned in its proposal.

The DNR State Lands Adaptive Management Program continued to develop links between scientific research and management. Several projects were published in technical reports and peer-reviewed journals (refer to *Publications and Presentations* section).

3.1 Implementation Monitoring

Appendix: Background on Implementation Monitoring

DNR-managed state lands are subject to complex forest management strategies necessary to achieve a variety of habitat conservation commitments. The objectives of the Implementation Monitoring Program are to confirm that these strategies are appropriately implemented, identify areas for continuous improvement, and respond to changing conditions and new information. DNR managers and field staff use the implementation monitoring findings to improve practices and reduce inconsistencies on the ground.

Implementation monitoring was conducted during fall and winter 2022 (FY 2023) to assess if DNR's riparian management activities are in compliance with the Riparian Forest Restoration Strategy (RFRS). DNR committed to conducting field surveys and database integrity assessments in Section-V of the HCP. The project consisted of three parts:

1) Assessing the accuracy of DNR's Land Resource Manager (LRM) database for tracking the number of riparian acres that received restoration treatments,
2) Determining if prescriptions for silvicultural activities in RMZs contain the five components outlined in the RFRS, and
3) Conducting field assessments of riparian management activities for compliance with guidance in the RFRS. A summary of the findings is provided in this report. The full report can be found on *DNR's Monitoring and Reporting webpage*.

Assessment of the Land Resource Manager Database

The review of forest management activities (FMAs) in LRM was conducted for management activities in riparian management zones (RMZs) that were completed between FY 2018 and 2022. The 2018 FY cut off was selected because it represents the first full FY after LRM replaced the Planning and Tracking (P&T) system that DNR previously used to document management activities. The land class attribute is included in LRM and allowed the database to be quickly searched for riparian harvests, but this feature was not explicitly included in the P&T system. A total of 414 FMAs with timber harvest activities in RMZs were found in the database and assessed for accuracy.

There were two categories of errors found during the investigation: 1) FMAs for variable retention harvests (VRHs) that were not in riparian areas, but had the riparian land class in LRM, and 2) FMAs for riparian management activities that had a spatial delineation larger than the actual treatment area (Figure 3.1a).

Figure 3.1a: Example of a forest management area (FMA) polygon with inaccurate spatial delineation. The boundary of the 14.8-acre FMA polygon is outlined in blue. The boundary of the 1-acre hardwood conversion within this FMA is outlined in red.

In total, there were six FMAs with Category 1 errors and 23 FMAs with Category 2 errors, all of which occurred during FY 2018 or 2019. No errors were found in FY 2020 through 2022. The combined effect of the Category 1 and 2 errors resulted in a 16-acre overrepresentation of riparian management areas in FY 2018 and a 435-acre over-representation in FY 2019 (Figure 3.1b).

All timber stales with Category 1 or 2 errors had sale dates prior to March 2018, but were not flagged as complete until FY 2018 or 2019. This represents the period during which the P&T system was replaced by LRM, and this transition is likely the source of the errors found within LRM. For example, the LRM FMA Spatial Delineation Standards were not published until December 2018, which was after the timber sale dates for all the FMAs with Category 2 errors. The lack of errors between FY 2020 and 2022 demonstrates that, once established, LRM has tracked RMZ treated acres with great accuracy. One important finding was how sensitive the accurate reporting of RMZ treated acres is to large FMAs with Category 1 or 2 errors. For example, of the 20 largest RMZ FMAs within LRM, 16 had Category 1 or 2 errors. The not-validated acres of these FMAs accounted for 23 percent of the total RMZ acres in the database, despite these FMAs representing only 4 percent of FMAs.

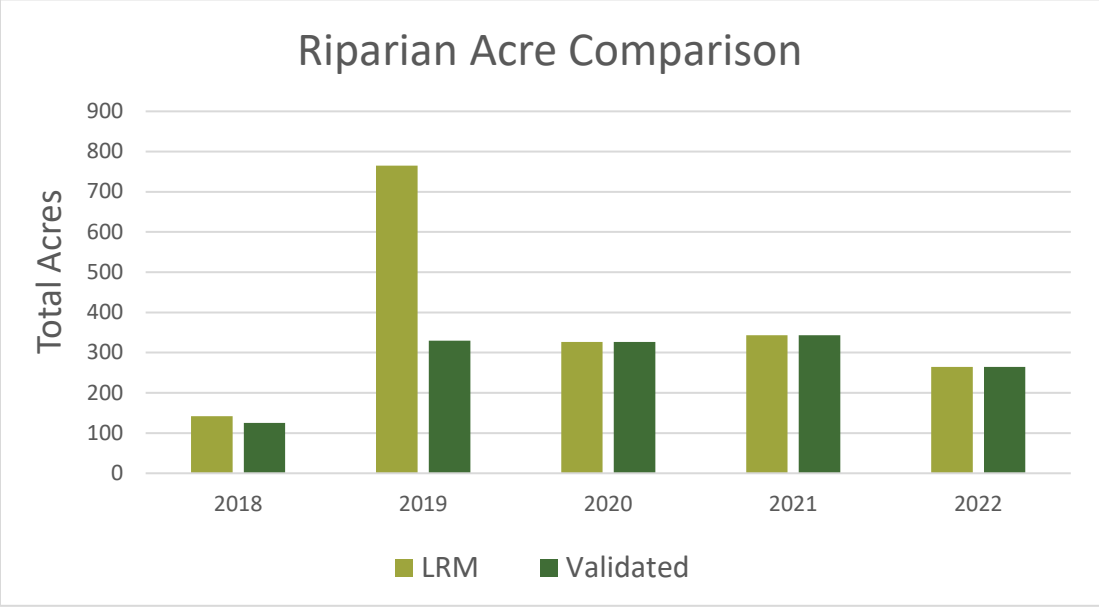


Figure 3.1b: Comparison of riparian acres with restoration treatments documented in the Land Resource Manager (LRM) database and the validated dataset produced in this project from fiscal year 2018 and 2022.

Review of Silvicultural Prescriptions

The silvicultural prescription and field assessment portion of the LRM review examined a subset of 37 RMZ FMAs that were marked completed during FY 2022. There were 11 FMAs in the OESF and 8, 14, and 11 FMAs within the Columbia, North Puget, and South Coast HCP planning units, respectively. The selected FMAs included two hardwood conversions, 25 thinnings, and 10 VRHs. All 10 VRHs were within the OESF, were not subject to the RFRS, and used allotted RMZ acres in the OESF Forest Land Plan. The silvicultural prescription of all 37 FMAs were reviewed and the results showed that 25 FMAs had complete silvicultural prescriptions per the RFRS, three were partially complete, and nine were incomplete.

Field Assessment of RMZ Management Activities

The buffer widths of all 37 assessed FMAs complied with RFRS requirements and there was no sign of equipment operating within 25 feet of the inner zone for assessed areas. All FMAs were also found to

have accurate spatial delineations. Eight of the 37 assessed FMAs had an issue with the implementation of the silvicultural prescription. The impacts of this ranged from a contractor felling the marked leave trees and leaving the take trees, to a portion of the trees marked for down woody debris (DWD) creation not being felled. For example, two assessed FMAs had a portion of the trees designated for DWD creation that were found standing. In one unit (Unit 5), these trees may have been missed by the contractor as they were difficult to locate through a dense shrub layer, with the tree stems covered in moss and lichen that obscured the paint (Figure 3.1c). In the other (Unit 6), the selected trees were along a power line corridor and could not be safely felled (Figure 3.1c). In both cases, these trees represented less than a third of the total trees marked for DWD creation.

All eight FMAs that had issues with prescription implementation had provisions in the signed contracts that clearly outlined the requirements of the RMZ thinning activities, including discussion of felling five trees per treatment acre toward the stream. Therefore, the issues found in the field assessments were related to contract implementation rather than errors in the development of riparian restoration prescriptions. Often, these errors occurred despite significant efforts by DNR staff to communicate implementation requirements to the contractors. When deviations from the prescription were identified, mitigation efforts such as increasing DWD creation, increasing bigleaf maple planting, or underplanting with a diverse mix of conifer species were considered. DNR is working on how to ensure the information gathered from these site visits can be best used to achieve prescription implementation goals.

Figure 3.1c: Example of trees marked for DWD creation, but left standing at Unit 5 (left) and Unit 6 (right). The trees at Unit 5 were difficult to locate. The trees at Unit 6 were along a power line corridor.

Summary of Implementation Monitoring Review

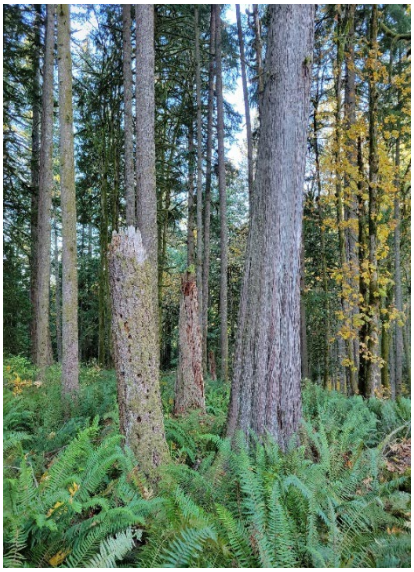


Figure 3.1d: Example of restoration treatments. These treatments include the creation of downed woody debris (left) while retaining a diversity of trees species and protecting important habitat features such as standing dead wood.

This implementation monitoring project provide a detailed overview of the tracking and implementation of DNR's RMZ management activities. The errors found within LRM all occurred during the timeframe of when LRM replaced the P&T system. All of the timber sales with Category 2 errors were sold before the FMA spatial delimitation standards were published, and no errors were found within LRM afterFY 2020. This indicates that the LRM database, once established, has had a high degree of accuracy. A review of silvicultural prescriptions found that a quarter of the reviewed prescriptions did not include any of the five required components outlined in the RFRS. Field assessments confirmed that RMZ buffers are being properly followed and that RMZ FMAs have accurate spatial delineations. Eight of the 37 assessed FMAs had issues with the implementation of the prescription due to contract administration. Often, these issues were relatively minor, and all the assessed harvests appear to be accelerating the RMZs towards the desired future condition (Figure 3.1d).

3.2 Effectiveness Monitoring

Appendix: Effectiveness Monitoring and Research 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 is intended to document changes in habitat conditions, such as general forest structure, specialized habitat features, and northern spotted owl prey populations following timber harvest and other forest management activities. Over time, the results from this effectiveness monitoring may be used to modify management practices to enable DNR to better manage land in accordance with the conservation objectives described in the HCP. This section includes annual updates on effectiveness monitoring programs for NSO habitat and riparian silviculture, and the Status and Trends Monitoring of Riparian and Aquatic Habitat project in the OESF.

NSO Effectiveness Monitoring Program

The NSO Effectiveness Monitoring Program evaluates changes in habitat, including forest structure and specific habitat features, that result from timber harvest and other management activities carried out under the HCP. The status of the two primary components of this program through FY 2022 is noted below. These components are (1) long-term tracking of the effects of variable density thinning (VDT) on improving habitat structure in stands designated as NSO habitat, and (2) landscape-scale monitoring of basic habitat indicators across the entire westside HCP land base.

Long-term tracking of the effects of VDT on improving habitat structure in stands designated as NSO habitat

The first component of this program 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 design included two or three replications of treated stands and one untreated control stand at each site. All stands were measured prior to and immediately after treatment.

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

In future years, DNR intends to identify additional effectiveness monitoring sites in stands classified as "Next Best" NSO stands using RS-FRIS data, with the objective of identifying VDT treatments that accelerate stand trajectory from Next Best to habitat.

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

The objective of this project is to determine whether broad-scale trends in basic habitat features such as tree height, mean tree size, and canopy layering appear to be meeting HCP goals. To accomplish this, DNR is using multiple datasets to cover all westside lands that have consistent data over time. Preliminary results suggest that on lands managed with conservation objectives in addition to economic objectives, the amount of large/complex forest structure is increasing since the signing of the HCP, a distinct change in trend from the years prior to the HCP. Results for this project will be updated upon release of additional data that use a newer data collection method and include additional years.

In addition to the monitoring activities described above, DNR is also conducting two research projects (see Research section) related to NSO effectiveness monitoring: (1) Mind the Gap, and (2) Westside Individuals, Clumps, and Openings.

Riparian Silviculture Effectiveness Monitoring Program

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 riparian management zones in cooperation with the DNR timber sales program.

The Effectiveness Monitoring Program 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.

Several datasets have been prepared for analysis. These datasets include measurements of various habitat metrics, such as downed wood, and overstory and understory structure and composition. DNR scientists are currently organizing the existing data and exploring options for remeasurement of these sites. The program will develop a report and present findings once analysis is complete.

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

The key objectives of the Status and Trends project are to provide empirical data to evaluate 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.

In FY 2022, 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. Automated stream flow monitoring stations recording continuous flow measurements at 10 different streams were maintained and calibrated.

In March 2022, the Status and Trends project team published a comprehensive report of the first eight years of the project. *Status and Trends Monitoring of Riparian and Aquatic Habitat in the Olympic Experimental State Forest: 2013-2020 Results* presents habitat status and trend results, based on data collected between 2013 and 2020. Results show that the stream buffers in DNR-managed watersheds have produced multiple habitat benefits. All sampled streams were found to be well-shaded, with stream temperatures and riparian microclimate remaining cool during summer.

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 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.

3.3 Validation Monitoring

Appendix: Validation Monitoring

The Riparian Validation Monitoring Program (RVMP) was formed to test the hypothesis that forest management practices implemented under the HCP will restore and maintain habitat capable of supporting viable salmonid populations within the OESF. If negative trends are detected in salmonid conditions (abundance, biomass, species composition, age structure, and number of spawning redds), monitoring will then seek to evaluate cause-and-effect relationships between DNR management activities, riparian habitat, and salmonids. Once underlying mechanisms are understood, DNR may use this information to adapt its management practices.

The RVMP was designed to use an observational study approach to monitor 50 fish-bearing watersheds within the OESF and 10 reference watersheds in the OESF, Olympic National Park, and Olympic National Forest. These 60 watersheds are the same watersheds used in the DNR Status and Trends Monitoring of Riparian and Aquatic Habitat project. Because not all of the 60 watersheds can be sampled within one summer, 20 watersheds are sampled annually (annual panel), while an additional 20 watersheds per year are sampled on a two-year rotation (even and odd years). In addition, a section of the Clearwater River, a Type 1 stream, is snorkel-surveyed to assess DNR management on some of the larger streams of the OESF.

In FY 2022, the lead of the RVMP, fish biologist Kyle Martens, represented DNR on the technical review groups for the *Quinault Indian Nation Lead Entity*, the *North Pacific Coast Lead Entity*, and the *Washington Coast Restoration and Resiliency Initiative***.** These groups coordinate salmon habitat restoration on the Washington coast. The technical review group provides scientific expertise to inform and prioritize potential restoration projects.

Seasonal staff of the RVMP also 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 (Figure 3.3),
- 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.

Figure 3.3: Backpack electrofishing for juvenile salmonids. Photo: Kyle Martens.

Monitoring has shown that salmonid populations have been relatively high within the annual panel of watersheds, primarily driven by age-0 trout. In June 2021, the Pacific Northwest experienced a unique heat wave that resulted in earlier-than-normal high temperatures in many streams. After this event, staff found both the highest

average density of coho salmon (a rebound from our 2020 lows) within the annual panel of RVMP watersheds and the lowest density of juvenile coho salmon in the mainstream Clearwater River. It is possible these extreme densities were related. The high temperatures within the Clearwater River were likely to have affected juvenile coho salmon densities through some combination of decreased survival and increased movement into tributaries or other habitats with cooler temperatures.

Overall, there have been large yearly and site variations in juvenile salmonid populations, showing the need for continuous (both annual and long-term) sampling to help separate fish responses between natural variations and habitat responses. However, staff have been able to identify two variations of Type 3 streams within DNR-managed watersheds (high density and high variability; low density and low variability). The high-density and high-variability watersheds likely have good salmonid habitat and are limited by either fish recruitment or yearly fluctuations in weather. The low-density and low-variability watersheds are likely limited by salmonid habitat deficits. Understanding the differences between these two Type-3 stream variations might lead to a greater understanding of what limits salmonid populations in waterways on DNR-managed lands.

More information on the RVMP can be found in the *2021 RVMP Annual Report*.

3.4 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 3-4 summarizes DNR research projects on HCP-covered lands and the priorities they address. Some projects address multiple research priorities and monitoring commitments.

Table 3-4: DNR's Research and Monitoring Projects on HCP-Covered Lands.

Project	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 twofold:

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

To date, 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 is assessing historic, current, and future NSO habitat across all available lands in the eastern Washington Cascades. DNR hopes to answer two fundamental questions:

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

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. 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 a NSO structural suitability map.

Concurrently, researchers developed maps of current forest zones, and projected shifts in zones 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 as such, 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 will be submitted to peer-reviewed journals by the end of calendar year 2023. For more information, contact Joshua Halofsky at *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.

The 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. The field measurements in FY 2021 focused on understory vegetation and tree seedlings. 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 (Figure 3.4). Treatments included one control plus two different densities of PCT, with or without the addition of gaps. In 2017, the sites were thinned again and 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. As of 2022, this research is ongoing. A summary is available on the *OESF webpage*. For more information, contact Warren Devine at *Warren.Devine@dnr.wa.gov*.

Figure 3.4: Understory vegetation community in a young stand in the OESF. This stand was pre-commercially thinned in 1998, creating gaps to foster development of structural complexity and habitat diversity. Photo: Richard Bigley.

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 Daniel Donato *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 led by DNR and the UW Olympic Natural Resources Center and includes researchers from multiple organizations.

In FY 2022, the principal investigators and DNR foresters and managers finalized the T3 silviculture study plan and allocated the experimental treatments into operational-scale timber sale units. DNR timber sale and silvicultural programs are implementing the study through 13 timber sales in the Coast District of the Olympic region. Pre-treatment monitoring continued for the third year in the riparian and upland portions of 16 experimental watersheds. Implementing a vision for learning-based collaboration, the project staff launched eight learning groups, which include DNR stakeholders, tribes, researchers, natural resource practitioners, and other community members. Each group focuses on separate topic, such as carbon, invasive species, or cedar-browse 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 2022 and FY 2023. 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: A retrospective study of 10-year-old silvicultural gaps.
- Phase II: An observational study of natural gap structures in primary (never-managed) old-growth forests, which will establish critical reference information.
- Phase III: A 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 are relevant to providing structural diversity and habitat in managed forests. The project was initiated and peer-reviewed in 2014, with data collection for Phase I completed that summer. Data analysis for Phase II is ongoing, including high-resolution LiDAR processing, gap delineation, field validation, and spatial analyses. Thinning treatments and pre- and post-treatment measurements have been conducted for Phase III. This study is now in a waiting period until the next set of measurements are taken, which are planned for 5-10 year intervals. A summary of this project is available on the *OESF webpage*. For more information, contact Daniel 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. For more information, contact Daniel Donato: *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. For more information, contact Daniel 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 details on this project can be found in the 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. Most 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. The project objectives are to

quantify the rate, density, and composition of tree and non-tree vegetation regeneration as influenced by burn severity and environmental setting, and to evaluate the potential for regeneration failure in warm, dry sites near the lower treeline. 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 established in 2018. Sampling continued through the 2022 field season and now includes nearly 400 field plots. Analysis of the data is ongoing. For more information, contact Daniel 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 is partially funded by a grant from the EarthWatch Institute and includes a citizen science component.

Acoustic recording unit installed in the Passive Acoustic Monitoring Study. Photo: Teodora Minkova.

In 2022, DNR researchers worked with two teams of volunteers to conduct forest habitat surveys in some of the 2013 monitoring stations. Sound recorders were installed and bird vocalizations were recorded for four days during the birds' breeding season in 32 monitoring sites where the T3 complex early seral experimental treatment will be implemented. Portions of the audio recordings have been screened for presence of 10 indicator bird species. 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. Stems in three pilot early old-growth stands and three thinned second-growth stands in westside planning units have been mapped; other qualified stands are being sought. DNR is conducting this project in partial collaboration with UW. For more information, contact Daniel Donato at *Daniel.Donato@dnr.wa.gov*.

3.5 OESF Research and Monitoring Program

Appendix: OESF Research and Monitoring Program

In FY 2022, 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. The OESF also continued with two 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 "Research on HCP-Covered Lands" section of this report and on the *OESF webpage*.

Despite the continuing COVID-19 pandemic, DNR researchers and field staff were able to complete all planned work while following federal, state, and DNR agency safety protocols.

The fifth annual OESF Science Conference took place virtually in May 2022 and more than 100 people attended. The focus of the six sessions was on engaging stakeholders, tribes, community members, and others in the T3 Watershed Experiment with the ultimate goal of forming learning groups. This goal was achieved with eight learning groups formed in June 2022 around of topics of interest to stakeholders: carbon, cedar-browse, tribal, economics and operations, aquatics, history, remote sensing, and invasive species.

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.

2022 field crew with OESF Research and Monitoring Manager Teodora Minkova (center, back row) and then-Coast District Planning Forester Kevin Alexander (front row, left).

Board of Natural Resources members, trust beneficiaries, and members of the public participated in a Board Retreat in the OESF in August 2022, after spending the previous day touring state trust lands near Port Angeles. In the morning, participants learned about thinning in the riparian management zone, and about log stringer and modular steel bridges. The afternoon was focused on the OESF Research and Monitoring Program and the T3 Watershed Experiment. The event was a success, and many participants said they found the tour and information valuable.

The program continued to work with capstone students, summer interns and graduate and undergraduate students. The 2022 field crew included DNR field technicians, DNR interns, interns from UW's *ONRC* and *Program on the Environment*, students from Oregon State University College of Forestry, scholars from the *Doris Duke Conservation Program*, and University of California San Diego. Field work included *acoustic monitoring*, *Riparian Status and Trends monitoring*, *fish monitoring*, soil sampling and electrofishing for the *T3 Watershed Experiment*, and ongoing work on the *Ethnoforestry field trial* and the *Long-term Ecosystem Productivity Study*. After the long period of remote learning, the students highly appreciate the hands-on experience and the interaction with researchers, DNR practitioners, and one another.

In FY 2022, the program had two external sources of funding to support several research projects on the Olympic Peninsula: a three-year grant from the Earthwatch Institute to conduct passive acoustic monitoring by engaging volunteers to collect field data, and a legislative budget proviso for FY 2022 and FY 2023 to coordinate with ONRC on four research projects.

3.6 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 calendar year are listed here. DNR authors are denoted in bold text.

2022 Publications

Devine, W., Minkova, T., Martens, K., Keck, J., Foster, D. (2022). Status and Trends Monitoring of Riparian and Aquatic Habitat in the Olympic Experimental State Forest: 2013-2020 Results. *Washington State Department of Natural Resources*, *Forest Resources Division, Olympia, WA.* *https://www.dnr.wa.gov/sites/default/files/publications/lm_oesf_st_status2022.pdf*

Martens, K. (2022). Riparian Validation Monitoring Program (RVMP) 2020 Annual Report. *Washington State Department of Natural Resources, Forest Resources Division, Olympia, WA*. *https://www.dnr.wa.gov/sites/default/files/publications/lm_oesf_rvmp_2020_ar.pdf*

Reilly, M.J., Zuspan, A., **Halofsky, J.S.**, Raymond, C., McEvoy, A., Dye, A.W., **Donato, D.C**., Kim, J.B., Potter, B.E., Walker, N., Davis, R.J. (2022). ***Cascadia Burning: The historic, but not historically unprecedented, 2020 wildfires in the Pacific Northwest, USA***. *Ecosphere. 13*(6), p. e4070.

2022 Presentations

Martens, K., Devine, W.., Minkova T. (2022). Riparian management influences on native salmonids in a predominantly second-growth forest. *152nd Annual meeting of the American Fisheries Society*. Spokane, WA. In-person oral presentation.

Devine, W., Halofsky, J., Donato, D. (2022). Carbon and state-managed lands: what has been done and what can be done in the T3 Watershed Experiment? *OESF Science Conference*. Virtual oral presentation.

Devine, W., Minkova, T., Martens, K., Foster, A. (Nov 2022). Riparian and aquatic habitat conditions in the Olympic Experimental State Forest. *Olympic Science Days.* Virtual oral presentation.

Minkova, T. (2022). Expanding the forest management toolbox: A large-scale field experiment on Washington state lands. *Western Washington University Environmental Speaker Series*. Bellingham, WA. In-person oral presentation.

Harvey, B.J., **Donato, D.C.**, **Halofsky, J.S.**, Buonanduci, M.S., Laughlin, M.M., Rangel-Parra, L.K., Morris, J. (2022). Forest fires in western Cascadia: Drivers, characteristics, and indicators of post-fire resilience. *92nd Annual Meeting of the Northwest Scientific Association*, *special session on Fostering Fire Resilience in the Pacific Northwest.* Virtual oral presentation.

Halofsky, J., Donato, D. (August 2022). Estimating the historical range of variation of tall-closed forest in the eastern WA Cascades. *Okanogan-Wenatchee National Forest*.

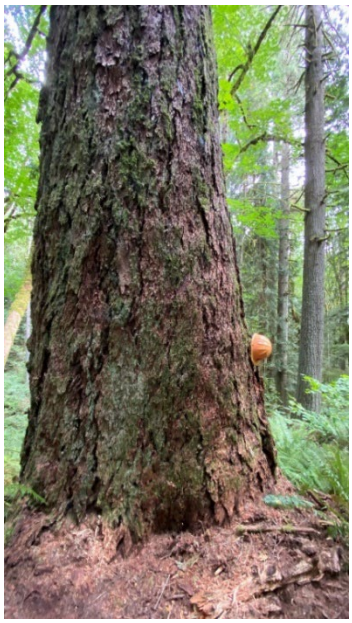
Halofsky, J. (June 2022). The fires that shape western WA. *Summer Institute for Teachers, Lacey, WA*.

Buonanduci, M., **Donato, D.**, **Halofsky, J.**, Kennedy, M., Harvey, B. (2022). Western Cascadia wildfire: spatial patterns of burn severity and implications for future ecological impacts. *University of Washington- School of Aquatic and Fishery Sciences Quantitative Seminar Series.*

Back to Adaptive Management section

4.0 Forest Inventory

Appendix A.4: RS-FRIS Comprehensive Review



A comprehensive review of DNR's RS-FRIS is in Appendix A.4 of this report. RS-FRIS relies largely on remotely sensed data instead of only 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 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 includes expanded coverage and now reports conditions using remotely sensed data collected in 2019 and 2020.

Updates for RS-FRIS 4.0 include:

- More recent remotely sensed data. RS-FRIS 4.0 incorporates remotely sensed data collected in 2019 and 2020. Approximately 85 percent of DNR-managed forestlands were flown in 2019; the remaining 15 percent were flown in 2020.
- Expanded coverage.
- Four new layers reporting aboveground biomass and carbon.
- Updated methodology to incorporate data from high-severity and very-high-severity fires in eastern Washington from 2010-20. Inventory attributes for these areas are imputed directly from plot data, instead of predicted from computer models. Origin year is reset to the fire year.

Additional funding provided by the Washington State Legislature through Second Substitute House Bill 1168 has allowed the forest inventory program to expand its field sampling efforts. The inventory program hired three additional field staff and has implemented two large-scale contracts to install field plots at an accelerated rate, with approximately 2,000 additional field plots to be completed by the end of the biennium (June 2023). The expanded effort represents a quadrupling of the rate of field sampling. The additional data will be used for fifth iteration of the inventory (RS-FRIS 5.0).

5.0 Silvicultural Activity

Appendix 5.0: Silviculture

Information and analyses provided in this section are based on 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 allows for the spatial tracking of individual forest management activities on the landscape.

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

Five major silviculture activity types are discussed in this report: timber harvest, site preparation, forest regeneration, vegetation management, and PCT. These activities typically occur in this order following final harvest of standing timber.

Table 5-1 shows completed silvicultural activity acres for FY 2022 by HCP planning unit. No silvicultural activities were completed in the Chelan HCP Planning Unit in FY 2022.

Table 5-2 shows completed acres by regional HCP grouping (eastside, westside, OESF).

Data in both tables is from LRM as of January 17, 2023, has been rounded to the nearest whole acre, and includes the mean annual completed acres of each activity for the last five fiscal years (2018-2022). Tables do not include silviculture activities for which both the completed acreage in FY 2022 and the five-year mean are below 50 acres.

5.1 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.

Dispersed retention on a VRH unit in the Northwest region. Photo: Zak Thomas.

Across all HCP planning units, acres of VRH completed in FY 2022 were 6 percent above the five-year mean, acres of VDT were 23 percent below the five-year mean, and acres of commercial thinning were 67 percent below the five-year mean. In the eastside planning units in FY 2022,

acres of completed VRH were 191 percent above the five-year mean while acres of VDT were 56 percent below the mean. This is a result of increased post-wildfire salvage efforts, which are generally classified as a VRH harvest technique.

5.2 Forest Site Preparation

Total acreage of forest site preparation completed in FY 2022 was 41 percent lower than the five-year mean. In westside planning units, not including the OESF ground herbicide treatment acres, acreage was 41 percent below the mean. In the OESF, acreage was 54 percent below. The reduction in site preparation acreage in westside planning units can be attributed to the seasonal variation of when this treatment is implemented during summer in the Straits and South Puget Sound planning units. In eastside planning units, there were no acres of chemical or mechanical site preparation; these activities are generally rare in eastside planning units.

5.3 Forest Regeneration

Total acreage of forest regeneration completed in FY 2022 was 6 percent higher than the five-year mean. There were 80 acres of completed natural regeneration in North Puget planning unit, representing less than 1 percent of all reforested acres on lands managed under the HCP. There was an 80 percent increase in the rate of hand-planting in the OESF, compared to the five-year mean reflecting an increase in timber harvest in the area. This was a planned increase per the Sustainable Harvest Calculation for the fiscal year. There were 183 acres of reforestation completed in eastside planning units in FY 2022, a decrease of 52 percent from the five-year mean.

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

5.4 Vegetation Management

Acres of completed vegetation management in FY 2022 were 6 percent above the five-year mean. In westside planning units, including the OESF ground herbicide release treatments, acreage was 53 percent above the five-year mean. Hand-cutting treatments were 48 percent below the five-year mean.

5.5 Pre-Commercial Thinning

The total acreage of PCT completed in FY 2022 was 23 percent above the five-year mean. Completed PCT acres in westside planning units, not including the OESF, was 45 percent higher than the five-year mean. Acreage was 56 percent lower than the mean in eastside planning units. New funding sources for silvicultural activities allowed for a greater amount of PCT to be completed in FY 2022.

Table 5-1 shows the acres of silviculture activities completed in FY 2022 by planning unit.

Table 5-1: Acres of silviculture activities completed in FY 2022 by planning unit. Data is from LRM as of January 17, 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 22 and the five-year mean are below 50 acres. There were no completed silviculture activities in the Chelan planning unit in FY 2022. OESF data is presented in Table 5.2.

FY 2022 Silviculture Activities by Planning Unit							
	Klickitat	Yakima	Columbia	North Puget	South Coast	South Puget	Straits
Timber Harvest							
Commercial Thinning	183		231	57		5	
Land Use Conversion			22	94	5	11	1
Uneven-aged Management	596					27	59
Variable Density Thinning	117		64	464	11	335	816
Variable Retention Harvest		599	1,898	2,449	3,650	1,717	1,361
Total	**896**	**599**	**2,215**	**3,063**	**3,666**	**2,095**	**2,236**
Forest Site Preparation							
Aerial Herbicide			1,291		1,166		
Ground Herbicide			455	1,951	231		31
Total			**1,746**	**1,951**	**1,397**		**31**
Forest Regeneration							
Hand Planting	183		2,351	3,358	3,181	1,125	1,262
Natural Regeneration				80			
Total	**183**		**2,351**	**3,438**	**3,181**	**1,125**	**1,262**
Vegetation Management							
Ground Herbicide			47	590	432	658	896
Hand Cutting			661	1,072	918	72	631
Hand Pulling					240		
Total			**707**	**1,662**	**1,589**	**730**	**1,527**
Pre-commercial Thinning							
PCT Total		**523**	**496**	**1,283**	**1,075**	**856**	**2,659**
Grand Total	**1,080**	**1,123**	**7,515**	**11,398**	**10,908**	**4,806**	**7,714**

Table 5-2: Acres of silviculture activities completed in FY 2023 by eastside, westside, and OESF. Data is from LRM as of January 17, 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 22 and the five-year mean are below 50 acres.

FY 2022 (five-year mean FY 2018–2022) by Eastside, Westside, and OESF				
	East	West	OESF	Total
Timber Harvest				
Commercial Thinning	183 (138)	292 (1,202)	0 (100)	**475 (1,441)**
Land Use Conversion	0 (0)	133 (36)	21 (8)	**154 (44)**
Uneven-aged Management	595 (419)	85 (36)	0 (0)	**681 (456)**
Variable Density Thinning	117 (266)	1,690 (1,240)	223 (1,139)	**2,031 (2,646)**
Variable Retention Harvest	599 (205)	11,074 (11,408)	2,331 (1,541)	**14,005 (13,155)**
Total	**1,495 (1,029)**	**13,275 (13,925)**	**2,577 (2,788)**	**17,348 (17,743)**
Forest Site Preparation				**Total**
Aerial Herbicide	0 (0)	2,457 (3,191)	0 (0)	**2,457 (3,191)**
Ground Herbicide	0 (0)	2,668 (5,452)	239 (520)	**2,908 (5,972)**
Total	**0 (0)**	**5,126 (8,643)**	**239 (520)**	**5,365 (9,164)**
Forest Regeneration				**Total**
Hand Planting	183 (281)	11,276 (11,573)	2,873 (1,594)	**14,332 (13,450)**
Natural Regeneration	0 (98)	80 (52)	0 (2)	**80 (153)**
Total	**183 (379)**	**11,356 (11,626)**	**2,873 (1,597)**	**14,412 (13,603)**
Vegetation Management				**Total**
Ground Herbicide	0 (0)	2,622 (2,020)	748 (186)	**3,370 (2,207)**
Hand Cutting	0 (0)	3,353 (4,422)	226 (414)	**3,579 (4,837)**
Hand Pulling	0 (0)	239 (452)	0 (4)	**239 (456)**
Total	**0 (0)**	**6,215 (6,895)**	**974 (605)**	**7,190 (7,501)**
Pre-commercial Thinning				**Total**
PCT Total	523 (1,191)	6,368 (4,395)	1,004 (817)	**7,896 (6,404)**
Grand Total	**2,202 (2,600)**	**42,341 (45,486)**	**7,669 (6,330)**	**52,213 (54,417)**

5.6 Salvage

Across all HCP planning units, the total acreage of salvage harvest was 134 percent above the five-year mean. The increase can be attributed to an area of windthrow salvage in the OESF and post-wildfire salvage in eastside planning units (Table 5-3).

Table 5-3 compares acres of salvage harvest completed in FY 2022 to the five-year mean by harvest type.

Table 5-3: Acres salvaged by harvest type in FY 2022 and five-year mean (FY 2018–22).

FY 2022 (five-year mean FY 2018–2022)				
Harvest Type	**East**	**West**	**OESF**	**Total**
Commercial Thinning	0 (0)	0 (0.2)	0 (0)	**0 (0.2)**
Uneven-aged Management	0 (0)	0 (0.2)	0 (0)	**0 (0.2)**
Variable Density Thinning	0 (0)	0 (71)	0 (0)	**0 (71)**
Variable Retention Harvest	599 (176)	264 (120)	20 (9)	**0 (306)**
Grand Total	**599 (176)**	**264 (192)**	**20 (9)**	**883 (378)**

6.0 Road Management Activity

Background: Road Management Activity

Forest Roads Program

The Forest Roads Program continues to improve DNR's forest road infrastructure across the state. Unlike most activities described in this report, DNR reports road management activities by calendar year instead of fiscal year because of the complexities of collecting data and reporting road-related activities during the height of the construction season.

Fish Barrier Removal

In October 2021 (FY 2022), DNR completed the removal or corrections of all fish barriers culverts under its RMAPs. Through land transactions and inspections, DNR acquires (i.e. adds to the inventory) barriers that need correction. DNR is committed to remediating new fish barriers within six years of their identification, and inspecting fish passage culverts every 10 years.

In calendar year 2022, inspection activities identified ("acquired") nine new fish passage barriers that need

Typical fish passable culvert. Photo: Alex Nagygyor

correction. Combined with 10 other fish passage barriers identified over the past several years, this totals 19 newly discovered fish barriers on DNR-managed lands that require correction. DNR continues to prioritize replacement of newly discovered fish barriers within 6 years of acquisition.

In calendar year 2022, 11 barriers were removed from the fish-barrier worklist on DNR-managed lands, an investment of more than $305,000. Of these 11 barriers:

Fish-barrier removal on West Fork Dickey River tributary. Photo: Jeremy Tryall.

- Nine barriers were removed or replaced, opening an estimated 0.3 miles of fish habitat on DNR-managed lands.
- Two barriers were removed from the work list because the stream designation was downgraded from “fish” to “non-fish” following protocol survey requirements.

Road Management Activities

On HCP-covered lands, DNR abandoned or decommissioned 34 miles of road and constructed 80 miles of road in 2022. In 2022, there was a net decrease of total road miles on HCP-managed lands (from 10,723 to 10,683 miles) due to land transactions, abandonment, decommissioning, and updates to the road inventory. Table 6-1 summarizes DNR’s road management activity on HCP-covered and non-HCP-covered lands in calendar year 2022.

Table 6-1: Road Management activity for calendar year 2022. Mileage is rounded to the nearest mile.

HCP Lands	Road Miles					Fish Barriers
	Constructed	Reconstructed	Abandoned	Decommissioned	Inventoried[1]	Removed
Chelan	0	0	0	0	51	0
Columbia	10	10	7	0	1,283	1
Klickitat	0	1	0	2	604	0
North Puget	37	11	6	0	1,485	5
OESF	6	1	0	1	1,837	1
South Coast	11	4	3	1	1,765	1
South Puget	3	3	4	0	1,365	3
Straits	12	4	0	0	922	0
Yakima[2]	1	5	0	10	1,370	0
Total	**80**	**38**	**20**	**14**	**10,683**	**11**

Non-HCP Lands	Road Miles					Fish Barriers
	Constructed	Reconstructed	Abandoned	Decommissioned	Inventoried	Removed
Non-HCP	15	14	1	2	3,081	0
Teanaway	0	0	0	6	349	0
Total	**15**	**14**	**1**	**8**	**3,429**	**0**
Grand Total	**96**	**52**	**21**	**22**	**14,112**	**11**

[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 Teanaway Community Forest because this land is not covered by the HCP.

Easements and 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 acquires new lands that are subject to existing easement rights.

Road Easement GIS and Spatial NaturE

DNR is digitally mapping all existing and new easements in the Road Easement GIS data set. Mapping of easements granted to DNR was completed in 2014. Initial mapping of road easements granted over DNR-managed trust lands in all regions was completed at the end of 2016.

In FY 2022, 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, irrigation infrastructure, water rights, agriculture and grazing leases, railroads, recreation sites, special use permits, and land use restrictions.

Road Easements, Road Use Permits, and Utility Easements

Table 6-2 reports easements granted in FY 2022 that created a new footprint (i.e., timber was cut to create a new open space).

Table 6-2: Road Easements and Road Use Permits (New Footprint) Granted in FY 2022.

Unit of Measurement	Columbia	North Puget	OESF	South Coast	Straits	Klickitat	Chelan	Yakima	South Puget	Total
Miles	0.03	0.8	0	0	2.4	0	0	0	0.25	**3.48**
Acres	0.15	0.46	0	0	10.04	0	0	0	0.31	**10.96**

7.0 Land Transactions

Appendix: Background on Land Transactions

Below is a summary of land acquisitions, dispositions, and transfers completed in FY 2022 by HCP planning unit. All newly acquired parcels listed in this section are now covered under the HCP and have been designated as "no role for northern spotted owl habitat," although this designation may be revised based on the outcome of future field surveys. All disposed parcels were classified as "no role for northern spotted owl habitat" and are no longer covered under the HCP, unless otherwise noted.

The narrative in this section incorporates acreage data from land surveys conducted during transactions, whereas Table 7-1 incorporates data from DNR GIS layers; therefore, the numbers in the narrative might not exactly match those in the table. Narrative acreage data is rounded to the nearest whole acre.

Transactions by HCP Planning Unit

Land transactions occur in the form of acquisitions, disposals, Trust Land Transfers, or State Forest Transfers. In 2022, there were no disposals. Following are the land transactions completed in FY 2022.

Eastside Planning Units

Chelan

No applicable transactions.

Klickitat

No applicable transactions.

Yakima

No applicable transactions.

Westside Planning Units

Columbia

Acquired: DNR purchased 266 acres of forestland in Wahkiakum County.

North Puget

Acquired: DNR purchased 39 acres of conservation land for Mount Si NRCA in King County.

OESF

Acquired: DNR purchased 79 acres of forestland in Clallam County. DNR purchased 485 acres of forestland in Jefferson County.

South Coast

Acquired: DNR purchased 75 acres of conservation land for Mima Mounds NAP in Thurston County.

South Puget

Acquired: DNR purchased 7 acres of conservation land for Kennedy Creek NAP in Mason County. DNR purchased 3 acres of conservation land for Kennedy Creek NRCA in Mason County. DNR purchased 23 acres of conservation land for Stavis NRCA in Kitsap County.

Straits

Acquired: DNR purchased 676 acres of forestland in Clallam County. DNR purchased 156 acres of forestland in Jefferson County.

Transactions by Stream Type and Asset Class

Table 7-1 lists acquired and disposed lands by stream type and asset class per HCP Planning Unit.

Table 7-1: Acquisitions and Dispositions completed in FY 2022 within HCP planning units. Dashes indicate no applicable transactions occurred during the fiscal year.

HCP Planning Unit								
		Columbia	North Puget	OESF	South Coast	South Puget	Straits	Totals
Acquired Lands [1]								
Stream miles by stream type	Type 1	-	-	-	-	-	-	**0**
	Type 2	-	-	-	-	-	-	**0**
	Type 3	1.36	0.05	3.25	0.95	0.62	3.39	**9.62**
	Type 4	2.05	0.47	3.62	-	0.03	3.14	**9.31**
	Type 5	1.09	0.14	4.17	0.39	0.02	3.91	**9.72**
	Type 9	12.29	4.66	30.98	4.15	1.51	55.54	**109.13**
Total miles		**16.79**	**5.32**	**42.02**	**5.49**	**2.18**	**65.98**	**137.78**
Acres per asset class[2, 3]	Forest	266	0	565	0	0	832	**1663**
	Conservation	0	39	0	75	34	0	**148**
Total acres[3]		**266**	**39**	**565**	**75**	**34**	**832**	**1811**
Disposed Lands								
Stream miles by stream type	Type 1	-	-	-	-	-	-	**-**
	Type 2	-	-	-	-	0.28	-	**-**
	Type 3	-	-	-	-	-	-	**-**
	Type 4	-	-	-	-	-	-	**-**
	Type 5	0.33	-	-	-	-	-	**-**
	Type 9	-	-	-	-	-	-	**-**
Total miles		**0.33**	**-**	**-**	**-**	**0.28**	**-**	**0.61**
Acres per age class[3]	Open (0–10 years)	-	77	-	-	-	-	**77**
	Regeneration (11–20 years)	31	-	-	-	-	-	**31**
	Pole (21–40 years)	-	-	-	-	-	-	**-**
	Closed (41–70 years)	6	86	-	-	-	-	**92**
	Complex (71–100 years)	-	177	-	-	-	-	**177**
	Complex (101–150 years)	-	13	-	-	-	-	**13**
	Functional (150+ years)	-	-	-	-	-	-	**-**
	Non-forest	2	170	-	-	27	-	**199**
	Unknown	-	-	-	-	-	-	**-**
Total acres[3]		**37**	**525**	**-**	**-**	**27**	**-**	

[1] Data for acquired lands are estimates that have not yet been field-verified.
[2] Asset-class data on acquired lands is obtained from deeds and other information relative to the holdings on the land. Over time, DNR will inventory acquired parcels and replace asset class information with more specific age-class data.
[3] Acres rounded to nearest whole number.

8.0 Natural Areas Program

Appendix: Background on Natural Areas Program

In FY 2022, the Natural Areas Program protected an additional 601.3 acres in Natural Area Preserves (NAPs) and Natural Resource Conservation Areas (NRCAs), including 154.0 acres within the area covered by the HCP. These protection efforts added to four existing natural areas and established one new natural area. The most significant of these were the following:

Steptoe Butte Natural Area: 447 acres were purchased at Steptoe Butte, creating the newest DNR-managed natural area within the state. This site, adjacent to the Steptoe Butte State Park, was established to protect the largest known remaining occurrence of Palouse Prairie in Washington. Less than 1 percent of the historic extent of this ecosystem remains and most remnants are very small and highly fragmented. The site also supports three rare plant species (including the federally threatened Spalding's catchfly) and an occurrence of the rare giant Palouse earthworm. Protection of these lands will serve a key role in the long-term conservation of the Palouse Prairie ecosystem.

Palouse prairie at the newly established Steptoe Butte Natural Area. Photo: DNR Natural Heritage Program.

Mima Mounds NAP: 79.1 acres of Garry oak woodland and prairie were added to this Natural Area Preserve, a key addition to the site and the first in nearly 10 years. This purchase adds some of the highest quality remaining prairie-oak habitat adjacent to the original preserve, includes a stretch of Mima Creek that supports coho salmon, steelhead, and cutthroat trout, and provides connectivity to undeveloped forested lands in the Black Hills.

In addition to land acquisitions, the Natural Areas Program continued to actively manage and enhance habitat on natural areas in FY 2022 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; Figure 8-2), and Puget Sound/Hood Canal salmon runs (Dabob Bay NAP/NRCA).

Table 8-1 lists acreage added to Natural Area Preserves located within the HCP boundary. Natural areas in bold text are composed primarily of mature forests and/or late-seral forests.

Reed canarygrass control, native plantings, and water level monitoring station in Oregon spotted frog habitat at Trout Lake NAP. Photo: David Wilderman.

Table 8-1: Acres added to NAPs and NRCAs within HCP-covered lands by county in FY 2022. Acreage data comes from the Land Transactions Program, determined through surveys at the time of transaction and might not match the "GIS acres" of transacted land in the DNR GIS system.

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
	Teal Slough NRCA	Pacific	-	8.4
	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	79.1	719.6
	Rocky Prairie NAP	Thurston	-	35
	Dailey Prairie NAP	Whatcom	-	228.8
Total		**Total Acres**	**79.1**	**26,886.8**

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	40	13,774.9
	West Tiger Mountain NRCA	King	-	3,915.5
	Stavis NRCA	Kitsap	24.2	3,020.4
	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
	Lake Louise NRCA	Whatcom	-	137.7
	Lummi Island NRCA	Whatcom	-	671.5
	Klickitat Canyon NRCA	Yakima	-	2,335.2
Total			64.2	95,276.2
NAP/NRCA	Lacamas Prairie NAP/NRCA	Clallam		211.1
NAP/NRCA	Washougal Oaks NAP/NRCA	Clark		318.5
NAP/NRCA	Dabob Bay NAP/NRCA	Jefferson	-	3,293.6
NAP/NRCA	Kennedy Creek NAP/NRCA	Mason	10.7	1,121.3
Scenic Area	**Rattlesnake Mtn Scenic Area**	King	-	1,875.7
Total			**10.7**	**6,290.6**
Grand Total			**154.0**	**128,453.6**

Table 8-2 lists the federally threatened and endangered species found in natural areas covered by the HCP.

Table 8-2: Federally Threatened and Endangered Species on 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
Golden Paintbrush	Threatened	Rocky Prairie NAP, Admiralty Inlet NAP, Mima Mounds NAP
Wenatchee Mountains Checker-Mallow	Endangered	Camas Meadows NAP

Table 8-3 lists other species of concern in the natural areas covered by the HCP.

Table 8-3: 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
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

Federal Species of Concern	
Species	**Natural Area[1]**
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
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

[1]*Location 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.*

9.0 Non-Timber Management Activity

9.1 Special Forest Products

Appendix: Background Special Forest Products

Three of DNR's upland regions – South Puget Sound, Olympic, and Pacific Cascade – offer opportunities to gather special forest products in the OESF, South Coast, South Puget, Columbia, and Straits 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 of these products.

In all three regions, DNR sells individual permits for multiple designated brush harvest areas. Applicants are able to buy one permit per harvest area annually. These region offices may also offer direct sales of some of the same special forest products. In South Puget Sound and Pacific Cascade regions, 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 9-1 summarizes DNR's sales of special forest products on HCP-covered forestlands in FY 2022.

Region	Permits		Leases		Direct Sales	
	Occurrences	Acres	Occurrences	Acres	Occurrences	Acres
South Puget	83	76,168	23	82,720	2	784
Olympic	54	170,930	0	0	0	0
Pacific Cascade	0	0	0	0	0	0
Total	**137**	**247,098**	**23**	**82,720**	**2**	**784**

9.2 Leases

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 2022, 79 communication sites were leased within the area managed under the HCP, totaling approximately 88 acres. There were 295 leases from individual tenants on the 79 communication sites.

Grazing Permits and Leases

Most DNR-managed grazing takes place on non-forested state trust lands east of the Cascade crest on lands that are not managed under the HCP. Grazing is selectively allowed on forested state trust lands managed under the HCP in both eastern and western Washington. In eastern Washington, state trust lands are grazed under permits and leases. In western Washington, state trust lands are grazed under a few leases that cover a very small total area.

Table 9-2 summarizes grazing permits and grazing leases for FY 2022.

Table 9-2: Acreage of grazing permits and grazing leases in FY 2022 by HCP planning unit (PU).

HCP PU	**Total all DNR-managed land** (forested & non-forested)		**Forested Lands** (HCP and non-HCP)		**All HCP lands** (includes non-forested)		**HCP lands** (forested only)	
	Grazing Leases	Range Permit	Grazing Leases	Range Permits	Grazing Leases	Range Permits	Grazing Leases	Range Permits
Chelan	8,226	0	3,466	0	4,303	0	3,453	0
Columbia	40	0	0	0	12	0	0	0
Klickitat	10,805	36,831	9,511	35,554	10,158	36,714	9,404	35,545
North Puget	39	0	0	0	38	0	0	0
OESF	0	0	0	0	0	0	0	0
South Coast	177	0	100	0	118	0	100	0
South Puget	0	0	0	0	0	0	0	0
Straits	0	0	0	0	0	0	0	0
Yakima	138,098	56,497	92,749	47,261	87,686	53,735	65,352	47,255
Total	**157,387**	**93,328**	**104,224**	**82,816**	**102,316**	**90,449**	**78,410**	**82,801**

9.3 Valuable Material Sales

Appendix: Background Valuable Material Sales

In FY 2022, DNR had four active sand, gravel, and rock contracts on lands managed under the HCP, totaling approximately 669 acres[1]. One of these, Livingston Quarry (with approximately 346[1] acres of HCP-covered land), is in the process of final reclamation, and is no longer actively mined, and the majority of the disturbed area is outside of the HCP area. These contracts, approved by the Board of Natural Resources and awarded through a public auction process, are summarized in Table 9-3. All contracts that include HCP lands contain provisions for HCP compliance and protection.

In addition to the contracts listed in Table 9-3, 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 which a purchaser is interested. Direct sales are typically negotiated through the region and do not require Board of Natural Resources approval.

Table 9-3: Sand, gravel, and rock contracts active in FY 2022.

Lease Name	HCP PU	Commodity	Acres[1]	Volume Sold (tons)
Jordan Road	North Puget	Sand, gravel	40.85	10,000,000
Livingston Quarry	Columbia	Rock, Sand, & Gravel	345.59	50,000
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**	**22,385,000**

[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.*

9.4 Recreation Program

Appendix: Recreation — 2022 Projects

Recreation sites allow public recreation on forested state trust lands so long as it is compatible with state laws and the objectives of the *Policy for Sustainable Forests* and the HCP. Sanctioned recreational activities on state trust lands include hiking, biking, horseback riding, off-road vehicle use, hunting, fishing, gathering, and camping. DNR's vision statement for recreation and public access is to "manage public and trust lands in a manner that provides quality, safe recreational experiences that are sustainable and consistent with DNR's environmental, financial and social responsibilities." DNR develops recreation plans for many of the areas it manages. Plans are developed with extensive involvement of local recreation groups and the public, many of whom also volunteer to help maintain recreation sites.

In calendar year 2022, DNR's recreation program continued work with Washington Conservation Corps crews and many other volunteer groups to complete numerous projects across the DNR landscape. These projects included 12 miles of new trail built, rerouted, or reopened to users. More than 250 miles of existing trail were maintained, including brushing, restoration, and new drainage. Thirteen bridges were installed, and 16 bridges underwent inspections and repairs. Two new CXT precast concrete restrooms and three sustainable urine diversion outhouses were installed, with more permitted for the future. Several picnic and rest areas, four corrals, and six new campsites were built, with many more maintained and restored. New signage was installed, including five new kiosks clarifying e-bike policy. Many tons of garbage were removed, unauthorized trails closed, and areas restored with the help of partner and volunteer organizations. This work enhances recreational experience, helps to keep people safe and informed, and protect resources from erosion and overuse.

Recreation related projects are summarized in the *Appendix: Recreation — 2022 Projects*

10.0 HCP Implementation Documentation

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. 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. Table 10-1 describes activities that have been documented. Not all documented activities have yet have taken place.

HCP consultation represents the cooperative problem solving that is necessary in the course of HCP implementation. Documentation of these discussions and agreements includes the following types:

- **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 10-1: Summary of FY 2022 HCP Implementation Documentation.

Region/ Division	Approval Date	Type	Associated Project	HCP Strategy	Activity Summary
Olympic	09/21/2021	Implementation Consultation	Taylor Downhill Sorts Timber Sale	Multispecies / Uncommon Habitats	Implementation of the draft cave procedure.
Olympic	02/04/2022	Implementation Consultation/Joint Concurrence	T3 Watershed Consultation	Multispecies / Uncommon Habitats/ Riparian/ Marbled Murrelet	A T3 watershed experiment study on 20,000 acres in the OESF. The memo describes the location and acres of alternative leave tree distributions, riparian buffers thinnings below RD 30 and marbled murrelet buffer thinnings. These activities were approved by USFW Service.
Pacific Cascade	12/17/2021	Implementation Consultation	Bee Hive Timber Sale	Northern Spotted Owl	Tailhold in northern spotted owl nest patch buffer.
Southeast	11/07/2021	Joint Concurrence	Ahtanum Northern Spotted Owl Dispersal Management Areas Adjustment	Northern Spotted Owl	An agreement to adjust the boundaries of the Ahtanum Dispersal Management area to provide a more contiguous management area. Habitat was also updated within the new boundaries resulting in an overall increase in habitat in the management area.
South Puget Sound	03/31/2022	Implementation Consultation	Butter Cup Timber Sale	Riparian	Nine trees in a Type 4 stream buffer needed to be moved because they were isolated by a road.

Appendix A: Background

A.1 State Trust Lands Habitat Conservation Plan

The *State Trust Lands Habitat Conservation Plan* (HCP) is a long-term land management plan that is authorized under the Endangered Species Act (ESA) and prepared in partnership with the United States Fish and Wildlife Service and NOAA Fisheries (the Services). The HCP describes, in a suite of habitat conservation strategies, how the Washington State Department of Natural Resources (DNR) will restore and enhance habitat for threatened and endangered species – such as the northern spotted owl, marbled murrelet, and salmon – in conjunction with timber harvest and other forest management activities. These strategies range from passive (for example, protecting unique habitats such as cliffs and springs) to active (thinning forests to speed development of habitat). Each strategy is written in the context of an integrated approach to management, in which commercial forest stands are managed to provide both revenue and ecological values such as biodiversity. Through these strategies, DNR offsets the potential harm of forest management activities on individual members of a species by providing for conservation of the species as a whole.

Land managed by DNR under the HCP and covered by the incidental take permit (ITP) are referred to in the HCP, ITP, and implementation agreement variously as "DNR-managed lands in the area covered by the HCP," "PERMIT LANDS," the "DNR forest lands," the "DNR-managed lands," the "lands within the planning units," and other similar terms (Figure A.1). All such terms, unless otherwise indicated used in the HCP, ITP, or the implementation agreement, refer to those lands identified in Map I.1 of the HCP as "DNR-managed HCP lands," in addition to those lands that have been added to the HCP planning units through land transactions. (See HCP Appendix B, p. 3, 15.0 for further discussion.)

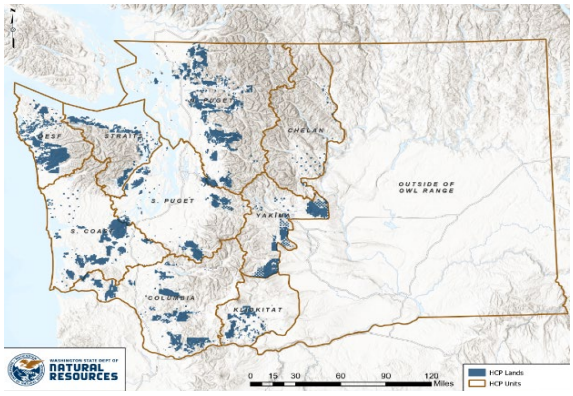


Figure A.1: HCP lands and planning units. Map: Thomas Broch.

An HCP is required to obtain an incidental take permit, which allows incidental take of a threatened or endangered species. 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 its obligations under the ESA. In this way, the HCP and incidental take permit provide DNR the stability, certainty, and flexibility needed to meet its fiduciary and ecological responsibilities as a trust lands manager to provide a perpetual source of revenue to trust beneficiaries while simultaneously developing a complex, 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 amount, the HCP guides management of approximately 1.9 million acres of forestland within the range of the northern spotted

owl (*Strix occidentalis caurina*). In general, these 1.9 million acres are located between the western coast and eastern slopes of the Cascade Range in Washington, from the Canadian border to the Columbia River. To manage these areas more effectively and efficiently, DNR divided this area into nine planning units based primarily on large watersheds (Figure A.1).

Implementation of the HCP conservation objectives for the nine planning units is grouped into the three areas: 1) the five westside planning units except the OESF (HCP, p. IV.3), 2) the OESF (HCP, p. IV.86), and 3) the three eastside planning units (HCP, p. IV.19). The five westside planning units are Straits, North Puget, South Puget, South Coast, and Columbia. The three eastside planning units are Yakima, Chelan, and Klickitat.

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.

Comprehensive Reviews

The HCP Implementation Agreement (Section 21.0, p. B.8) requires periodic comprehensive reviews of the HCP, the Incidental Take Permit, and the Implementation Agreement, as well as consultation in good faith between DNR and the Federal Services to identify amendments that might be more effective at mitigating incidental takes. In 2012, DNR and the Federal Services agreed to conduct annual comprehensive review by subject as funding and staffing allow. Table A-1 provides a summary of the comprehensive reviews completed since 2012.

Table A-1: Comprehensive Reviews Developed for HCP Annual Reports

Link to Report[1]	Subjects
FY 2012 Annual Report	Road Management
FY 2013 Annual Report	Silviculture Activities, Northern Spotted Owl Data
FY 2014 Annual Report	Land Transactions, Natural Areas
FY 2016 Annual Report	Implementation Monitoring, Effectiveness Monitoring
FY 2017 Annual Report	Recreation
FY 2018 Annual Report	Riparian Forest Habitat Restoration
FY 2019 Annual Report	Forest Inventory
FY 2022 Annual Report	Implementation Monitoring

[1]A comprehensive review was not completed for the FY 2015, 2020, or 2021 report due to limited staff capacity and the COVID-19 pandemic. The FY 2022 Annual Report on Implementation Monitoring is in final review. A link to that report will be included in the FY2023 HCP Annual Report.

Back to the HCP Annual Report

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.

Northern Spotted Owl Conservation Strategy

Northern Spotted Owl 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. These designated northern spotted owl management areas include three subsets:

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.

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 Northern Spotted Owl Conservation in the OESF HCP Planning Unit later in this section for more information.

Northern spotted owl. Photo: Teodora Minkova.

In 2006, DNR designated another type of northern spotted owl management area called an "owl area." 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). These areas were a) designated in HCP Implementation Memorandum No. 1 (January 12, 1998), (b) located within Washington Department of Fish and Wildlife (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 areas are intended to sunset when the commitments of the Settlement Agreement are met.

Northern Spotted Owl Habitat Classes and Types

Each northern spotted owl management area is managed for certain habitat classes, and each habitat class includes specific habitat types. Table A-2 provides habitat classifications and types for each westside northern spotted owl management area

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.

Table A-2: Habitat Classifications and Types for Each Westside Northern Spotted Owl Management Area.

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

As noted in this year's Conservation Strategy Updates (***Section 2.1***), northern spotted owl habitat is now calculated using data from the DNR Remotely Sensed Forest Resources Information System (RS-FRIS).

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-3 includes the definitions of each habitat type, as well as the queries DNR uses to identify it using RS-FRIS data. Updated queries are:

- 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-3: Northern Spotted Owl 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 ≥ 21" diameter class) ≥ 31 trees per acre **and**
		(Live trees ≥ 31" diameter class) ≥ 15 trees per acre **and**
	At least 12 snags per acre larger than 21" dbh	(Snags ≥ 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 ≥ 4" diameter class) ≥ 2,400 ft.^{3} per acre
	At least three of the 31 trees ≥ 21" dbh have broken tops	Not in query
Type A	A multi-layered, multispecies canopy dominated by large (≥ 30" dbh) overstory trees (typically 15–75 trees per acre)	Canopy layers ≥ 2 **and**
		Secondary species is not null **and**
		(Live trees ≥ 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 ≥ 30" diameter class) ≥ 2.5 trees per acre **and**
	Large accumulations of fallen trees and other woody debris on the ground	(Down wood ≥ 4" diameter class) ≥ 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 Type B, cont.	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 ≥ 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 ≥ 20" diameter class) ≥ 1 tree per acre **and**
	Accumulations of fallen trees and other woody debris on the ground	(Down wood ≥ 4" diameter class) ≥ 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 ≥ 4" diameter class) ≥ 30% of all live trees per acre **and**

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used
	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' 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) ≥ 11" QMD **and**
	Top height of at least 85'	(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
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.	

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Tracking Northern Spotted Owl Habitat

Within each northern spotted owl 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 ¼ 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 with the rest composed of structural or better 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-4 describes habitat thresholds for selected HCP planning units.

Table A-4: Habitat Thresholds for HCP Planning Units

HCP Planning Unit	Habitat Threshold		Habitat Classification	Habitat Types
OESF	40% of each SOMU	At least 20%	Old Forest Habitat	Old Forest
				High-quality nesting
				Type A
				Type B
		20%	Structural 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.

Northern Spotted Owl Conservation in the OESF HCP 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.

Northern Spotted Owl 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.

Marbled Murrelet Conservation Strategy

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 on DNR-managed lands. To address this, 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.

In November 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. At this same time, 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*

Following extensive research, public consultation, input from an independent science team, and several years of consultation with USFWS on the development of alternatives for a long-term conservation strategy, the Board of Natural Resources adopted a long-term strategy in December 2019. Additional information is on DNR's *Long-Term Conservation Strategy* webpages.

The marbled murrelet long-term conservation strategy (the *MM Amendment*) replaces the interim strategy.

As discussed in the MM Amendment (page 19), 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. 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 (described below). Natural disturbance will be tracked through the reporting of salvage activities, and during the first decade of implementation, DNR will report on "metered" acres (MM Amendment, page 34).

More information is provided below on each of these concepts. For a full description, see the MM Amendment references given in each subsection.

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. P-stage attempts 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. For the MM Amendment, it groups stands with 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 refers to 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. Examples include whether the proximity of acres close to a forest edge that can attract predators, acres which are near or far from occupied sites, and whether the habitat is subject to 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 one unit of measurement.

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.

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).

MM Amendment Implementation

DNR will implement the MM Amendment in two phases. During Phase One, DNR will initially limit some of the flexibility provided in the MM Amendment to allow the development of a detailed implementation procedure and conduct staff training on implementation specifics. Implementing in phases also provides DNR and the trust beneficiaries and stakeholders time to become familiar with the LTCS approach and concepts before moving into full implementation.

Full implementation occurs in Phase Two. Activities that may be allowed in Phase Two with timing restrictions, consultation with USFWS, and/or other requirements are not encouraged during Phase One, without deliberate coordination. Although DNR has more flexibility in Phase Two, activities in occupied sites, occupied site buffers, SHAs, and other LTFC will still be limited.

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

Table A-4 of the MM Amendment (page A-5) describes the activities allowed and not allowed in the various habitat categories. 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.

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Riparian Conservation Strategy

For the five westside HCP planning units, the HCP riparian conservation strategy was developed with two specific objectives:

- Maintain or restore freshwater habitat for salmonids on state trust lands, and

- Contribute to the conservation of other species that depend on aquatic and riparian habitats, including wetlands (HCP, p. IV.55).

Meeting these objectives means using RMZs and WMZs to provide clean water, shade, and large logs for streams. It also means preventing sediment delivery to streams and wetlands through management standards for road building and for conducting forest management activities on potentially unstable slopes and rain-on-snow areas.

Adopted in 2006, the *Riparian Forest Restoration Strategy (RFRS)* is part of the HCP riparian conservation strategy. The RFRS, which applies to all westside HCP planning units except the OESF, was developed by a technical review committee consisting of technical staff from DNR, NOAA, USFWS, Northwest Indian Fisheries Commission, and WDFW.

Under the RFRS, DNR designs riparian forest thinnings to restore older forest structure and species composition in areas where historic timber harvest created stands that were even-aged and overstocked. DNR uses canopy gaps and "skips" — areas that are left unmanaged — to help increase structural diversity and accelerate the development of habitat. Candidate stands for RFRS treatments are often missing long-lived conifer species like western red cedar, or are dominated by short-lived species like red alder.

Accelerating the growth of large conifer trees is an important part of the RFRS. Over time, these trees will provide shade and nutrient-rich litter to streams when they are alive and large woody debris when they die and fall over. Large woody debris in the stream channel creates pools and cover, which are important for salmon habitat. Once the riparian forest is on a developmental trajectory to reach an older forest structural condition, further restoration activities are low priority and site-specific. During the initial RFRS implementation period, thinning in stands 70 years of age or older was conducted on a site-specific basis in consultation with the Services. This restriction was lifted in 2012 through a *joint concurrence letter* signed by DNR and the Services.

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 along Type 5 streams and complete the HCP riparian conservation strategy. It was determined, however, that the draft strategy would have required a high level of spatial tracking to comply and document, and it would have introduced a prohibitive number of management decisions to complete each timber sale. As a result, a simpler alternative draft headwaters strategy is being developed that will meet the original conservation objectives of the previous version. This alternative strategy incorporates emerging ideas about the importance of non-fish-bearing stream habitat for ecosystem conservation and downstream fish habitat quality.

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Multispecies Conservation Strategy

In addition to providing habitat for ESA-listed species, the conservation objectives developed for the HCP were designed to provide appropriate habitat protection for many native species not currently listed or protected under the ESA. The HCP also specifies habitat protection for numerous Washington state-listed plant and animal species of concern.

Uncommon Habitat Objectives

The multispecies conservation strategy involves identification and protection of uncommon habitat types for unlisted species. These habitat types include caves, cliffs, talus slopes, wetlands, balds, mineral springs, snags, oak woodlands, and large structurally unique trees. These habitat types provide nesting, roosting, hiding, and foraging opportunities for many species.

A.3 Adaptive Management, Monitoring, and Research

Monitoring and research provide the information necessary to improve the implementation and effectiveness of the conservation strategies in the HCP. Monitoring and research also help DNR document how well different plans and actions are working to achieve the desired outcomes. The information gained can be used to adjust or adapt DNR's management practices as needed.

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. However, much remains to be learned, and new systems and techniques continue to be developed and tested. Monitoring and research support the completion of conservation strategies, evaluate their implementation and effectiveness, test promising alternatives to current conservation approaches, and contribute to the ecological foundation of habitat management on DNR-managed lands.

The adaptive management process outlined in the HCP allows changes to DNR forest management techniques and activities when results from the 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*, and a *legacy tree procedure for eastern Washington* that protects old-growth trees and stands.

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 the following tasks:

- Set research priorities
- Develop study plans.
- Manage research projects.
- Review results.
- Make changes to DNR's forest management practices if necessary.
- Monitor 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.

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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 system consisting of three types of monitoring — implementation, effectiveness, and validation — has become a common organizational framework for monitoring programs in forest management.

- **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 and Research 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.

Northern Spotted Owl Conservation Strategy Effectiveness Monitoring

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.
- Landscape-scale monitoring of basic habitat indicators across the entire westside HCP land base.
- DNR is also conducting two 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.

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.

Riparian Silviculture Effectiveness Monitoring

The objective of effectiveness monitoring 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. To achieve this, DNR has established several permanent monitoring sites in the OESF, North Puget, and South Puget HCP

planning units in which various habitat metrics are measured immediately before and after thinning treatments, and periodically thereafter. Thinning treatments are characteristic of treatments implemented under the 2006 Riparian Forest Restoration Strategy and are intended to facilitate the development of structurally complex riparian forests.

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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: (1) interior-core buffers to protect soils on floodplains and unstable stream banks, incised stream valleys, and adjoining unstable slopes; (2) exterior, or wind buffers adjacent to interior buffers, as needed, to protect against blowdown; (3) a comprehensive program of road management, maintenance, and improvement including stabilizing and decommissioning particularly risky roads; and (4) protecting forested wetlands. Riparian validation monitoring will determine if the riparian conservation strategy is maintaining or improving salmonid habitat and expressing stable or positive effects on salmonids as anticipated in the HCP.

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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.

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A.4 RS-FRIS Comprehensive Review

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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).

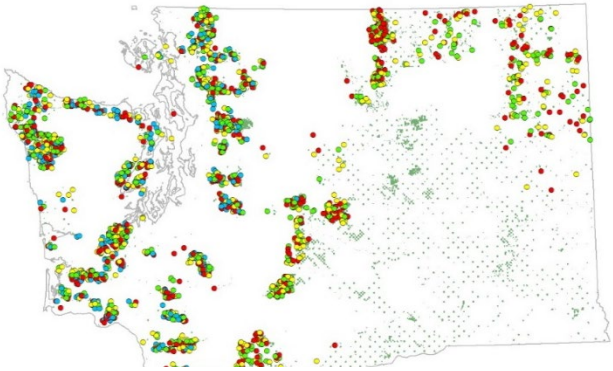

Figure A.4a: Location of RS-FRIS Inventory Plots Completed on DNR-Managed Forest Land. Each plot is color-coded by panel. Map: Jeff Ricklefs.

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).

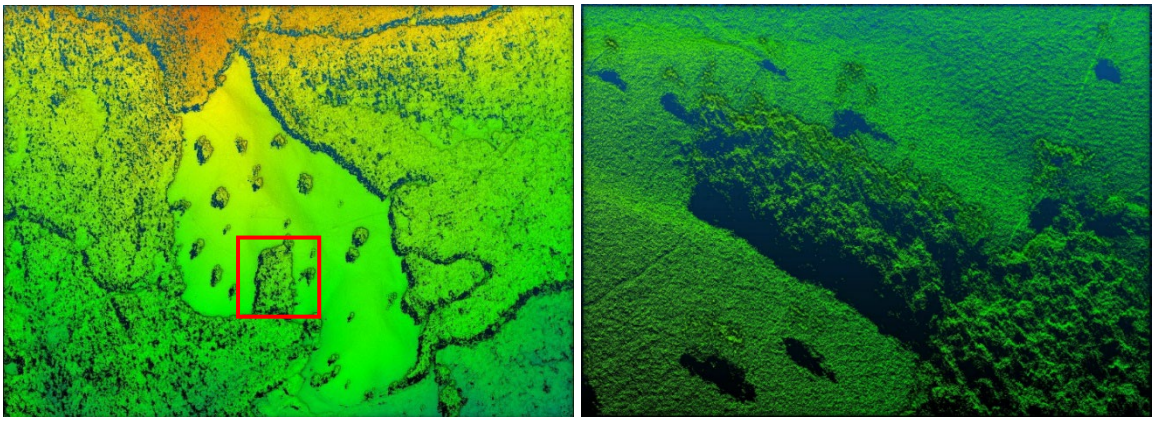

Figure A.4b: Example of Remotely Sensed Digital Aerial Photogrammetry Data Products. A three-dimensional surface model constructed from stereo imagery using photogrammetric software is pictured at left. An oblique view of the area in red is shown at the right. This image depicts a riparian buffer and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

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).

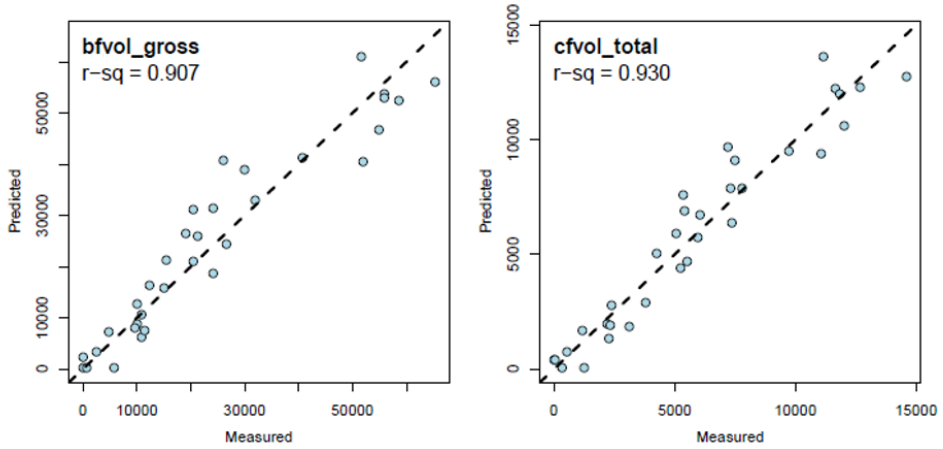

Figure A.4c: Results of RS-FRIS Validation for Merchantable Volume (Left) and Total Volume (Right). Each point shows stand-level summaries from a single validation block. Results from field measurements (x-axis) are compared to RS-FRIS model predictions (y-axis). The r-squared value indicates the correlation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

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 northern spotted owl management areas are managed for certain habitat classes and types that are defined in the HCP (p. IV11–12) and *WAC 222-16-085*.

In order 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.

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A.5 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 its 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, more 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), un-thinned 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 soils on which intensive management is not cost-effective. This type of management may also be used in fire-prone areas to mimic the effects of periodic, lower-intensity fires that do not remove all of the trees.
- **Variable retention harvest:** Variable retention harvest is a type of regeneration, or 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 a 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.6 Non-Timber Management Activities

Road Management Activities

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. DNR completed a full stream-crossing assessment in 2001 and a road assessment for all forested state trust lands in 2006. In 2015, RMAP rules were changed to allow forest landowners to apply for an extension of the completion date to October 2021. DNR completed its state uplands RMAP work statewide by the October 2021 completion date.

Under the HCP, DNR made a commitment to develop and institute a process to achieve comprehensive, landscape-based road network management. The major components of this process include the following:

- Minimization of active road density.
- A site-specific assessment of alternatives to new road construction (for example, yarding systems) and the use of such alternatives where practicable and consistent with conservation objectives.
- A 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 a prioritization of their retrofitting or removal.

DNR evaluates overall active road density through forestland planning (completed for the South Puget and OESF HCP Planning Units). The department conducts site-specific assessments of alternatives to new road construction at the operational level when planning individual activities, and DNR addresses the last three components of this process through implementation of RMAPs.

To meet HCP annual reporting requirements, DNR tracks and reports the number of road miles that are: constructed (newly built roads),

- reconstructed (existing roads improved to a timber-haul standard),
- decommissioned (roads stabilized and made impassable to vehicular traffic),
- abandoned (roads stabilized and abandoned to forest practices standards),
- total active forest road miles, and
- total number of fish barriers removed.

Unlike other activities, road management activities are reported on a calendar year (rather than fiscal year) basis because the end of the fiscal year is at the start of the busiest construction season. Most roadwork is subject to a hydraulic "work window" that limits in- or near-stream work to the summer (typically June 15 through September 30).

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

Unlike other categories of non-timber activities, DNR does not report easements and road use permits on a cumulative basis. Only new easements and permits that create a new "footprint" on state trust lands managed under the HCP are reported for each fiscal year. These include easements for new roads and utilities. DNR does not currently have a system to tally total easement acres, primarily because many easements were granted in the early 1900s and hand-entered on records that are now archived. However, easement mapping under the Road Easement GIS and Spatial NaturE projects is helping to address this issue.

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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 that DNR identifies 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, the department either does not transfer them, 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 the SFT program, the property must be encumbered by harvest restrictions due to species listed under the Endangered Species Act. The value of the timber (which is not cut) 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.

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Natural Areas Program

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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 Washington State Legislature 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. These areas provide opportunities for research, education and, where appropriate, low-impact public use. In addition, these areas help meet statewide conservation priorities and DNR's HCP obligations.

Habitat for Listed, Candidate, and Sensitive Species

Statewide, Washington's natural areas protect over 166,000 acres in 57 NAPs and 39 NRCAs. Over 128,000 of those acres fall within the area managed under the HCP, protecting habitat for 15 species listed as threatened or endangered under the ESA and another 36 special status species. This total includes 83,423.2 acres that DNR has added to the program since the HCP was signed in 1997. An additional 18,100 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, the Loomis NRCA and Chopaka Mountain NAP support substantial populations of whitebark pine (*Pinus albicaulis*) (a candidate species for federal listing), and several natural areas provide suitable habitat for grizzly bears (*Ursus arctos horribilis*).

Golden paintbrush in Rocky Prairie NAP. NAPs provide habitat for federally listed species such as the golden paintbrush (*Castilleja levisecta)*. Photo: David Wilderman.

Federally listed species living on natural areas include:

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

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

- insects like the Makah copper butterfly (*Lycaena mariposa charlottensis*), 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.

Native Forests

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

Estuaries

In the Natural Areas Program, there are 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 wastes from land and sea. Estuaries are some of the most biologically productive systems in the world.

Rare Species

NAPs and NRCAs protect a broad representation of ecological communities and contribute to the conservation of many species, which is important since DNR's inventory of the state's biodiversity is incomplete. 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. DNR 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*).

Restoration and Research

DNR is actively working to restore and enhance habitat for special-status species at a number of NAPs and 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 Puget Sound estuary and nearshore habitats at Stavis, Cypress Island, and Woodard Bay NRCAs by removing bulkheads, fill, and creosote-treated structures.

Special Forest Products

Special forest products are Christmas greens, medicinal plants, western greens (typically used by florists), mushrooms, or other items that can be harvested from forested state trust lands but are not traditional timber or fiber categories. DNR allows commercial and/or recreational harvest of special

forest products when doing so will benefit the trusts and will have an insignificant, or *de minimis*, impact on the environment. Permits, leases, and direct sales are selectively granted to prevent habitat degradation.

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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 air quality, and any exploration holes must be plugged following use. There has been only one active oil and gas lease involving drilling on lands that are now managed under the HCP (in 1996), and the well has since been abandoned and plugged; there have not been any since.

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. In 1996, when the HCP was written, there were no active mining operations (i.e. mineral extraction) on lands managed under the HCP and there have not been any since.

Communication Site Leases

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

Grazing Permits and Leases

Most DNR-managed grazing takes place on non-forested state trust lands east of the Cascade crest on lands that are not managed under the HCP. Grazing is selectively allowed on forested state trust lands managed under the HCP in both eastern and western Washington, though the number of acres permitted in western Washington is minimal.

In eastern Washington, state trust lands are grazed under permits and leases. Permits cover large acreages, and each permit includes a resource management plan with ecosystem standards that the permit holder must meet, such as turnout and removal dates, riparian protections, and the number of animals allowed on the range. Leases cover smaller areas than permits, and they also include resource management plans. These leases can allow grazing at any time during the year, as long as lessees follow the management plans.

Special-Use Leases

Special-use leases are issued for a wide variety of commercial and other uses on state trust lands. Some examples include golf courses, small commercial businesses and buildings, commercial recreation facilities, colleges, takeoff or landing sites for paragliding, governmental or public use facilities, honeybee hive sites, and stockpile sites. Special use leases do not cover major urban commercial uses or aquatic land uses. Often, but not always, these leases are for "interim uses," and, as such, they contain language that allows for termination should DNR choose to take advantage of a "higher and better use" of the land.

Washington Trails Association (WTA) volunteers at Blanchard State Forest. Photo: Arlen Bogaards, WTA.

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. Occasionally, DNR will conduct a direct sale, a one-time agreement for the removal of a small amount of a resource (a maximum of $25,000 in value) that does not require Board of Natural Resources approval.

Early in the implementation of the HCP, DNR had a substantial number of rock, sand, and gravel sales. Since then, that number has decreased, primarily due to the lengthy contract-development process and limited staff capacity.

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 the specifications in the contract.

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A.7 Recreation — 2022 Projects

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Recreation Development

Northwest Region

Blanchard State Forest, Skagit County: WCC crews and volunteers worked on a combined 15 miles of trail. Work included maintaining culverts, clearing ditches, reestablishing drain dips, cleaning bridges to reduce the accumulation of debris above creeks, and rerouting unsustainable sections of trail, minimizing the impact of recreational use on sensitive soils and wildlife habitat. Trail dirt turnpikes were built to reduce impacts to wetlands, trail braiding, and sediment erosion to nearby lakes and streams.

Blanchard State Forest, Oyster Dome, Skagit County: Washington Trails Association (WTA) volunteers finished work on the final approach to Oyster Dome. Work lengthened the trail to reestablish an out-

sloped bench cut, removing fall line sections, and helping to improve drainage in an effort to reduce soil delivery to Oyster Creek. They also repaired sections of trail damaged by trees that fell during the winter of 2021.

Blanchard State Forest, Samish Overlook, Skagit County: A section of road was rerouted and rebuilt. The previous road had a steep dip that was unsustainable due to the high volume of 2-wheel-drive public traffic. The new road has a more consistent grade, making Samish Overlook sustainably accessible to the public. This reroute will reduce erosion and soil loss.

Harry Osborne State Forest, Skagit County: WCC crews and volunteers from the Backcountry Horsemen worked to maintain trail culverts, clear ditches, and reestablish drain dips. Unsustainable sections of trail were rerouted, and new sections of trail were built with native soil and gravel surfacing. The work included installing drainage features, ditches, and culverts. Volunteers constructed trail dirt turnpikes to reduce impacts to wetlands, trail braiding, and sediment erosion to nearby lakes and streams. Abandoned vehicles and trailers, trash, and human and equine waste was removed from the Les Hilde Trailhead weekly.

Galbraith Mountain, Whatcom County: Two miles of mountain bike trails were maintained, reducing soil erosion.

Cattle Point Natural Resources Conservation Area, San Juan County: Routine maintenance conducted on approximately 1 mile of trail and 1 CXT vault toilet. The parking and picnic area were regraded. A shed was installed on site to provide storage for routine maintenance equipment.

Cypress Island Natural Resources Conservation Area, San Juan County: Routine maintenance conducted on approximately 20 miles of trail, two camping areas and seven composting toilets.

Trash is removed from DNR landscapes daily. Photo: Dan DeVoe.

Griffin Bay Recreation Site, San Juan County: Routine maintenance was conducted on approximately 1/3 mile of trail, five campsites and two outhouse style vault toilets. In addition, installation was continued on two new diversion style toilets. Construction took longer than expected due to challenges adapting and implementing new technology and designs.

Lummi Island Natural Resources Conservation Area, Whatcom County: Hazard trees were removed within the camping area and public safety concerns were mitigated by closing a section of the loop trail affected by seasonal storm damage. Continued investigation of beach access and campground renovation at the water-access-only camping area in the NRCA. This is a very sensitive project due to presence of cultural resources. As such, this work is deliberate to ensure effective consultation and collaboration with affected Tribes.

Morning Star Natural Resources Conservation Area, Snohomish County: Completed construction of 3 bridges (20', 25', and 35') near the Cutthroat Lakes camping area. This process involved several helicopter mobilizations to transport bridges and construction materials to the sites and backhaul remaining equipment. Additionally, nearly a month and a half of crew labor went into preparing and constructing these structures. Completed construction of a 65' bridge across Boulder Creek along the Boulder Lake Trail. Construction involved one helicopter mobilization to transport footing materials, and one to transport the bridge itself. This bridge replaces a condemned structure after more than 10 years of closure, and will allow us to reopen Boulder Lake Trail to the public.

New Boulder Creek bridge. Photo: Rob Crawford.

Additional improvements at the Cutthroat Lakes camping area included installation of six new tent pads and benches. DNR continued with the permitting process for three water crossings along the Boulder-Greider Mainline Trail. These bridges will protect water quality at stream crossings along the trail system, and provide for public safety during periods of high flow. Continued work on campsite relocation and camping area renovation at three camping areas in the Ashland Lakes landscape, including Beaver Plant Lake, Upper Ashland Lake and Lower Ashland Lake. Campsites and trail segments, which are seasonally inundated by water, were relocated to higher ground. Decommissioning of these sites involved removal of benches and older fire rings. Tent pads and new fire rings were installed at relocated campsites. Conducted significant trail maintenance along the Ashland Lakes Trail. Work included reestablishing 80 feet of rock causeway and repairing 100 feet of failing boardwalk.

Completed tribal outreach and cultural resources fieldwork for grant-funded improvements to the Boulder Lake Trail and camping area. This work will include renovations on 3.8 miles of existing trail, improvements in nine campsites, and the installation of a backcountry urine diversion toilet in the camping area. Completed design work for the toilet structure. To facilitate fieldwork access, 3.8 miles of the existing trail was brushed and fallen trees were removed from the trail corridor. Completed tribal outreach and cultural resources fieldwork for grant funded improvements to the Gothic Basin Trail and camping area. This work will include trail improvements to 1 mile of existing trail, the designation of 0.5 miles of user trail within the Basin itself, the designation of 6 campsites, and the installation of a backcountry, urine diversion toilet in the camping area. Completed design work for the toilet structure. Additionally, trail building and maintenance organizations were engaged to help complete this work. Performed routine maintenance on approximately 20 miles of trail and five camping areas.

Point Doughty Natural Area Preserve, San Juan County: Installed 3 interpretive signs along 1/3 mile of trail. Conducted engineering review of one set of stairs affected by seasonal storm damage. Replaced two picnic tables. Completed permitting for replacement of two existing outhouse style vault toilets. The new toilet is urine diversion style that separates solids from liquids. Conducted routine maintenance on approximately 1/3 mile of trail, three campsites and two outhouse style vault toilets.

Upright Channel Recreation Site, San Juan County: Conducted routine maintenance on approximately 1/3 mile of trail, 3 picnic sites, and 1 CXT vault toilet. Hazard trees were removed from picnic areas.

Reiter Foothills Forest, Snohomish County: DNR and WCC crews finished roughly 2.2 miles of ATV/motorcycle trail to complete Phase 1 of the motorized trail network. Conducted multiple trail inspections along roughly 33 miles of ORV trails and 3 miles of non-motorized trail, identifying needed trail repairs to prevent sediment delivery to streams. Inspected and made minor repairs to two trail bridges for safety and water quality maintenance needs. Removed down trees across sections of trail throughout the forest. Blocked several miles of illegal/undesignated trails closed to ORV use in the Index Aquifer Recharge Area, Forest Glade block, Woods Lake block, and Sultan Basin block.

Cascade District, Snohomish County: With help from WCC, DNR installed and maintained signage on all DNR access gates throughout entire district, illustrating Discover Pass requirements, Non-Motorized Use Only, Restricted Access, Do Not Block Gate, and No Shooting where applicable.

Walker Valley ORV Area, Skagit County: One new bridge replacement on the Chris Cross Trail, and the following maintenance activities: 13.6 miles of hand maintenance to maintain trail drainage functions; bridge maintenance; and 12 miles of trail brushing.

Some heavy maintenance also occurred, including 300 feet of trail hardening (hauling in larger rock or similar material), and 230 feet of new turnpike construction in areas of saturated soils. The trailhead received 27 cleaning operations, plus daily checks for additional attention. A total of 94 days of WCC crew time (six-person crew size) was used during 2022.

Olympic Region

Foothills ORV and Sadie Multi-Use Trails, Clallam County: DNR worked with the WCC and volunteer groups to improve public safety and promote environmental stewardship. Projects included:

- 180 hours of maintenance and clean-up work at the trailhead,
- installation of 6 culverts,
- maintenance of 7 culverts,
- installation of 34 drain dips,
- maintenance of 90 drain dips,
- construction of 0.5 miles of new trail,
- restoration or rehabilitation of nearly 2 miles of trail,
- inspection and maintenance of 39 miles of trails, with 150 feet of rock applied, 190 feet of rail installed, and 3 miles of brushing, maintenance of 1 bridge, and
- removal of 44 hazard trees, snags, and wind-fall.

Highpoint Trail and Bridge Construction, Sadie Block, Clallam County: The bridge along a Sadie Creek trail collapsed December 2021. DNR removed the collapsed bridge and rerouted the trail farther up tributary to a smaller crossing, building a new bridge from cedar that was found on site. Built 1.2 miles of new motorized trail. Built a new 22’ bridge.

Sadie Creek Lyre River Section Reroute, Sadie Block, Clallam County: Rerouted a 900-foot section of trail in heavy clay soils due to slope failure.

Sadie Creek Lyre River section slide (left), Sadie Creek Highpoint Trail (middle), Sadie Creek Highpoint Trail Bridge (right).

Striped Peak Block, Clallam County: Built a sitting area near the top of the climb to Striped Peak along the Bunker Ridge Trail.

Striped Peak Bunker Ridge Trail rest area (DNR)

E-bike kiosk signage, Clallam and Jefferson Counties: Installed 5 kiosks at various locations for future signage related to e-bike policy.

Dungeness Block, Clallam County: Built 120 feet of turnpike in a muddy section heavily used by equestrian riders.


Muddy Section Dungeness Trails, before (left) and after (right).

Nolan Creek, Commissioner's Trail, Clearwater Block, Jefferson County: Removed 120 feet of old puncheon bridge and placed gravel. Built an 8' puncheon bridge at depression.


Commissioner's Trail, before (left) and after (right).

Pacific Cascade Region

Region-wide: Closed numerous unauthorized bypasses to gates, and repainted vandalized gates. Cleaned up numerous shooting areas and graffiti. Posted over 30 new 'No Target Shooting' signs and over 20 Discover Pass signs. General maintenance of trailheads, campgrounds and day-use facilities: CXTs pumped and maintained; all fire rings brought to fire safety compliance; hazard tree removal; installed new campground rules signs.

Events, Clark County: Numerous volunteer events and work parties, including Pick Up the Burn, mountain bike classes, and the Backcountry Horsemen Statewide Meeting Picnic and Trail Ride.

Yacolt Burn State Forest, Bells Mountain Trail System, Clark County: Brushing and drainage work on 7.5 miles of Bells Mountain Trail. Closed numerous unauthorized bypasses.

Yacolt Burn State Forest, Tarbell Trail System, Clark County: Finished approaches to 40' Hidden Falls Bridge. Drainage and culvert work on approximately 8 miles of trail to reduce erosion. Brushed 20 miles on Tarbell Trail. Volunteer work parties included the Evergreen Mountain Bike Association SW, WTA, Boy Scouts of America Battleground WA chapters, and Trash No Lands.

Yacolt Burn State Forest, Jones Creek and Hagen Creek Trail Systems, Clark County: New signage on new motorized trails. Repaired or replaced fence in 'First Year First Gear' area. Repaired and improved bridge bypass. Replaced vandalized kiosk. Reroutes and grade adjustments on motorized trails to reduce erosion. Competed construction of approximately 1 mile of the new ATV trail, Hagen Vista Trail. New bridge approaches completed and several dumped trash piles removed. Volunteer work parties held with Jones Creek Trail Riders Association.

Yacolt Burn State Forest, Cold Creek Campground and Day Use Area, Clark County: Speed bumps installed; new sign installation at Day Use Area. Repaired gate for power line access road.

Yacolt Burn State Forest, Rock Creek Horse Camp and Day Use Area, Clark County: Installed road signs and speed bumps. Three fire rings and three picnic tables installed. Volunteers included two full-time Camp Hosts. Four new metal corrals were installed with the Backcountry Horsemen.

Yacolt Burn State Forest, Dougan Creek Campground and Day Use Area, Skamania County: Removed trash from area. Installed several new Discover Pass and No Parking signs. Repaired and painted day-use area fencing. Volunteers included two full-time Camp Hosts, January through August.

Winston Creek Campground, Lewis County: Two outhouses replaced. Installed new campsite numbers. Reservation system continued. Three campsites upgraded with new fire rings and picnic tables.

Mitchell Peak, Skamania County: Worked to establish route of new Sugar Loaf Trail.

North Siouxon Block, Skamania County: Maintenance scouting to Black Hole Falls.

Yacolt Burn State Forest, Three Corner Rock Trail, Skamania County: Scouted for new trail reroute and met with forester on after-harvest trail issues.

Merrill Lake, Cowlitz County: Non-potable water tested. One mile of trail improved and bridges repaired. Road to campground was cleared of winter blow down. Improved the campsites and campground parking area.

Butte Creek Day Use Area, Pacific County: Maintained approximately one mile of non-motorized hiker-only trail. Brushed out road.

Radar Ridge Block, Snag Lake, Pacific County: New signs installed in parking area to discourage camping. Brushed out trail around lake.

Radar Ridge Block, Western Lake Campground, Pacific County: Brushed trail around lake.

Salmon Creek Block, Tunnerville Campground, Pacific County: Installed new kiosk. Removed abandoned campsite.

Bradly ORV, Wahkiakum County: Two miles of trail maintained. Surveyed trail system with State Lands for upcoming Timber Sale. Painted CXT.

South Puget Sound Region

Middle Waddell Campground, Capitol State Forest, Thurston County: Rebuilt interior fences and updated campsites at the completion of the Janeway Timber Sale. WCC and volunteers completed the construction of a woodshed at the Camp Host site.

Margaret McKenny Campground, Capitol State Forest, Thurston County: The day use area parking expansion project was completed. This larger parking area will better accommodate equestrian users with increased trailer parking and an improved ADA horse mounting area. Staff built 4 new campsites within the campground. Removed old ADA horse ramp and replaced it with a newly constructed ramp.

MnM Trail, Capitol State Forest, Thurston and Grays Harbor Counties: This new trail provides 3 miles of additional front country trail loops for non-motorized trail enthusiasts.

Motorized Trails, Capitol State Forest, Thurston and Grays Harbor Counties: Reworked Waddell Basin East (WBE) washout trail section. Constructed nearly 3 miles of new ORV trail (Alpine Ridge and Connector). Built new 20' bridge on connection trail between C-9000 road and WBE trail.

Non-Motorized Trails, Capitol State Forest, Thurston and Grays Harbor Counties: Work party held with WSECU employees at McLane Creek. Repaired a portion of the Equine Loop with volunteers. Campground Trail repairs opened two additional miles for year round use. Staff and members of the Backcountry Horsemen of Washington rebuilt a corral at Fall Creek Campground. Rebuilt a deck bridge on the Greenline Tie Trail.

Elbe Hills State Forest, Pierce County: Recreation staff and volunteers removed nearly 4 tons of garbage from the forest, along with an abandoned vehicle.

Sahara Creek Campground and Nicholson Horse Trails, Elbe Hills State Forest, Pierce County: Recreation staff conducted routine maintenance on seven bridges and 40 miles of non-motorized trail, including fallen tree removal, brushing, tread and drainage maintenance, and signage. Routine maintenance was conducted on six day-use areas, six CXT restrooms, three trailheads and one campground.

Recreation staff rebuilt a hitching post at Woodpecker Point Day Use Area. Multiple picnic table boards were replaced. One CXT restroom toilet was repaired. Three CXT restrooms were resealed and repainted. Sixty tons of gravel were spread on the Sahara Creek Campground Day Use Area to solidify the parking surface. Portions of the Upper Elk Spur, Diamond Loop, and Fawns Crossing trails were closed to the public beginning in summer 2022 due to land management activities occurring over the trails. Once land management activities conclude, the trails will need to be reestablished on the ground.

Elbe ORV Campground and Trails, Elbe Hills State Forest, Pierce County: Recreation staff conducted routine maintenance on five bridges and 13 miles of ORV trail, including fallen tree removal, brushing, tread and drainage maintenance, and signage. Maintenance was conducted on four CXT restrooms, one trailhead, and one campground. Two challenge sections on the Mainline and Busywild trails were repaired to improve structural integrity. One CXT restroom's hardware was replaced and two CXT restrooms were resealed and repainted.

92 Road Sno-Park and Mt. Tahoma Ski Trails, Elbe Hills State Forest, Pierce County: Routine maintenance was conducted on 7 miles of non-motorized winter trail, one CXT restroom, and one sno-park. The upper parking area of the 92 Road sno-park was refurbished, including installing a replacement gate, re-installing

signs, installing eco blocks on a dead end spur, and laying down 120 cubic yards of gravel on the parking surface to solidify it and prevent erosion. The 92 Road Sno-Park has been closed to the public since spring of 2022 due to land management activities occurring over the facility. Once land management activities conclude, the facility will need to be cleaned of forest debris.

Tahoma State Forest, Lewis County: Approximately 400 pounds of garbage was removed from the forest, along with 2 abandoned vehicles.

1 Road Sno-Park and Tahoma Ski Huts, Tahoma State Forest, Lewis County: Recreation staff conducted routine maintenance on 23 miles of non-motorized winter trail, 4 CXT restrooms, 3 ski huts, and 1 sno-park (such as fallen tree removal, brushing, tread and drainage maintenance, and signage). Hardware was repaired on 1 CXT restroom.

Anderson Lake Campsite, Tahoma State Forest, Lewis County: Recreation staff conducted routine maintenance on 1 mile of non-motorized winter trail, and 1 wooden restroom. A new picnic table and fire ring were installed at the campsite.

West Tiger Mountain NRCA, King County: Working with WTA and WCC, DNR rerouted several segments of High Point, Lingering, and Tiger Mountain trails. These reroutes resulted in several trail segments being moved to new long-term sustainable locations that also provide a better use experience for hikers and trail runners. They also allowed for the decommissioning and restoration of previous trail segments displaying resource damage originating from trail alignments traveling through terrain unsuitable for trails due to poor drainage and saturated soils. In coordination with Weyerhaeuser and a number of public stakeholders, DNR planned and began reconstruction of a jointly managed trail system located on and adjacent to the three summits of West Tiger Mountain. A recent timber harvest overlapped portions of the historic trail system, resulting in the creation of new views of the Puget Sound and an opportunity to make improvements to the trail system. Reconstruction of the trail system will include restoring degraded trail segments to their desired condition, reroutes to improve overall trail system connectivity, and renovation of trail segments.

Middle Fork Snoqualmie NRCA, King County: Working with WCC, DNR completed a logout of the Thompson Lake Trail and began to reroute several hundred feet of trail to a new long-term sustainable location. When completed, this reroute will allow for the decommissioning of a trail segment that travels through saturated organic soils thinly placed on top of glaciated bedrock. In partnership with the Mountains to Sound Greenway Trust, DNR began renovation of Mine Creek Day Use Area, installing new gravel surfacing and enhancing river viewing areas to make the site more universally accessible and preparing for relocating an existing CXT to a more sustainable location. Future work will include volunteer work parties to plant native trees and understory plants to restore impacted areas.

Mount Si NRCA, King County: DNR worked with Mountains to Sound Greenway Trust on several trail renovation and construction projects, including:

- Renovation of Teneriffe Falls Connector Trail. When completed, this renovation project will provide a more accessible route to Teneriffe Falls, improve overall trail system connectivity within Mount Si NRCA, provide a loop option from Teneriffe Falls, and replace a ford of the stream originating from Teneriffe Falls with a pedestrian bridge.
- Renovate and reconstruct segments of the Little Si Trail. The trail currently receives in excess of 100,000 annual visitors, far exceeding the level of use that the trail was originally designed to

sustainably support. Trail renovation and reconstruction work will incrementally upgrade trail segments to a condition suitable for use at current levels, which will reduce environmental and resource damage while also reducing obstacles along this popular trail.

- Completed approximately one mile of road-to-trail conversion, improving the Green Mountain Trail to the Last Chance Promontory overlook. Conducted bridge site preparation for the Green Mountain Trail Bridge. Trail construction will reduce unsustainable water issues by implementing proper trail drainage and water control techniques. This will reduce erosion and prevent sediment deposition into the environment
- Completed renovation of Russian Butte View river access to delineate viewing areas. Improvements included installing new gravel surfacing and natural log benches and barriers along the edges of viewing areas to discourage wandering and protect the surrounding forest.

Tiger Mountain State Forest, King County: DNR crews neared completion of a 0.75 trail extension to Crosshaul Trail, which creates a more direct mid-mountain trail connection to Inside Passage Trail. This connection will provide a safer and more direct route for mountain bikers and hikers, and will avoid unnecessary forest road travel. This trail work included the installation of two trail bridges.

Green Mountain State Forest, Kitsap County and Tahuya State Forest, Mason County: DNR and WCC crews conducted site and material preparation, installation, and assembly for 3 trail bridges, one located on the Green Mountain Trail and the other two on the CCC Trail. These bridges will allow for a safer and more enjoyable year-round user experience for hikers, mountain bikers, and equestrian riders, while protecting habitat and water quality. Held several cleanup events, including one for Earth Day, which resulted in over 15 tons of trash, several hundred tires, a hot tub and other large items being removed. Strong support was shown from a variety of local motorized and non-motorized recreationists and clubs for the event. Trash No Land and local target shooting enthusiasts volunteered to clean up popular local shooting areas.

Hood Canal State Forest, Mason County: Collaborated with the local Gambler group for a major trash cleanup on the west side of Hood Canal during their annual Sasquatch Run.

Southeast Region

No report

Recreation Planning and Design

Northwest Region

Blanchard State Forest, Skagit County: Development work began on an RCO WWRP Development grant which will fund the purchase and installation of 2 new backcountry bathrooms at Lily and Lizard Lake Campgrounds. This project includes the purchase and installation of a single vault CXT to be installed at the Upper Trailhead. The addition of 3 bathrooms will reduce delivery of human waste to nearby bodies of water protecting water quality and wildlife habitat.

Olsen Creek Forest, Whatcom County: Existing user-built trails were assessed for their proximity to and impacts on critical areas. Where existing routes were deemed unsuitable, DNR staff proposed new trail routes. A contract with Leon Environmental was initiated to evaluate a small priority area of the proposed trail routes for their impacts on critical areas and to create a strategy for mitigating those

impacts. Leon Environmental and DNR staff will work together to apply for a Fill & Grade permit with Whatcom County for trail sanctioning and development in 2023. Leon Environmental performed critical areas review of a proposed trail bridge site across Olsen Creek, a fish-bearing stream. They also subcontracted Aspect Consulting to assess the suitability of the proposed site crossing. Kingworks Structural Engineers was subcontracted to develop bridge designs. The bridge will reduce erosion and soil delivery and reduce foot/bike/equine traffic through Olsen Creek.

North Fork Nooksack Water Access, Whatcom County: A WWRP grant was submitted to the Recreation and Conservation Office (RCO) for the development of a sustainable water access site to help reduce erosion from current use as a dispersed water access site.

Morning Star Natural Resources Conservation Area, Snohomish County: Commenced A/E work on three proposed bridge locations along the Boulder-Greider Mainline trail. Work done to date includes geotechnical review, hydrologic review, critical areas review, and design. Cultural resources review has commenced and tribal outreach and SEPA review are expected to occur before the end of the calendar year.

Reiter Foothills Forest, Snohomish County: Pursued grant funding from RCO, Federal, and private partners for a permanent trailhead/parking lot for the motorized area.

Cypress Island Natural Resources Conservation Area, San Juan County: Contracted with A/E consultant and commenced data collection toward restoration of recently acquired property in Strawberry Bay. Completed topographic survey work, wetland delineation, and cultural resources survey work related to both.

South Puget Sound Region

Capitol State Forest, McLane Creek, Thurston County: The Forestry Loop Interpretive sign plan is in the final phase of development. Contracted and received structural engineering plans for the first phases of boardwalk replacement on the pond loop and a stretch to be replaced with truss bridges on pin piles to protect the beaver dam and create a newly renovated walkway overlooking the dam that is safer for pedestrians and ADA accessible. Received engineered designs for the substructure and in the process of ordering truss bridges to replace the boardwalk along the beaver pond. Received typical design for boardwalks to replace existing pressure treated wood with steel substructure and pin piles to create a completely ADA accessible route that is less invasive to the sensitive wetland environment. Work to build out will be phased out over the next several biennia. Master planning for the whole site renovations continues.

Capitol State Forest, North Slope, Thurston County: Staff continued planning for the construction of a parking lot at the North Slope bike area.

Capitol State Forest, Margaret McKenny, Thurston County: Began planning for construction of new sidewalk to access ADA bathroom.

West Tiger Mountain NRCA, King County: Completed design for a forest entry addition to the High Point Trailhead and a connection to the regional trail system in order to welcome visitors, improve safety and to discourage unauthorized dumping and overnight camping.

Tiger Mountain State Forest, King County: Completed planning and permitting work for a future reroute of the Middle Tiger Trail approaching the summit of Middle Tiger. This project will replace a steep and

erosion-prone segment of the Middle Tiger Trail with a reroute constructed at sustainable grades (averaging approximately 10%), and improve trail system connectivity by reducing the current need for visitors to use a segment of forest road. Completed design for an addition to the Tiger Summit Trailhead to provide parking. The trailhead addition is needed to provide a safe alternative to informal parking areas in the SR-18 right-of-way that will be lost when the highway is widened. Completed a site survey and geological review in order to repurpose a former gravel pit as a viewpoint near East Tiger Summit.

Alder forest in Pacific Cascade region in May 2022. Photo: Brian Williams.

Raging River State Forest, King County: Continued final phases of trail system layout and design for approximately 20 additional trail miles. Received bridge materials in preparation for future installation during the final phase of trail development.

Marckworth State Forest, King & Snohomish Counties: Continued pre-planning, land suitability analysis, and cultural resources reviews to identify potential locations for access and trails.

Green Mountain State Forest, Kitsap County: Completed a topographic survey, geotechnical report, site design and permitting to renovate the Green Mountain Summit Vista. The renovation will replace an old guardrail with a new one while protecting the surrounding forest.

Mount Si and Middle Fork Snoqualmie NRCAs, King County: Completed cultural resources reviews, wetland surveys and designs for renovation of existing river access sites along the Middle Fork Snoqualmie River. The design evaluated existing access in order to better direct the public to sustainable viewing areas and river access locations while identifying unsustainable social trails to be removed and impacted areas to be protected and restored.

Southeast Region

No Report

Pacific Cascade Region

Yacolt Burn State Forest, Jones Creek Expansion Project, Clark County: The region was granted a stormwater permit from the Department of Ecology. Archeology/Cultural Resource documents were completed. Regulatory signs posted. RCO Grant Awarded for development 2021-2023. Permit awarded from Clark County.

Northeast Region

No recreation planning on HCP land during 2022.

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Appendix B: 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 impassible to vehicles.

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

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

Cadastre: 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: 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 that removes only small amounts (a maximum of $25,000 in value) of a resource such as gravel or trees from state trust lands and is not subject to public auction or advertisement.

Dispersal habitat: Habitat used by northern spotted owls when moving from one area of nesting, roosting, and foraging habitat to another, often to establish new breeding sites.

Dispersal: The movement of an animal from one subpopulation to another or movement from one area to another, often to establish a new nesting area.

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: For the State Trust Lands Habitat Conservation Plan, 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.

Final harvest: The harvest that signifies the end of a rotation by harvesting trees within a forest management unit in order to make room for regeneration of a new stand.

Forest land planning: A DNR process — focused at the scale of State Trust Lands Habitat Conservation Plan planning units — to integrate sociocultural, economic, and ecological issues into management strategies for forested state trust lands.

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 to the larger rangeland of a grazing permit) that includes a resource management plan to protect natural resources. It allows grazing at any time of year as long as the plan's guidelines are followed.

Grazing permit: A DNR agreement covering large areas that includes a resource management plan containing specific details regarding 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. Using ground herbicides allows for application in smaller work areas, thus avoiding spraying areas where herbicides are not desired (i.e., streams, wetlands, and 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.

Hand cutting: In forestry, using handheld equipment to cut stems of existing vegetation to achieve site preparation or vegetation management objectives, such as removing invasive species.

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.

I

Implementation monitoring: For the State Trust Lands Habitat Conservation Plan, a form of monitoring that determines whether or not a management plan or its components are implemented as written.

Inholding: A parcel of land owned by one party that is entirely surrounded by another ownership.

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: Short for “light detection and ranging,” a remote sensing technology that uses lasers to detect distant objects and determine their position, velocity, or other characteristics by analyzing reflections. It has a wide variety of uses, including measuring tree canopy heights, making topographical maps, and mapping floodplains.

M

Multiple-pass removal: A field sampling method used to estimate fish populations in a stream that involves placing nets across a stream at the beginning and end of a reach (typically around 100 meters) to confine fish to that area. A backpack electrofisher is then used to temporarily disable fish, which are then captured, measured, and released. Each reach is sampled multiple times within a day until the desired precision in the population estimate is achieved.

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 carrying out 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.

Nesting, roosting, and foraging habitat: A forested area with the right forest structure, a large enough size, and adequate food to meet the needs of a nesting pair of northern spotted owls.

Next-best stands: 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 a plan of operations approved by DNR.

P

Planning unit: In the State Trust Lands Habitat Conservation Plan, a management unit based on large watersheds. The approximately 1.9 million 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 does not generate revenue and is performed before the 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 which 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 snow pack to be partially or completely melted during rainstorms several times during the winter.

Reclassified habitat: Two classes of marbled murrelet habitat, identified based on a predictive model:

1. Marginal habitat: Those lands expected to contain a maximum of 5 percent of the occupied sites on state trust lands within each State Trust Lands HCP planning unit. These areas were made available for harvest. All known occupied sites were deferred from harvest, and were not included in this habitat designation.
2. Higher-quality habitat: In contrast to marginal habitat, those 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 simply 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 consequently, a theoretical optimal range for thinning. Relative density guidelines for thinning vary by species and sometimes other factors, such as climatic zones. A commonly used version of relative density is formally known as Curtis' RD after Bob Curtis, a U.S. Forest Service biometrician who developed the measure.

Riparian desired future condition: In the Riparian Forest Restoration Strategy, the riparian desired future condition refers to six measureable target stand conditions that are intended to eventually develop 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 all 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 construction: The building of new roads in compliance with DNR policy and state forest practices standards.

Road maintenance and abandonment plan: A plan that covers all forest roads on a landowner's property constructed or used for forest practices after 1974. It is based on a complete inventory that

also shows streams and wetlands adjacent to or crossed by roads. The plan lays out 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 log 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 these seed trees may be harvested.

Selective product logging: A timber harvest that removes only specific species from certain size classes which are highly valuable, for example 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 that are regenerating in the stand. Compared to a seed tree intermediate cut, a shelterwood typically retains more trees per acre following harvest; 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 particular 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 may be performed concurrently with logging (by, for example, pulling up and disposing of brush clumps or it may be performed through piling and burning logging 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 (for example, tree tops and branches) that is 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 Christmas trees and boughs, medicinal plants, and floral greens.

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

Stand: A group of trees that is 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 (formerly known as Forest Board) lands in timber-dependent counties are transferred from trust status to natural resource conservation 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 (public K-12 schools and universities, capitol buildings, counties, and local services such as libraries).

Suitable northern spotted owl habitat: Each northern spotted owl 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 a species' normal behavior.

Thumping: The exploration for oil or gas deposits by measuring seismological tremors caused by dropping large weights or by detonating explosives.

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).

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 soils on which more intensive management is not cost-effective. This type of management also may be used in fire-prone areas to mimic the effects of periodic, lower-intensity fires that do not remove all of the trees.

V

Validation monitoring: For the State Trust Lands Habitat Conservation Plan, a form of monitoring that determines whether or not 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 that 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 (trees, snags, logs, etc.) from the harvested stand for integration into the new stand to achieve various ecological objectives. The following threshold targets apply under the State Trust Lands Habitat Conservation Plan:

- 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 blown out by wind.