



State Trust Lands Habitat Conservation Plan 2018 Annual Report

.....
For Fiscal Year 2018

Published May 2019

▲ A cohort of young seedlings grows between trees left standing after a variable retention harvest in Northwest Region. During a variable retention harvest, structural elements such as standing trees, snags, and down logs are retained from the harvested stand for integration into the new stand to achieve multiple ecological objectives.



WASHINGTON STATE DEPT OF
**NATURAL
 RESOURCES**

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Prepared by
Washington State Department
of Natural Resources
Forest Resources Division



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Acronyms

dbh	Diameter at breast height
DEIS	Draft environmental impact statement
DFC	Desired future condition
DNR	Washington State Department of Natural Resources
ESA	Endangered Species Act
FEIS	Final environmental impact statement
FY	Fiscal year
GEM	General ecological management
GIS	Geographic information system
GNN	Gradient Nearest Neighbor
HCP	State Trust Lands Habitat Conservation Plan
LPU	Landscape planning unit
LiDAR	Light detection and ranging
LRM	Land Resource Manager
MoRF	Movement, roosting, and foraging
NAIP	National Agriculture Imagery Program
NAP	Natural area preserve
NEPA	National Environmental Policy Act
NRCA	Natural resource conservation area
NRF	Nesting, roosting, and foraging
NOAA	National Oceanic and Atmospheric Administration
OESF	Olympic Experimental State Forest
ONRC	Olympic Natural Resource Center
PhoDAR	Photogrammetric Detection and Ranging
QMD	Quadratic mean diameter
RCW	Revised Code of Washington
RD	Relative density
RDEIS	Revised draft environmental impact statement
RFRS	Riparian Forest Restoration Strategy
RMAP	Road maintenance and abandonment plan
RS-FRIS	Remote-Sensing Forest Resource Inventory System
RVMP	Riparian Validation Monitoring Program
SEPA	(Washington) State Environmental Policy Act
SOMU	(Northern) Spotted owl management unit
UAS	Unmanned aircraft system
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
WAU	Watershed administrative unit
WCC	Washington Conservation Corps
WDFW	Washington Department of Fish and Wildlife

Introduction

Appendix: Background on the State Trust Lands Habitat Conservation Plan

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

The HCP Annual Report is a summary of management activities completed on DNR lands managed under the HCP, monitoring and research efforts, and conservation strategy progress. Unless otherwise noted, information about DNR programs included in this report covers fiscal year (FY) 2018 (July 1, 2017–June 30, 2018). In some cases, significant program activities that occurred in FY 2019 are also reported, including DNR’s continuing collaboration with the Services on the Marbled Murrelet Long-Term Conservation Strategy.

Report Organization

In FY 2018, DNR’s Forest Resources Division continued producing comprehensive reviews of program activities for the HCP Annual Report. This year’s comprehensive review focuses on implementation of the 2006 Riparian Forest Restoration Strategy (RFRS) and reporting landscape-level trends in the development of riparian forest structure.

Based on positive feedback on last year’s ArcGIS story map, the Forest Resources Division developed a [story map](#) to accompany this year’s report as well. The story map contains highlights from the report in an accessible, interactive format intended to engage a broader audience.

This year’s report also includes a new section: [Additional Habitat Restoration and Enhancement](#). This section describes habitat restoration projects and research and monitoring activities conducted on DNR-managed land that are not required under the HCP but that support many of its conservation objectives. These projects are primarily grant-funded and include in-stream restoration, riparian and upland habitat enhancement, and invasive species eradication.

Highlights

In FY 2018 and early FY 2019, DNR accomplished several objectives affecting lands managed under the HCP. Highlights include:

- **DNR and USFWS released a [revised draft environmental impact statement \(RDEIS\)](#) on a long-term strategy for marbled murrelet conservation.** The RDEIS analyzed two new alternatives, G and H, and reanalyzed the six alternatives from the 2016 [draft environmental impact statement](#) (DEIS) with updated data. Alternative G was developed in response to comments received on the DEIS, and Alternative H, DNR’s preferred alternative, was developed to reflect direction from the Board of Natural Resources.
- **DNR added 1,824 acres to natural area preserves (NAPs) and natural resource conservation areas (NRCAs) within the area covered by the HCP.** These protection efforts added to six existing natural areas.

- **DNR upgraded to a new forest management activity tracking database, Land Resource Manager (LRM).** LRM allows DNR to more accurately track the spatial boundaries of forest management activities using a built-in geographic information system (GIS).

Progress Toward Conservation Objectives

[*Appendix: Background on Conservation Objectives*](#)

Northern Spotted Owl Habitat

[*Appendix: Habitat Type Definitions*](#)

DNR’s northern spotted owl (NSO) conservation strategy on the westside involves maintaining thresholds of habitat in each spotted owl management unit (SOMU). Most designated nesting, roosting, and foraging (NRF) 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 which are described later in this section.

Figures 1–3 below show NSO habitat percentages, by HCP planning unit, as they existed on January 7, 2019, when the data was extracted from DNR’s GIS system.

There are five primary factors that can affect habitat percentages reported from year to year:

- Land is acquired or disposed through a land transaction;
- Stands are inventoried and their boundaries are refined and/or their habitat type is updated due to growth or an enhancement thinning;
- A regeneration harvest is conducted within habitat in a SOMU that is over the habitat threshold target;
- Refinements are made to cadaster data across the state; or
- Candidate stands in the OESF are thinned to meet habitat requirements.

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

In FY 2018, an additional factor affected habitat percentages in the OESF. As described in last year’s report, DNR modeled snags and down wood to map the current extent of NSO habitat for the OESF Forest Land Plan which increased habitat percentages in all Landscape Planning Units (LPUs, also generically referred to as SOMUs). Prior to the Forest Land Plan, some harvests had been planned in areas that were identified as non-habitat at that time. After the Forest Land Plan was adopted, they overlapped with newly identified habitat. In some cases, those sales were not harvested, allowing those stands to be identified as habitat for this year’s report.

Columbia and North Puget HCP Planning Units

In the Columbia and North Puget HCP Planning Units, DNR’s habitat goal is to restore and maintain at least 50 percent of NRF and dispersal SOMUs as habitat. Figure 1 shows percent habitat for SOMUs in the Columbia and North Puget HCP Planning Units. Within these units, the Upper

Washougal, Upper Skagit South, and Alder SOMUs are above habitat threshold.

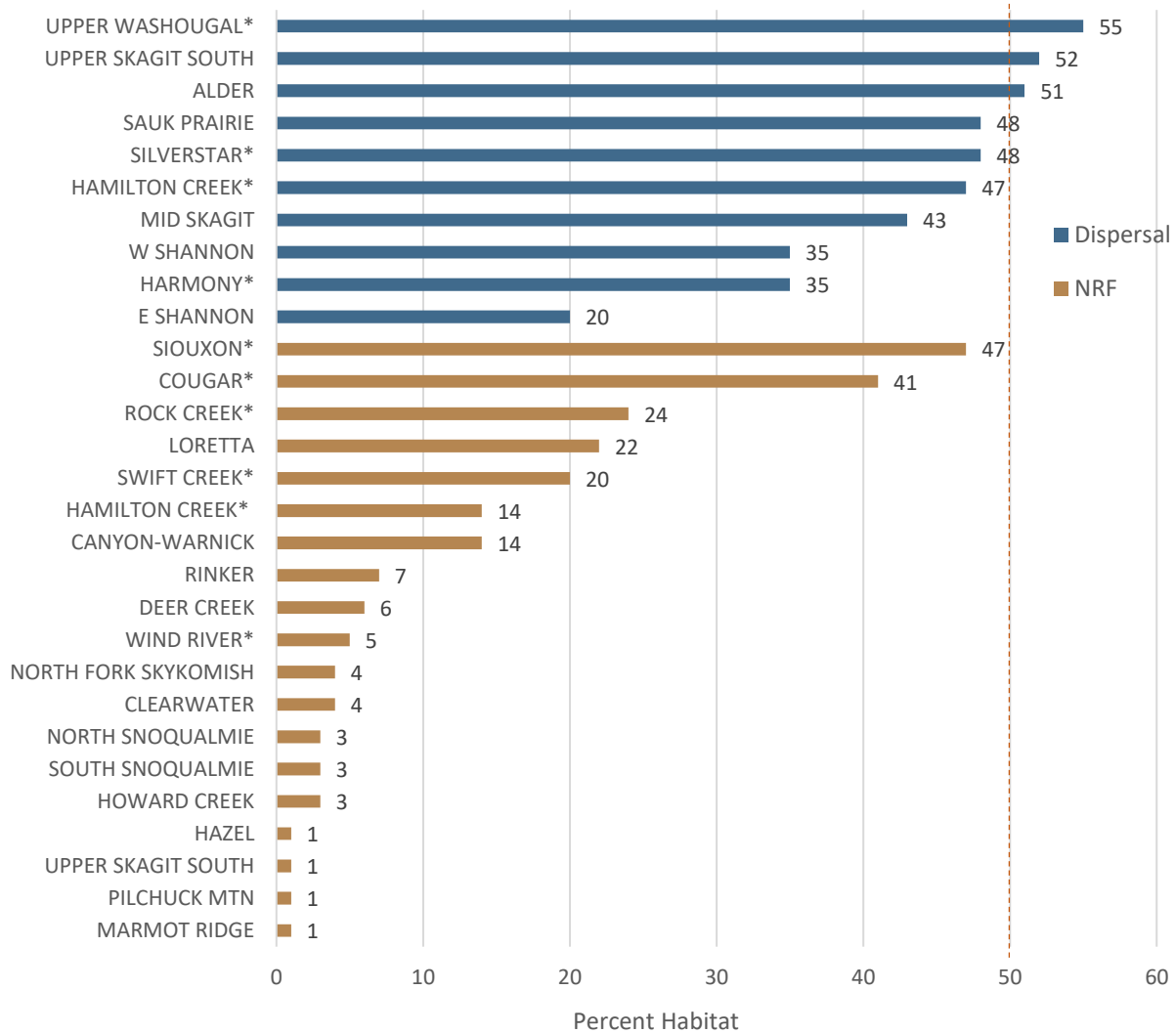


Figure 1: Habitat Percentages by SOMU in the Columbia (*) and North Puget HCP Planning Units as of 1/7/2019. The dashed line represents the habitat target. Percentages have been rounded to the nearest percent. The following NRF SOMUs, all in the North Puget HCP Planning Unit, are not included because they have less than one percent habitat: Sauk Prairie, French Boulder, Spada, Cavanaugh, East Shannon, Ebey Hill, Mid Skagit, Silverton, South Fork Skykomish, Tenas, Upper North Fork Stilly, Upper Skagit North, West Shannon, Wallace River.

Olympic Experimental State Forest HCP Planning Unit

In the OESF HCP Planning Unit, habitat is tracked based on 11 LPUs. DNR does not designate NRF or dispersal areas in the OESF. In each LPU, DNR’s habitat goal is to restore and maintain a minimum of 40 percent NSO habitat. Of that 40 percent, at least 20 percent must be Old Forest Habitat, and the remaining habitat must be Structural or better. Figure 2 shows current total NSO habitat percentages in OESF Planning Unit LPUs.

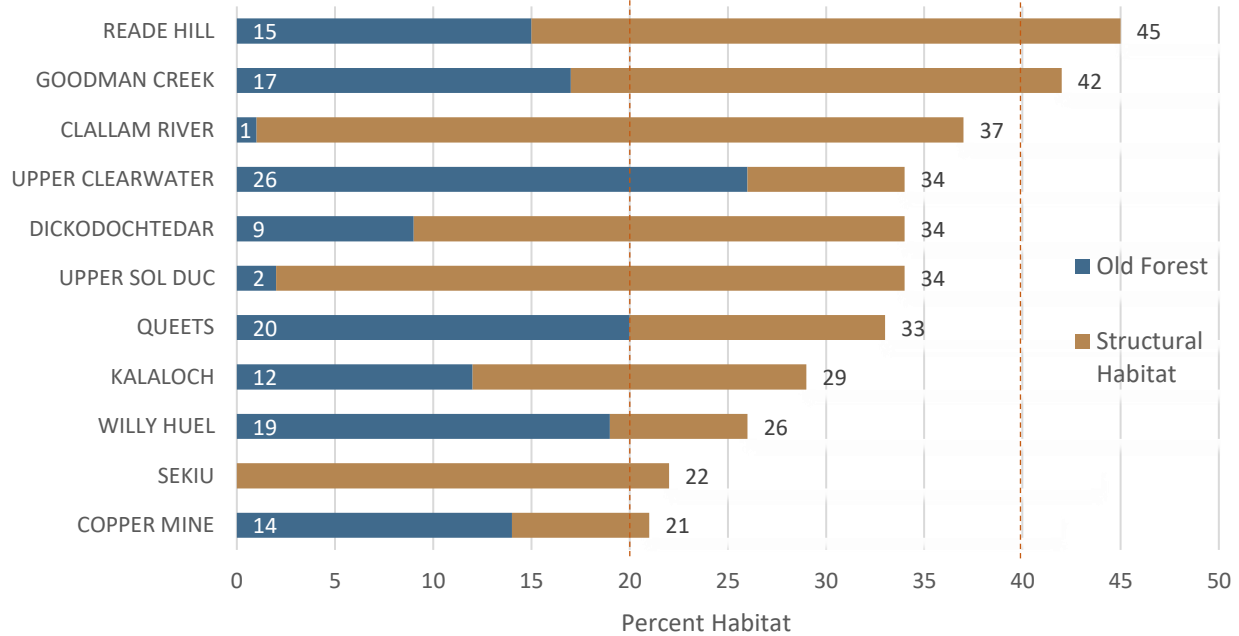


Figure 2: Old Forest and Total Habitat Percentages by LPU in the OESF HCP Planning Unit as of 1/7/2019. Dashed lines represent habitat targets. Percentages have been rounded to the nearest percent.

South Puget HCP Planning Unit

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 that were identified in the 2010 *South Puget HCP Planning Unit Forest Land Plan Final EIS*. The two NRF management areas within the South Puget HCP Planning Unit share the same habitat targets as other westside NRF management areas. Figure 3 shows NSO habitat percentages by SOMU in the South Puget HCP Planning Unit.

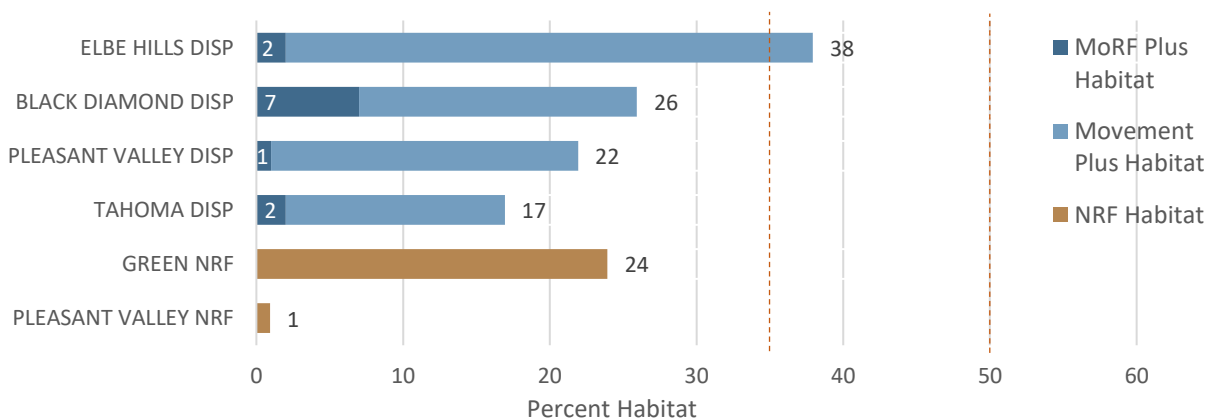


Figure 3: MoRF Plus and Total Habitat Percentages by SOMU in the South Puget HCP Planning Unit as of 1/7/2019. Dashed lines represent habitat targets. Percentages have been rounded to the nearest percent.

Comprehensive Review: Riparian Forest Habitat Restoration

Appendix: Background on the Riparian Conservation Strategy

Appendix: Background on Comprehensive Reviews

Introduction

Of the 1.57 million acres of trust lands managed by DNR west of the Cascades, approximately 31 percent are riparian areas (Figure 4). Forest management in these areas is guided by the two riparian conservation strategies in the HCP, one that applies only to the OESF planning unit, and another that applies to the other five westside planning units. Together, these strategies apply to approximately 483,000 acres of riparian areas on state trust lands. In the east-side planning units, riparian areas are managed according to Washington State Forest Practices rules.

The riparian conservation strategy for the five westside planning units was developed with two specific objectives:

- Maintain or restore salmonid freshwater habitat on DNR-managed lands, and
- Contribute to the conservation of other aquatic and riparian obligate species (HCP, p. IV.55).

The OESF riparian conservation strategy has similar objectives, but implementation of restoration activities there is site-specific to allow for intentional learning and testing of different conservation approaches. This comprehensive review only covers riparian forest restoration efforts in the other five westside planning units. The OESF riparian conservation strategy is discussed in the section on [Status and Trends Monitoring of Riparian Habitat in the OESF](#).

The riparian conservation strategy for the five westside planning units includes several components designed to achieve the stated objectives (Table 1).

Table 1: Summary of Components in the Riparian Conservation Strategy for the Five Westside Planning Units

Component	Summary
Riparian Management Zone	<ul style="list-style-type: none"> ▪ Establishes riparian management zone (RMZ) widths for Type 1-4 waters and wind buffer requirements for Type 1-3 waters ▪ Describes interim protections of Type 5 waters and future development of a long-term conservation strategy for forest management along Type 5 waters

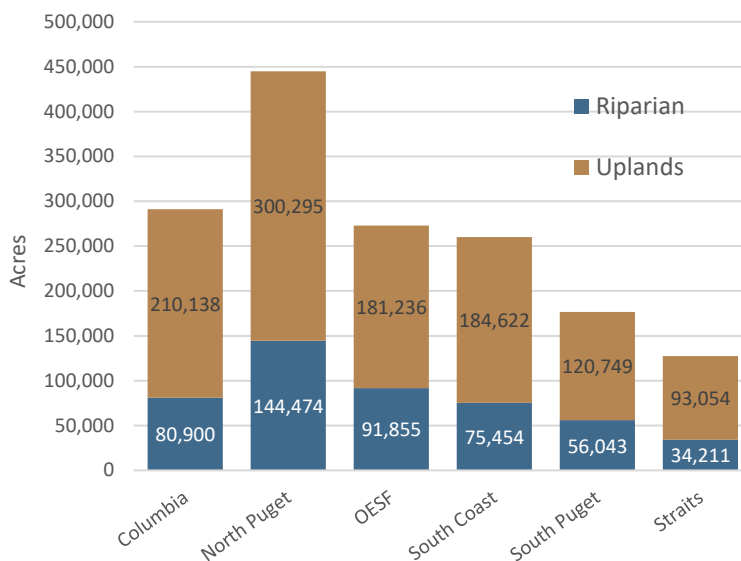


Figure 4: Acres of Riparian Areas and Uplands in the Westside Planning Units. Riparian acreage includes aerial estimates of mapped streams, water bodies, wetlands, and FEMA 100-year floodplains as well as riparian buffers associated with those features required by the HCP. Data courtesy of Chris Snyder.

Activities in the Riparian Management Zone	<ul style="list-style-type: none"> ▪ Describes forest management activities permitted in the inner, middle, and outer zones of RMZs ▪ Directs DNR to develop procedures for making site-specific forest management decisions in riparian management zones and wind buffers
Unstable Hillslopes and Mass Wasting	<ul style="list-style-type: none"> ▪ Directs DNR to develop procedures for delineating portions of hillslopes with a high risk of mass wasting ▪ Provides strategies to minimize adverse impacts to salmon habitat caused by the road network
Road Management Strategy	<ul style="list-style-type: none"> ▪ Provides strategies for road management to reduce mass wasting and surface erosion impact to streams
Hydrologic Maturity in the Rain-on-Snow Zone	<ul style="list-style-type: none"> ▪ Describes a hydrologic maturity prescription to minimize adverse impacts of rain-on-snow floods on ecosystems that support salmonids
Wetlands Protection	<ul style="list-style-type: none"> ▪ Establishes wetland management zone (WMZ) widths and guidelines for forestry operations in wetlands and WMZs

With the adoption of the implementation procedures for the [Riparian Forest Restoration Strategy](#) (RFRS) in 2006, DNR fulfilled its commitment to develop procedures for making site-specific forest management decisions in westside riparian management zones outside the OESF. The focus of this comprehensive review is on 1) Implementation of the RFRS, and 2) Reporting landscape-level trends in the development of riparian forest structure to understand progress toward the objectives in the conservation strategy.

The Riparian Forest Restoration Strategy

The development of the RFRS began shortly after the HCP was signed in 1997. At that time, the science of restoration forestry was rapidly emerging, and there was a growing understanding of the role active management could play in the restoration of riparian forests. The RFRS was developed by a Technical Review Committee consisting of staff from DNR, NOAA, USFWS, Northwest Indian Fisheries Commission, and WDFW. After the RFRS was adopted in 2006, a three-year implementation period began during which DNR staff were trained on the new procedures, and pilot projects were conducted in each of the four westside regions. In 2008, the recession led to considerable staff turnover, limiting the agency’s capacity to implement restoration treatments. Since then, implementation of the RFRS has increased, and it is now a regular part of DNR management.

The RFRS has two complementary long-term goals: shortening the period a riparian forest spends in the competitive exclusion development stages, and moving riparian stands toward the fully functional forest development stage, which is ecologically similar to old-growth conditions. Under the RFRS, important structural features of the fully functional stage such as down woody debris, instream large woody debris, and snags are created to hasten the development of riparian stands towards the desired future condition. DNR implements commercial silviculture treatments such as thinnings, individual conifer release, and conversion of hardwood to conifer-dominated stands to achieve structural complexity and restore habitat functions while not appreciably reducing short-term ecosystem benefits. The RFRS includes stand structure targets to provide a means to assess management alternatives and measure progress.

RFRS treatments are implemented through DNR’s timber sales program, and field staff consider site-specific conditions to determine which components of the RFRS should be implemented on a particular sale. Treatment is usually applied to portions of riparian management zones (RMZs) where it is expected to provide the most benefit.

DNR tracks timber sales that include RFRS treatments to ensure that stand conditions are appropriate for treatment and to better understand the role of active management in meeting the long-term goals of riparian habitat restoration. DNR’s current tracking methodology has been in place since FY 2012, and since then, approximately 20 percent of timber sales in the five westside planning units where the RFRS applies have included RFRS treatments. DNR does not track riparian stands that would benefit from restoration but where the RFRS was not applied due to stand conditions or operational infeasibility.

Figure 5 shows the estimated acreage treated, by DNR region, under the RFRS since FY 2012. Approximately 475 acres of riparian area were treated in FY 2018 and over 2,200 acres have been treated since 2012 to accelerate development of complex forest structure. Over the past seven years, there has been a gradual increase in the acreage of completed RFRS treatments, which is likely a result of DNR staff’s growing confidence in their ability to properly implement treatments.

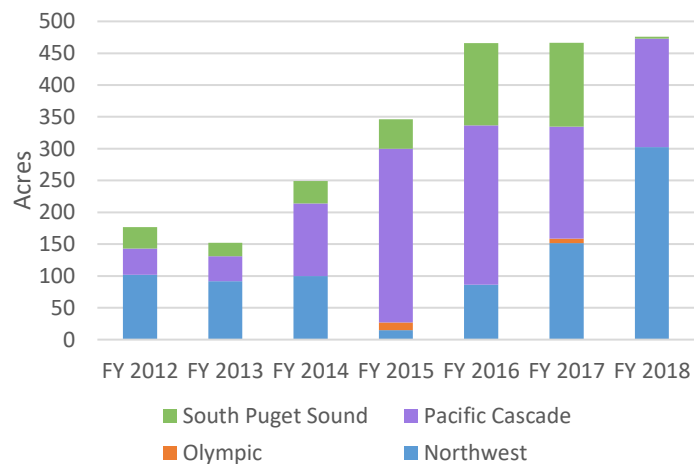


Figure 5: Estimated Acreage of RFRS Treatments by Region. Data for Olympic Region excludes the OESF where the RFRS does not apply. Chart courtesy of Hannah Yourd.

DNR’s previous forest management tracking software, Planning and Tracking, was not able to report the frequency or acreage of RFRS treatments, so this information was manually calculated each year for the HCP Annual Report. In FY 2018, DNR upgraded to a new forest management tracking software, LRM, that will better track timber sales implementing RFRS treatments.

Landscape Trends in Riparian Forest Habitat Development

RFRS treatments are expected to improve habitat quality across a growing area of westside riparian forests. However, the primary driver of complex structure in riparian areas is likely to be natural forest succession as influenced by natural disturbance, stand density, and species dynamics. One significant impact of the riparian conservation strategy has been the expansion of riparian buffers beyond those required by Washington State Forest Practices rules, allowing passive restoration to occur over a much broader area than if DNR had not entered into the HCP.

To gain a better understanding of landscape-level changes in forest structure since the HCP was signed, DNR utilized gradient nearest neighbor ([GNN](#)) data, a research product developed by the U.S. Forest Service (USFS) comprised of detailed vegetation maps covering all forested lands in Washington and Oregon since 1984. The GNN product leverages USFS Forest Inventory and Analysis (FIA) data and satellite imagery to develop pixel-level inventories of vegetation conditions. GNN has been found to reliably reflect trends in forest structure across large areas. Repeated through time and validated with DNR’s forest inventory, GNN data provide an independent, quantitative description of forest conditions on DNR-managed lands before and since HCP implementation.

DNR’s analysis of GNN data included two components. First, DNR’s GIS layers were used to identify lands managed under the riparian conservation strategy and lands primarily managed to provide revenue to trust beneficiaries, also known as general ecological management (GEM) lands. GEM lands were included in this analysis because they have been managed with consistent objectives over time and they provide a useful contrast with riparian areas which are typically not managed primarily for revenue generation.

GNN data was then used to create a snapshot of forest structure on riparian and GEM land at three times: 1984 (pre-HCP), 1998 (approximate signing of the HCP), and 2016 (approximately 18 years after the HCP was signed). The analysis was limited to land DNR has managed continuously since 1984 to only include trends resulting from DNR management.

Figure 6 shows tree size class, expressed as average quadratic mean diameter (QMD), present on riparian and GEM lands in 1984, 1998, and 2016. On riparian land, there was a notable decrease in the area of the smallest diameter class since 1998. This indicates that much of the riparian forest harvested before the HCP was signed has grown into young forest in the competitive exclusion development stage (11–21 inches QMD). Over time, as RMZs experience natural disturbance and selective mortality from competition between trees, growing space will be made available to the remaining trees, which will increase their size and wind stability. The start of this trend is already reflected in the slight increase in the 21–31 inch size class since the HCP was signed, a trend which was not present prior to the HCP.

Different trends are present on GEM lands where there has been an increase in the smallest diameter class and a decrease in the 11–21 inch diameter class since 1998. This is consistent with the management objectives of GEM land as timber harvest followed by replanting typically occurs when trees reach the 11–21 inch merchantable size class.

GNN data was also used to identify structural characteristics of early old growth, known as the OGS_I_80 index. This index reflects structural complexity associated with the early stages of older forest, similar to the desired future condition defined in the RFRS.

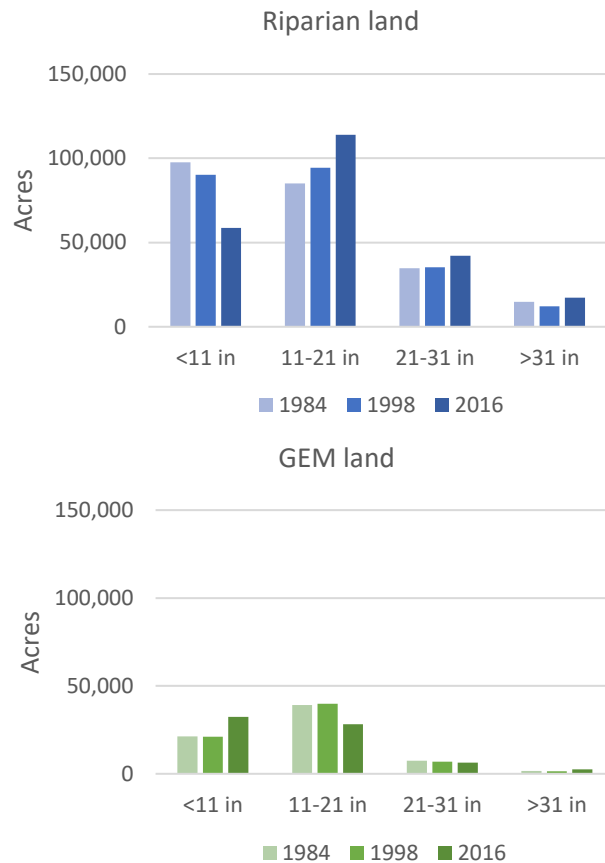


Figure 6: Tree Size Class Expressed as Average Quadratic Mean Diameter in GEM and Riparian Lands. Chart courtesy of Josh Halofsky, Dan Donato, Thomas Laxson, and Richard Bigley.

In riparian areas, there has been a small upward trend in forest area that meets the OGS_I_80 criteria (a gain of approximately 16,200 acres, or 20 percent) and a complementary decline in non-OGS_I_80 area since the HCP was signed (Figure 7). Consistent with the objectives in the conservation strategy, these trends should continue and perhaps accelerate as natural succession proceeds in RMZs.

On GEM land, there has been a slight decrease in lands meeting the OGS_I_80 criteria since the HCP was signed, which likely reflects the harvest of some older and more structurally complex stands to meet DNR’s fiduciary responsibilities to the trusts.

Overall, the trends identified in this analysis represent significant short-term progress toward restoration of high-quality riparian habitat. Forest succession and natural disturbance have led to a shift toward stands with greater structural complexity that will eventually provide the ecological functions needed to meet the conservation objectives in the HCP.

This analysis was conducted with the most recent GNN data available, which was published in 2016 and is currently in draft form. DNR plans to repeat this analysis when finalized data is released but does not anticipate significant changes in the broad trends in forest structure identified here.

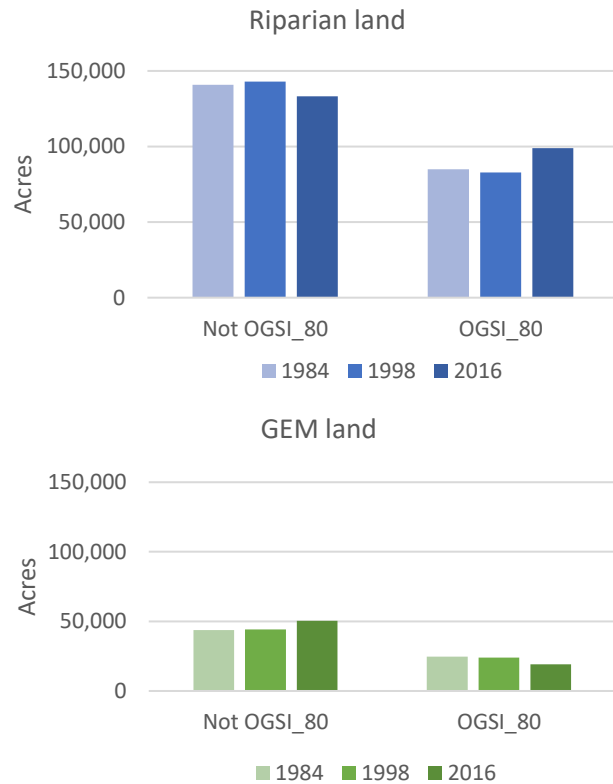


Figure 7: Presence of Early Old Growth Structural Characteristics (OGS_I_80) in GEM and Riparian Lands. Chart courtesy of Josh Halofsky, Dan Donato, Thomas Laxson, and Richard Bigley.

Marbled Murrelet Conservation Strategy Development

Appendix: Background on the Marbled Murrelet Conservation Strategy

Long-Term Conservation Strategy

In September 2018, DNR and the USFWS released a [revised draft environmental impact statement \(RDEIS\)](#) on a long-term strategy for marbled murrelet conservation for the six western Washington HCP planning units. The RDEIS analyzed two new alternatives, G and H, and reanalyzed the six alternatives from the 2016 [draft environmental impact statement \(DEIS\)](#) with updated data. Alternative G was developed in response to comments received on the DEIS, and Alternative H, DNR’s preferred alternative, was developed to reflect direction from the Board of Natural Resources. Following the release of the RDEIS, DNR held four public meetings in October 2018 (Figure 8).



Figure 8: Participants at a Public Meeting in Sedro-Woolley in October 2018. Photo courtesy of Heidi Tate.

As summarized in a [factsheet](#) DNR published in May 2018, the agency's preferred alternative protects all occupied sites with 100-meter buffers (approximately 92,000 acres), creates 29 special habitat areas (approximately 58,000 acres), delays harvest of some habitat until after the first decade of the planning period, and maintains approximately 567,000 acres of land already in conservation status. The preferred alternative also contains conservation measures to manage the impacts of forest management activities including harvest, thinning, recreation, road building and maintenance, and other activities that could cause audio-visual disturbance to nesting murrelets.

Concurrent with the release of the RDEIS, DNR published a [proposed amendment to the HCP](#) that would replace the interim marbled murrelet conservation strategy with a long-term strategy representing Alternative H. The RDEIS and the proposed amendment were subject to a 60-day public comment period.

To supplement the RDEIS, DNR published an updated [financial analysis](#) (October 2018) that provided estimates of short- and long-term impacts to revenue and timber harvest volume under each alternative for each trust, county, and sustainable harvest unit. DNR also published a [Losses and Gains Analysis](#) (October 2018) that estimated the impact of the first 10 years of implementation of the preferred alternative on four factors: 1) Volume and value of timber supply, 2) Annual revenue to DNR and trust beneficiaries, 3) Value of processed output produced, and 4) Statewide and county-wide economic output and employment. The Losses and Gains Analysis was intended to fulfill direction provided by the Commissioner of Public Lands at the November 2017 Board of Natural Resources meeting for staff to analyze the impacts of the preferred alternative on jobs and economic vitality, and also to meet the requirements of [House Bill 2285](#) that directs DNR to prepare an economic analysis of the losses and gains of the proposed alternative. The analysis was also intended to provide information to the [Solutions Table](#), an advisory committee designed to assist in marbled murrelet recovery while mitigating the economic impacts of the long-term conservation strategy.

To provide time for review of the Financial Analysis and Losses and Gains Analysis, and to allow public comment on these documents to occur simultaneously with the RDEIS and HCP amendment, the comment period for the RDEIS and HCP amendment was extended an additional 30 days, ending on December 6, 2018.

Following the comment period, DNR and USFWS will summarize and reply to public comments on the DEIS and the RDEIS, and prepare a joint final environmental impact statement (FEIS) to describe and analyze the potentially revised preferred alternative amongst a range of other alternatives. The FEIS will analyze the potential impacts of the alternatives on those elements of the natural and built environments most likely impacted by the proposed action. The FEIS will be used to satisfy requirements of both the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), and it will be accompanied by the submission of a final HCP amendment to USFWS. The anticipated release of both documents is September 2019. USFWS will then complete a biological opinion, determine sufficiency under the Endangered Species Act, and issue a record of decision under NEPA. The Board of Natural Resources will ultimately decide whether the DNR will adopt the final long-term strategy.

Interim Conservation Strategy

Negotiations between DNR and the USFWS on the long-term strategy for marbled murrelet conservation began on July 8, 2013 and are ongoing. DNR will continue to implement the interim marbled murrelet conservation strategy throughout western Washington until a long-term conservation strategy is completed.

In keeping with the interim marbled murrelet conservation strategy, stands on DNR-managed lands were classified by a habitat relationship model. These “reclassified habitat” stands were predicted to contain occupied sites, and the reclassified habitat that was predicted to contain 95 percent of the occupied sites had protocol surveys conducted to determine occupancy. Inventory surveys using the [2003 Pacific Seabird Group murrelet survey protocol](#) were completed for DNR state lands in Straits, South Coast, and Columbia HCP planning units and documented to USFWS on December 2, 2003.

Within the areas where surveys were completed, DNR identified 42,358 acres of unoccupied reclassified habitat. Some of that surveyed, unoccupied habitat has been released from deferral status as directed in Step 4 of the marbled murrelet interim conservation strategy in the HCP (p. IV.40). As described in Step 4b of the interim conservation strategy, reclassified habitat within the South Coast and Columbia Planning Units in Southwest Washington was recently made available for some harvests because more than 12 months had passed since the initiation of negotiations with USFWS on the marbled murrelet long-term conservation strategy. Southwest Washington is defined as those portions of the Columbia and South Coast planning units west of Interstate 5 and that portion of the South Coast Planning Unit that is located south of state Route 8 and south of U.S. Highway 12 between Elma and Aberdeen.

Of the 13,418 acres currently available for harvest under the interim conservation strategy, 2,969 acres, or 22 percent of available acres, have been harvested.

Table 2 shows the amount of released, reclassified marbled murrelet habitat in the Straits, South Coast, and Columbia planning units and acres harvested within each watershed administrative unit (WAU).

Table 2: Released Reclassified Marbled Murrelet Habitat.

WAU ¹	Total Acres of Reclassified Habitat ²	Acres of Released, Reclassified Habitat Available for Harvest	Acres Harvested as of 6/30/2018 ^{3, 4}
Straits HCP Planning Unit			
Bell Creek	222	0	0
Big Quil	122	61	1
Chimakum	13	6	0
Cushman	15	8	0
Dabob	22	11	0
Discovery Bay	1,161	580	424
Dungeness Valley	1,409	264	39
Hamma Hamma	184	92	37
Lake Crescent	156	0	0
Lilliwaup	573	287	39
Little Quil	97	49	7
Ludlow	94	47	45
Lyre	636	19	0
Morse Creek	308	8	3
Port Angeles	1,440	154	118
Salt	2,417	745	252
Sequim Bay	1,958	450	253
Siebert McDonald	1,856	607	200

WAU ¹	Total Acres of Reclassified Habitat ²	Acres of Released, Reclassified Habitat Available for Harvest	Acres Harvested as of 6/30/2018 ^{3, 4}
Skokomish, Lower NF	71	36	10
Sutherland-Aldwell	1,924	560	224
Twins	731	347	71
South Coast HCP Planning Unit, East of I-5			
Newaukum, Lower NF	5	3	0
Scatter Creek	167	84	22
Skookumchuck, Lower	91	45	35
South Coast HCP Planning Unit, North of Highways 8 and 12			
Cook-Elk	230	0	0
Copalis River	249	21	0
Hoquiam, EF	8	4	1
Hoquiam, WF-MF	57	0	0
Humtulpis, Middle	110	55	66
Humtulpis, WF	253	30	1
Joe-Moclips	635	158	33
Stevens Creek	107	54	49
Columbia and South Coast HCP Planning Units within Southwest Washington, West of I-5 and South of Highways 8 and 12			
Abernathy	997	499	36
Bear River	185	0	0
Black River	553	276	1
Cedar Creek	2,565	1,283	167
Chinook	40	0	0
Cloquallum	2	1	0
Curtis	54	27	0
Delezene	4	0	0
Elk Creek	162	81	2
Elk River	40	20	0
Elochoman, Main	955	478	0
Garrard Creek	1,619	809	1
Grays Bay	846	43	0
Headwaters	688	344	0
Johns River	24	12	0
Lincoln Creek	337	169	33
Main Fork	300	0	0
Mill Creek	1,503	751	136
Mox Chehalis	578	289	11
Naselle Headwaters	1,243	194	0
Naselle, Lower	725	69	0
Nemah	1,450	0	0
Palix	670	161	0
Porter Creek	2,443	1,221	403

WAU ¹	Total Acres of Reclassified Habitat ²	Acres of Released, Reclassified Habitat Available for Harvest	Acres Harvested as of 6/30/2018 ^{3, 4}
Rock-Jones	39	19	0
Skamokawa	2,975	319	0
Smith Creek	34	0	0
South Fork	566	28	0
Waddel Creek	885	443	3
Willapa Headwaters	1,731	866	165
Willapa, Lower	94	44	1
Willapa, SF	728	187	78
Wilson Creek	1	0	1
TOTAL	42,358	13,418	2,969

¹ The Skokomish (Straits); Wishkah, Lower (South Coast, North of Highways 8 and 12); Hanaford (South Coast, East of I-5); and Kennedy Creek (Southwest Washington) WAUs have no reclassified habitat, so they are not displayed in this table.

² Due to changes in rounding methods in DNR's GIS software, the acreage reported for some WAUs may be slightly different (+/- 1 acre) than what was reported last year.

³ Data originated in DNR's Land Resource Management (LRM) system. The LRM data have been overlaid with the Marbled Murrelet Habitat GIS layer, queried 12/5/2018 to identify timber sale activities (sold and completed, FYs 2004–2018) in released habitat. Values have been rounded to the nearest acre.

⁴ Harvested acreage includes blowdown salvage sales as well as traditional harvest treatments.

Adaptive Management

[Appendix: Background on Adaptive Management](#)

In FY 2018 DNR's State Lands Adaptive Management Program continued to develop links between scientific research and management. Department scientists presented findings for ten research projects during the second annual meeting of the State Lands Adaptive Management Committee which was held in conjunction with the OESF Science Conference in April 2018. Members of the OESF Adaptive Management Advisory Group also attended the meeting to better link the State Lands and OESF adaptive management processes. Many of the research projects presented are still in early stages, and therefore it is not yet possible to identify potential changes to current management practices. Further research results will be presented during the committee's next annual meeting in 2019.

The OESF adaptive management process, which is described in an administrative procedure adopted after the publication of the OESF Forest Land Plan, requires two annual meetings of DNR managers and scientists to identify priority research projects, and report project findings and their management implications. The first of these meetings included both the OESF Adaptive Management Advisory Group and the State Lands Adaptive Management Program, as noted above. The second meeting focused on four aspects of the [large-scale integrated management experiment](#): coordinating project implementation with timber sale operations in Olympic Region, external research partnerships, the value of expected information, and funding.

Implementation Monitoring

[Appendix: Background on Implementation Monitoring](#)

State lands managed by DNR are subject to complex forest management strategies necessary to achieve a variety of habitat conservation objectives. The Implementation Monitoring Program

confirms that these strategies are appropriately implemented, identifies areas for continuous improvement, and responds to changing conditions and new information. Implementation monitoring findings are used by DNR managers and field staff to improve practices and reduce the frequency of inconsistencies on the ground.

In FY 2018, monitoring staff analyzed data for a pilot project that compared and tested different remote monitoring methodologies to assess leave tree quantity and spacing in recently harvested stands. The remote methods included mapping of leave trees using four data sources: 1) PhoDAR-derived 3D point clouds produced by unmanned aircraft systems (UAS) imagery (Figure 9); 2) PhoDAR-derived 3D point clouds produced by National Agriculture Imagery Program (NAIP) imagery; 3) NAIP-derived 3D stereo imagery; and 4) LIDAR-derived 3D point clouds. On-the-ground data collection of leave tree locations was also conducted for comparison with the remote methodologies. Preliminary findings indicate that:



Figure 9: Image Acquired by an Unmanned Aircraft System (UAS) of a Unit Sampled for the Leave Tree Pilot Project.
Photo courtesy of Justin Schmal.

- The four data sources and ground sampling yielded different results for leave tree quantity and spacing. For example, across 37 inventoried units, LIDAR-derived 3D point clouds identified a total of 12,051 leave trees while NAIP-derived 3D stereo imagery identified 8,535.
- NAIP-derived 3D point clouds overestimated leave tree quantities compared to the other three data sources and the ground sampling. For example, NAIP-derived 3D point clouds identified almost four times more leave trees than were identified through ground sampling.
- Blowdown of leave trees in recently harvested stands is common. In the 23 units that were ground sampled, an average of 16 percent of all leave trees had blown down (a range of 0–75 percent blowdown was observed in individual units). In ten of the 23 units, more than 10 percent of leave trees had blown down.

The Implementation Monitoring Program plans to publish complete findings in FY 2019.

Effectiveness Monitoring

[Appendix: Background on Effectiveness Monitoring](#)

As described in the HCP, DNR is required 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 including general forest structure, specialized habitat features, and spotted owl prey populations following timber harvest and other forest management activities. Over time, the results from DNR’s 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 DNR’s effectiveness monitoring programs for spotted owl habitat, aquatic and riparian habitat in the OESF, and riparian silviculture.

Northern Spotted Owl Effectiveness Monitoring Program

The NSO Effectiveness Monitoring Program evaluates changes in habitat, including general forest structure and specific habitat features, that result from timber harvest and other management activities carried out under the HCP. In FY 2018, DNR made progress on the two primary components of the program:

1. Long-term tracking of the effects of variable density thinnings (VDTs) on improving habitat structure in stands designated as NSO habitat.

The first component of this program was initiated in 2004–2007 across five VDTs 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 includes two or three replications of treated stands and one untreated control stand at each site. All stands were measured prior to treatment and again immediately after treatment.

Between 2013 and 2015, the 5- to 7-year re-measurement of all five permanent plots was conducted. Data analysis is currently underway to compare various metrics, such as 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 PhoDAR-based metrics of canopy cover for the pre- and post-treatment measurements. This will allow for consistent comparison of canopy cover and closure between the pre- and post-treatment measurements, and the 5- to 7-year re-measurement.

In future years, DNR intends to identify a second set of effectiveness monitoring sites in stands classified as “next-best” NSO stands using Remote-Sensing Forest Resource Inventory System (RS-FRIS) data, with the objective of identifying VDT treatments that accelerate stand trajectory from next-best to habitat. DNR scientists have begun working with the timber sales program to identify planned harvests that may be appropriate for site establishment.

2. 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 meet HCP goals. To accomplish this, DNR is using GNN data, a regional data set produced by the USFS that covers all forestland in Pacific Coast states. This project has been placed on temporary hold in anticipation of the release of additional GNN data in 2019 that can provide a more updated assessment.

In addition to the monitoring activities described above, DNR is also conducting two research projects related to NSO effectiveness monitoring (Mind the Gap, and Westside Individuals, Clumps, and Openings). More information about both projects can be found in the [Research](#) section.

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.

In FY 2018, DNR and collaborators from the USFS Pacific Northwest Research Station continued field sampling and data management for nine habitat indicators such as riparian vegetation, stream temperature, and in-stream wood (Figure 10). The researchers also explored the feasibility of using UAS to augment or replace some of the fieldwork. Preliminary findings indicate that using UAS may work for measuring some habitat attributes such as vegetation cover. Additional testing is needed to determine whether UAS can be used to measure in-stream large wood or other attributes hidden under the canopy.



Figure 10: A DNR Field Technician is Trained to Collect Stream Channel Measurements for the Status and Trends Monitoring Program. Photo courtesy of Teodora Minkova.

In 2018, DNR signed an agreement with the USFS to add six unmanaged or minimally managed watersheds on the western Olympic National Forest to the existing network of four reference watersheds in Olympic National Park and two reference watersheds in the OESF. An adequate sample of reference sites is needed to distinguish between the effects of DNR management and natural disturbances, and to assess the natural range of variability in habitat conditions. This mutually beneficial collaboration was made possible through the [Good Neighbor Authority](#), an agreement between DNR and the USFS that allows the agencies to work together to manage public forests and watersheds across jurisdictions. The selection of watersheds and establishment of the long-term monitoring installations started in May 2018.

Over the past five years, the Status and Trends Monitoring Program has monitored winter water temperature in 54 streams on the western Olympic Peninsula. Analysis of this data revealed abrupt, region-wide fluctuations in stream temperature in response to weather patterns. Smaller streams experienced greater warming from precipitation events compared to larger streams. Stream temperatures were generally colder at higher elevations, though on the coldest days, elevation did not affect stream temperature. Streams with greater exposure to solar radiation had greater temperature variability and sensitivity to air temperature. Future monitoring and management of riparian and aquatic resources can be improved through a better understanding of how winter temperatures are distributed and controlled. The estimates of how these patterns and processes may change in the future are particularly important in light of a changing climate. These results were presented at the annual conference of the Northwest Scientific Association in March 2018.

Riparian Silviculture Effectiveness Monitoring Program

The objective of DNR's 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 RMZs in cooperation with DNR’s timber sales program.

The monitoring program uses an active monitoring 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. A sampling history of the monitoring sites is included in Table 3.

Table 3: Treatment Summary and Sampling History of Riparian Silviculture Effectiveness Monitoring Sites.

Site/Timber Sale Name	Planning Unit	Treatments	Year Measured		
			Pre-treatment	Post-treatment	Last Re-measurement
H1320	OESF	RD40, RD50, REF	2003	2006	2015
Salmon PC	OESF	RD40, RD50, REF	2004	2008	2013
Cougarilla	South Puget	RD40, RD50, RD50 gap, REF	2006	2008	2016
Big Beaver	South Puget	RD40, RD50, RD50 gap, REF	2006	2008	2016
Sumas Pass	North Puget	RD40, RD50, REF	2008	2013	2017
Pink Flamingo	North Puget	RD40, RD50, REF	2008	2010	2017

In FY 2018, the Riparian Silviculture Effectiveness Monitoring Program did not take any re-measurements. The program continues to analyze existing re-measurement data and plans to publish measured changes in the future.

Validation Monitoring

[Appendix: Background on Validation Monitoring](#)

The Riparian Validation Monitoring Program (RVMP) is designed 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 uses an observational study approach to monitor 50 Type-3 watersheds within the OESF and four reference watersheds in the neighboring Olympic National Park. These 54 watersheds are the same watersheds used in DNR’s Status and Trends Monitoring of Riparian and Aquatic Habitat Program. As not all of the 54 watersheds can be sampled within a summer, 20 watersheds are sampled annually (annual panel), while an additional 15 watersheds per year are sampled on a two-year rotation (even and odd years; Figure 11). 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. Starting in FY 2019, the RVMP will add the six new reference sites established under the Good Neighbor Authority on the Olympic National Forest to the sampling pool.

In FY 2018, the lead of the RVMP, Fish Biologist Kyle Martens, was invited to join the Technical Review Group of the [Quinault Indian Nation Lead Entity](#), a group that coordinates salmon habitat restoration on the western Olympic Peninsula. As part of the Technical Review Group, the RVMP provides scientific expertise to inform and prioritize potential restoration projects.

The RVMP also completed its second year of fieldwork which included three primary efforts:

1. Multiple-pass removal juvenile salmonid abundance sampling in the annual and odd-year panel of watersheds;
2. Adult coho redd surveys in the annual panel to measure abundance;
3. Snorkeling and habitat surveys over a 12-kilometer stretch of the Clearwater River.

Sampling results from 2017 revealed a range of salmonid species assemblages, densities, biomass, and coho redd abundance across the OESF (Figure 12). Despite this range of conditions, mean salmonid densities between 2016 and 2017 were similar. This suggests that fish populations appear to be relatively stable in the OESF although it is too early to detect any long-term trends.

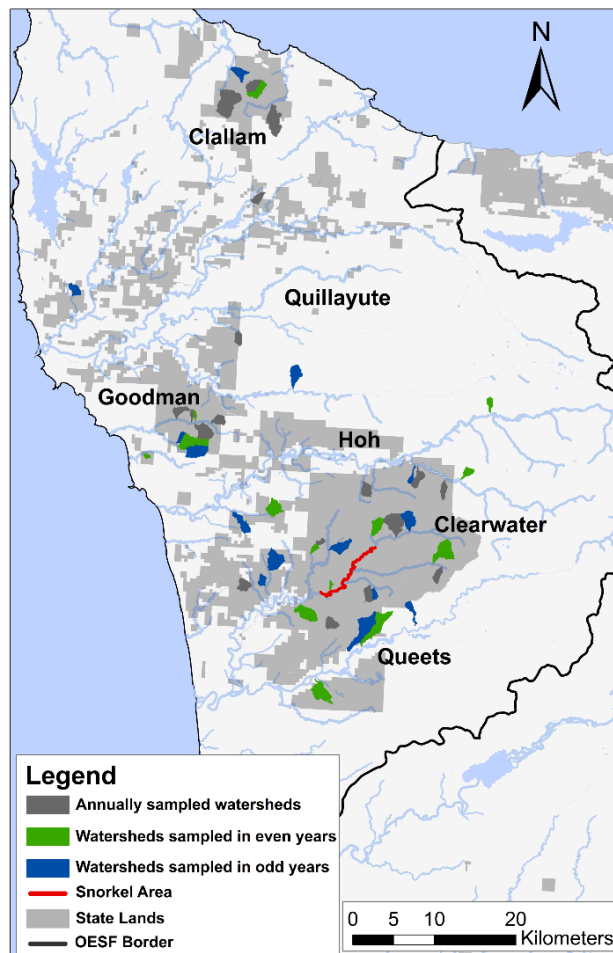


Figure 11: Watershed Sampling Schedule on the OESF for the Riparian Validation Monitoring Program. Map courtesy of Kyle Martens.

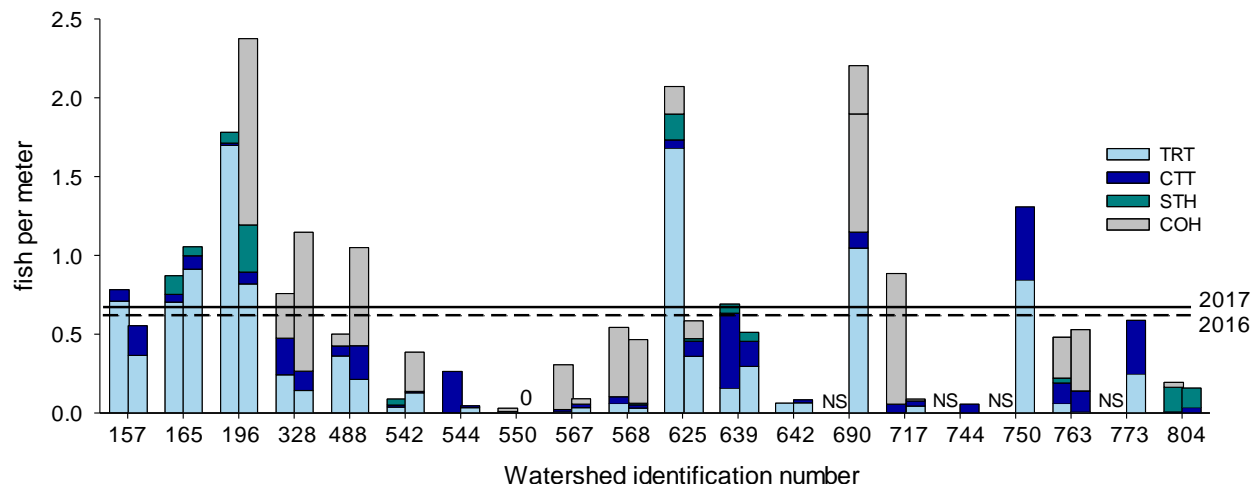


Figure 12: Comparison of Salmonid Densities in Watersheds Sampled in 2016 (left bar) and 2017 (right bar). The solid and dashed lines represent the average densities for 2017 and 2016. TRT = age-0 trout; CTT = age-1 or older cutthroat trout; STH = age-1 or older steelhead trout; COH = juvenile coho; NS = not sampled. Chart courtesy of Kyle Martens.

Results from snorkeling and habitat surveys in the Clearwater River indicate low levels of instream wood over the entire 12-kilometer section. However, areas that contained key pieces of instream wood (greater than 45-centimeter diameter and two meter length) had higher densities of juvenile salmonids compared to areas without key pieces. This suggests that increasing the amount of instream wood may increase juvenile salmonid densities. This section of the Clearwater River may provide an ideal location for a restoration project because DNR’s annual monitoring efforts could be used to assess salmonid response. The RVMP plans to explore potential funding sources and external partnerships to support a restoration project in this area.

More information about results from FY18 can be found in the [RVMP 2017 annual report](#) or [ArcGIS story map](#).

Research

DNR continually conducts research on its forestlands to better understand how forest management practices affect habitat conditions and forest productivity. This section describes DNR’s 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 4 summarizes DNR’s research projects on HCP-covered lands and the priorities they address. Some projects address multiple research priorities and monitoring commitments. More information on each project is included below the table.

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

Project	Priority 1	Priority 2	Priority 3	Monitoring
Eastside NSO Habitat and Fire Risk Evaluation	x	x		
Examining How Changing Climate and Wildfires Could Alter the Forests of Western Washington		x		
Experiment in Long-Term Ecosystem Productivity		x	x	
eDNA Research in OESF			x	x
Historic Range of Variation in Forest Structure in the Washington Cascades	x			
Influence of Repeated Alternative Biodiversity Thinning on Young Stand Development Pathways		x		
Landscape-Scale Effectiveness Monitoring of Western Washington HCP Lands		x		x
Large-Scale Integrated Management Experiment on the OESF	x	x	x	x
Mind the Gap		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	
Westside Individuals, Clumps, and Openings		x	x	

Eastside NSO Habitat and Fire Risk Evaluation: This project will assess historic, current, and future NSO habitat on state 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 the agency determine the degree to which the current approach for managing eastside NSO habitat under the HCP is likely to be sustainable for the life of the HCP. This research will also help inform other DNR priorities such as sustainable harvest calculations and forestland planning efforts. DNR has begun analyzing the approximately 12,700 stand polygons that have been digitized and attributed from DNR’s original mapped inventory (circa 1960) to begin to estimate how much potential NSO habitat may have been present. For more information, contact Josh Halofsky: Joshua.Halofsky@dnr.wa.gov.

Examining How Changing Climate and Wildfires Could Alter the Forests of Western Washington:

This project examines potential changes in vegetation zones, wildfire, early-seral, and late-successional conditions under different climate and fire suppression assumptions. Results suggest that overall, climate-related vegetation changes in western Washington will occur later than changes in other regions such as eastern Washington, in part because wildfire is rarer in the landscape even under a warmer future, and fires will continue to be suppressed across much of the study area (Figure 13). Areas more sensitive to change include high-elevation subalpine forests, forests in the Puget Trough, and forests in the rain shadow of the Olympic Peninsula. This project is complete and two papers have been published. For more information, contact Josh Halofsky:

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

Pacific Northwest Research Station, Oregon State University, the University of Washington, Western Washington University, and DNR, will test the influence of stand composition and the level of wood removed on tree and soil productivity, soil structure, and plant species diversity. The cooperative, multiple-decade study has been replicated in four experimental sites in the Pacific Northwest: three national forests in Oregon (Willamette, Siskiyou, and Siuslaw) and one site in the OESF. The OESF permanent plot installation in Sappho, Washington was established in 1995 and was re-measured in 2000 and 2016. A summary of this project is available on the [OESF webpage](#). For more information, contact Teodora Minkova: Teodora.Minkova@dnr.wa.gov.

eDNA Research in OESF: Many aquatic species that occupy streams of the OESF are found in low densities and are often difficult to detect. In 2016 and 2017, DNR's Riparian Validation Monitoring program partnered with the USFS Pacific Northwest Research Station to collect water samples for environmental DNA (eDNA) analysis. By filtering water in streams of the OESF, researchers can identify the DNA left behind by the aquatic species that recently occupied or currently occupy each stream. Data from eDNA analyses, along with DNR fish abundance data, may help to develop tools for understanding the presence, abundance, and genetic variability of multiple aquatic species including fish, amphibians, and macroinvertebrates. In addition, results from this work will help DNR better understand the aquatic communities that occupy streams of the OESF. Data from this project are currently being analyzed by the USFS with the hope of developing a manuscript in the near future. For more information, contact Kyle Martens: Kyle.Martens@dnr.wa.gov.

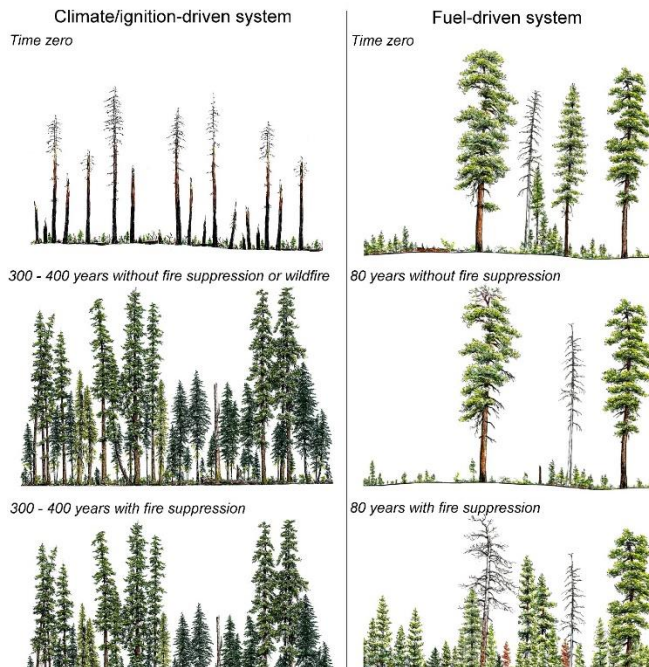


Figure 13: A Comparison of Forest Structure in Climate- and Fuel-driven Systems Following a Natural Disturbance (Time Zero). Illustrations depict a westside Douglas-fir/hemlock/cedar forest (left) and an eastside pine/douglas-fir forest (right). On the westside, large stand-replacing wildfires are more typical and fire rotations are sufficiently long that forest structures and fuels are similar regardless of what is causing wildfire absence. In contrast, eastern forests tend to have more low- and mixed-severity wildfires with shorter fire rotations, resulting in fuel accumulation when wildfire is excluded. Figure courtesy of Josh Halofsky.

Historic Range of Variation in Forest Structure in the Washington Cascades: Estimates of historic range of variation for late-successional conditions can be used as a coarse-filter proxy to identify the historic range in abundance of NSO and murrelet habitat under natural disturbance regimes. These historic conditions can then be compared with current conditions to identify differences in late-successional conditions for different forest zones. Using computer models and USFS FIA data, DNR developed estimates of historic and current amounts of early-seral, mid-seral, and late-successional conditions across all forestlands in the North and West Cascades. This project is complete and a manuscript is currently in journal review. Results suggest: 1) complex early-seral conditions are rare in this landscape because the natural disturbances that create such conditions are rare, but early-seral conditions would generally have composed approximately 1–30 percent at any given time, 2) there is currently an over-abundance of mid-seral conditions due to past and current management (68 percent, compared to less than 40 percent historically), and 3) due to large and infrequent wildfire events, historic late-successional conditions may have composed approximately 45–92 percent of the landscape at any given time. For more information, contact Josh Halofsky or Daniel Donato: Joshua.Halofsky@dnr.wa.gov, Daniel.Donato@dnr.wa.gov.

Influence of Repeated Alternative Biodiversity Thinning on Young Stand Development Pathways: In the late 1990s, DNR used pre-commercial thinning (PCT) across the landscape including in riparian and wetland areas and in sites adjacent to high-quality older forest habitat. Managers recognized the ability of PCT to influence stand development trajectory and were interested in exploring a wide variety of alternative approaches to increase future wildlife habitat by increasing forest structural diversity. Setting stands on different development pathways was recognized as important for meeting the management goal of balancing timber and non-timber management on the OESF.

In 1999, DNR initiated an empirical test of alternative biodiversity stand management pathways in young stands. This set of PCT treatments (randomized block design with five treatments and five replicates) is now being re-thinned with new gap treatments to explore the influence of gap timing on structural complexity and wildlife habitat. Thinning prescriptions and gap installations were incorporated into the Goodman Demo timber sale which was sold in December 2015. Harvesting was completed in the spring of 2017, and post-treatment measurements were completed in the fall of 2017. Information gained from this project will inform agency decisions about the value of different treatment options in meeting multiple management objectives under the biodiversity pathways approach. This project was featured in a recent issue of the *The Learning Forest*, a biannual newsletter developed by DNR's OESF Research and Monitoring Program and the University of Washington's Olympic Natural Resource Center (ONRC). A summary of this project is available on the [OESF webpage](#). For more information, contact Warren Devine: Warren.Devine@dnr.wa.gov.

Landscape-Scale Effectiveness Monitoring of Western Washington HCP Lands: The goal of this project is to determine how landscape-scale habitat conditions have changed since the implementation of the HCP. More information can be found in the [NSO Effectiveness Monitoring](#) section. For more information, contact Daniel Donato: Daniel.Donato@dnr.wa.gov.

Large-Scale Integrated Management Experiment on the OESF: The purpose of this project is to compare three different integrated management strategies to identify which increases the wellbeing of the OESF's communities and forests above current levels. One strategy includes the level of integrated management as described in the [OESF Forest Land Plan](#). The other two strategies include more and less integration of revenue production and ecological values than described in the plan. A non-management control is also planned. The study is currently in the planning stage and is co-led by DNR and the University of Washington's ONRC.

In FY 2018, DNR and the ONRC continued developing the study plan and building an interdisciplinary team of researchers. Four thematic workshops and a number of field trips took place to conceptualize the four main components of the study: silviculture, aquatic ecology, operations research, and social science (Figure 14). The workshops were attended by researchers from the University of Washington (UW), Oregon State University, USFS Pacific Northwest Research Station, Hama Hama Company, and the Washington Coast Sustainable Salmon Partnership. Additional outreach activities for the project included presentations at scientific forums and for local governments and professional groups, publications in newspapers and newsletters, and multiple meetings.



Figure 14: Researchers from Oregon State University Observe Harvest Operations in the OESF during a Field Trip to Discuss a Tethered Logging Study as part of the Large-Scale Integrated Management Experiment. Photo courtesy of Teodora Minkova.

Securing funding for monitoring, analyses, stakeholder participation, and other project costs continued to be a challenge in 2018. DNR and UW explored multiple grant opportunities to fund the study and submitted a proposal to the EarthWatch Institute, an international environmental charity sponsoring citizen science research, to fund the monitoring of upland biota. In early FY 2019, DNR was notified that the grant was awarded. For more information, contact Teodora Minkova: Teodora.Minkova@dnr.wa.gov.

Mind the Gap: 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 ten-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. A summary of this project is available on the [OESF webpage](#). For more information, contact Daniel Donato: 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 NRF and dispersal habitat. More details can be found in the [NSO Effectiveness Monitoring](#) section. 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. More details about this ongoing research can be found in the [Riparian Silviculture Effectiveness Monitoring](#) section. For more information, contact Daniel Donato: Daniel.Donato@dnr.wa.gov.

Riparian Validation Monitoring: This work helps determine whether DNR’s current forest management practices in the OESF restore and maintain habitat capable of supporting viable salmonid populations within the OESF. A summary of this work can be found in the [Validation Monitoring](#) section. For more information, contact Kyle Martens: 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 work can be found in the [Effectiveness Monitoring](#) section. For more information, contact Teodora Minkova: 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 the 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 2012–2015. 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 were established in 2018 (Figure 15). Plot establishment will continue over the next few years, with a plan to monitor plots at 5–10 year intervals. For more information, contact Daniel Donato: Daniel.Donato@dnr.wa.gov.



Figure 15: Plot Establishment in a Severely Burned Eastside Forest. Photo courtesy of Daniel Donato.

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 VDT 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 the University of Washington. For more information, contact Daniel Donato: Daniel.Donato@dnr.wa.gov.

OESF Research and Monitoring Program

Appendix: Background on the Research and Monitoring Program

In FY 2018, the OESF Research and Monitoring Program continued implementing two HCP monitoring projects (*Status and Trends Monitoring of Aquatic and Riparian Habitat* and *Riparian Validation Monitoring*) and continued planning the [large-scale integrated management experiment](#) in cooperation with University of Washington's ONRC. Information about these projects can be found in the [Research](#) section of this report and on the [OESF webpage](#).

The program also helped five students implement research projects:

- A Ph.D. student from UW used hydrologic models calibrated to OESF flow observations to examine basin response to timber harvests.
- A graduate student from the UW School of Environmental and Forest Sciences researched the export of carbon through streams.
- A graduate student from The Evergreen State College investigated spatial and temporal variability of microclimates in riparian areas.
- Two graduate students from The Evergreen State College successfully defended their Master's theses on research done in the OESF: GIS analysis of past management history and a quantification of mercury accumulation in periphyton.

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, and an additional 180 email subscribers.

The second annual OESF science conference took place in Forks, Washington in April 2018. Several OESF-based research projects were featured in scientific presentations on winter stream temperature, hydrological monitoring, wetland characterization, watershed-level experimentation, predictive site index models for red alder, acoustic monitoring, and predictive modeling for archaeological sites. Videos of the presentations are available on [DNR's YouTube channel](#). In an afternoon workshop, DNR staff explained and demonstrated the use of small UAS in management of state trust lands. The conference was well-attended, drawing more than 75 participants.

The OESF Research and Monitoring Program and Olympic Region supported multiple educational and research activities in 2018. In August, DNR taught students from UW about forest management on state lands using the newly-constructed Reade Hill hiking trail near Forks (Figure 16). DNR also maintained formal and informal research partnerships that involved data sharing, facilitation of external research on state lands, field trips, lectures, and other activities.



Figure 16: Students from UW Learn About Forest Management from DNR Staff. Photo courtesy of Teodora Minkova.

Publications and Presentations

In addition to conducting research on DNR-managed forestlands, DNR state lands researchers also write and contribute to publications and presentations relevant to forest management in the Pacific

Northwest. DNR contributed to the articles and presentations listed below published in 2018. DNR authors are denoted in bold text.

Devine, Warren D, Teodora V. Minkova, E. Ashley Steel, Alex D. Foster, **Kyle D. Martens**. “Winter water temperature in small fish-bearing streams.” Invited presentation. Northwest Scientific Association annual meeting. 2018.

- An analysis of winter temperatures from 54 streams monitored over the last five years on the Olympic Peninsula identified abrupt, region-wide fluctuations in stream temperature in response to weather patterns. Smaller streams experienced greater warming from precipitation events compared to larger streams. Stream temperatures were generally colder at higher elevations, though on the coldest days, elevation did not affect stream temperature. Streams with greater exposure to solar radiation had greater temperature variability and sensitivity to air temperature.

Donato, Daniel C. “Don’t panic, but do buckle up: Putting Oregon’s Eagle Creek Fire in perspective.” Invited presentation. Columbia Gorge Cooperative Weed Management Area Invasive Species and Exotic Pests Workshop. 2018.

- This presentation was part of a land-management workshop focusing on fires and invasive species in the Columbia Gorge. The focus of the presentation was on westside fire regimes and how the Eagle Creek Fire, in a relative sense, was a small event from which the system will likely readily recover.

Donato, Daniel C. “Buckle up: The under-recognized role of large wildfires in the West Cascades.” Invited presentation. Washington Society of American Foresters Annual Meeting. 2018.

- The focus of this talk was to increase awareness of westside fire regimes, particularly very large events for which regional land managers and policymakers may not be well-prepared.

Donato, Daniel C., Joshua S. Halofsky, Matthew J. Reilly. “Corralling a black swan: Natural range of variability in a forest landscape driven by rare, extreme events.” Invited presentation. Northwest Scientific Association annual meeting. 2018.

- This presentation described research in establishing how much late-successional forest would likely have been on the West Cascades landscape under historic disturbance regimes, and thus, what would likely have been sufficient to support associated species such as the northern spotted owl.

Halofsky, Joshua S. “Fire, forests, and habitat of western Washington’s past and future.” Invited presentation. Olympia City Hall. 2018.

- The presentation reviewed how much wildfire, early-seral habitat, and late-seral habitat was likely historically present on the landscape, how those historic abundances compare to present conditions, and how both wildfire and habitat may change with climate.

Halofsky, Joshua S., Daniel C. Donato, Jerry F. Franklin, Jessica E. Halofsky, David L. Peterson, Brian J. Harvey. “The nature of the beast: Examining climate adaptation options in forests with stand-replacing fire regimes.” *Ecosphere* 9(3): e02140. 2018.

- This paper discusses the unique challenges of managing westside PNW forests (and similar forests elsewhere) for climate change adaptation and identifies several relevant strategies for doing so. [Available online](#).

Khadduri, Nabil. “Nursery soil fumigation and outplant performance.” *Tree Planters’ Notes* 61, no. 2: 117–125. 2018.

- This paper summarized seedling performance in the woods and in large containers following three nursery trials comparing standard methyl bromide + chloropicrin (MBC) soil fumigation and non-fumigated control treatments. In the first two trials, seedlings grown in MBC-treated soil had lower nursery cull rates, larger initial seedling size, and lower initial root pathogen loads. They also maintained larger volume growth over non-fumigated control seedlings through the first five growing seasons in the woods. The third trial demonstrated that seedlings with lower initial root pathogen load outperformed seedlings with greater initial disease, even in the absence of initial size differences. [Available online.](#)

Martens, Kyle. “DNR salmonid monitoring on the OESF.” Invited presentation. Timber, Fish and Wildlife meeting. 2018.

- This presentation focused on monitoring and initial findings from the [Riparian Validation Monitoring Program.](#)

Martens, Kyle. “DNR salmonid monitoring on the OESF.” Invited presentation. North Pacific Coast Lead Entity. 2018.

- This presentation focused on DNR monitoring and initial findings from the [Riparian Validation Monitoring Program.](#)

Martens, Kyle. “DNR’s Riparian Validation Monitoring Program on the OESF.” Invited presentation. Coastal Cutthroat Trout Symposium. 2018.

- This poster described DNR’s [Riparian Validation Monitoring Program](#) and provided initial findings regarding coastal cutthroat trout.

Minkova, Teodora V. “Large-scale integrated management experiment in the Olympic Experimental State Forest - opportunities for operational research.” Invited presentation. Western Council of Forest Engineers Annual Conference. 2018.

- The purpose of this presentation was to introduce the landscape management experiment planned in the OESF to forest engineers from Washington and Oregon, share ideas for operations research, and solicit participation in the study. The presented topics included innovative road management techniques such as geosynthetics and aggregate recycling, and cost-effective logging systems such as tethered logging.

Stevens-Rumann, Camille S., Kerry Kemp, Philip Higuera, Brian Harvey, Monica Rother, Daniel Donato, Penelope Morgan, Thomas Veblen. “Evidence for declining forest resilience to wildfires under climate change.” *Ecology Letters* 21(2): 243–252. 2018.

- This large regional study combined data on post-wildfire tree regeneration from several studies across the interior West, finding that stands burned during recent wildfires (post-2000) are regenerating at slower rates and less reliably than those that burned prior to 2000. The data suggest that warmer, drier climate conditions are limiting tree regeneration, particularly in low-elevation dry sites.

Conservation Strategy Updates

The HCP established numerous conservation strategies designed to minimize and mitigate the adverse effects of land management activities on the habitats of federally listed species, riparian habitats, unlisted species of concern, and uncommon habitats that exist within the land base covered by the HCP. DNR's conservation strategies are occasionally updated due to research, plan development, changes to laws, and/or adjustments to DNR's administrative procedures. DNR did not make any updates to the conservation strategies in FY 2018.

Additional Habitat Restoration and Enhancement

Under the HCP, DNR conserves, restores, and enhances habitat for the northern spotted owl, marbled murrelet, and several federally listed salmonids, primarily through timber harvests and other forest management activities. These activities benefit species covered under the HCP and also generate revenue for trust beneficiaries.

DNR also works on a variety of additional habitat restoration and enhancement projects that are not required under the HCP. These projects, which are primarily funded through federal or state government grants, include in-stream restoration, riparian and upland habitat enhancement, and invasive species eradication. Additionally, DNR facilitates research and monitoring projects that go beyond the requirements in the HCP.

Much of this additional work is conducted in partnership with local, state, or federal agencies; tribes; non-profit organizations; educational institutions; or members of the public. These projects are typically executed under a land use license, special use lease, interagency agreement, memorandum of understanding, or research permit that allows external parties to conduct activities on state lands. In some cases, DNR completes projects in-house.

These additional projects can be separated into two types: habitat restoration and enhancement (Table 5), and research and monitoring (Table 6). These tables summarize projects that were initiated or renewed in FY 2018 within the HCP boundary.

Table 5: Summary of Habitat Restoration and Enhancements Projects Initiated or Renewed in FY 2018 on DNR-Managed Land Within the HCP Boundary. Some projects initiated prior to FY 2018 are included if a significant portion of work was completed in FY 2018.

Primary species or habitat	Project type	Approximate project area on DNR land	Partner	Natural area (if applicable)
Chelan Planning Unit				
Wenatchee Mts. checker-mallow, Wenatchee larkspur, white-headed woodpecker	Forest and wet meadow restoration, prescribed burning, ecological thinning, invasive plant control, native vegetation establishment	130 acres	N/A, DNR project	Camas Meadows NAP
Columbia Planning Unit				
Summer steelhead and resident rainbow and cutthroat trout	Modification of three log dams to restore fish passage	3.5 miles	Lower Columbia Fish Enhancement Group	N/A
Klickitat Planning Unit				
Meadow and dry forest habitat, greater sandhill crane	Thinning, prescribed burning, native vegetation planting, invasive species control, hydrologic restoration, removal of accumulated woody debris	167 acres	N/A, DNR project	Klickitat Canyon NRCA
Oregon spotted frog, greater sandhill crane, various migratory birds, rosy owl clover, pale blue-eyed grass	Meadow and wetland restoration	35 acres	N/A, DNR project	Trout Lake NAP
North Puget Planning Unit				
Golden paintbrush	Restore rare coastal prairie and plant habitat	2.2 acres	Whidbey Camano Land Trust	Admiralty Inlet NAP
Island marble butterfly	Upland habitat enhancement	10 acres	N/A, DNR project	Cattle Point NRCA
Grassland balds	Upland habitat enhancement	5 acres	Samish Tribe	Cypress Island NAP/NRCA
Salmon	Fish barrier removal	<1 acre	City of Everett	N/A
Salmon	Stream enhancement	15 acres	Lummi Skookum Tribe	N/A
South Coast Planning Unit				
Coastal forest and rare salt marsh habitat	Restore quality of habitat for marbled murrelet, spotted owl, amphibians, and elk	895 acres	N/A, DNR project	Bone River NAP, Niawiakum River NAP, Elk River NRCA, Ellsworth Creek NRCA
Surge plain wetlands, salmonids, Olympic mudminnow	Wetland habitat enhancement	28 stream miles	N/A, DNR project	Chehalis River Surge Plain NAP

Primary species or habitat	Project type	Approximate project area on DNR land	Partner	Natural area (if applicable)
Coho, fall chum, winter steelhead, bull trout, fall chinook	Riparian enhancement	15.6 acres	Private landowner	N/A
South Puget Planning Unit				
Golden paintbrush	Upland habitat enhancement	35 acres	N/A, DNR project	Mima Mounds NAP
Golden paintbrush, Mazama pocket gopher, valley silverspot butterfly, white-topped aster, Puget blue butterfly	Restore rare grassland habitats, remove Scot's broom, prescribed burning, oak release	205 acres	WDFW	Mima Mounds NAP, Rocky Prairie NAP, Bald Hill NAP
Garry oak woodland	Upland habitat enhancement	11 acres	N/A, DNR project	Oak Patch NAP
Bats, migratory waterfowl, neotropical migratory birds	Wetland, salt, and freshwater shoreline restoration	100 acres	N/A, DNR project	Woodard Bay NRCA
Salmon	Fish barrier removal and habitat enhancement	24 acres	Cowlitz Indian Tribe	N/A
Salmon	Stream restoration	12 acres	Cowlitz Indian Tribe	N/A
Summer-run steelhead	Stream enhancement	< 2 acres	Lower Columbia Fish Enhancement Group	N/A
Chum	Channel restoration	<1 acre	WDFW	N/A
Winter-run steelhead, coho, coastal cutthroat	Stream enhancement	10 acres	Cowlitz Indian Tribe	N/A
Pheasant	Habitat enhancement	76 acres	WDFW	N/A
Elk	Enhance forage, open travel corridors, and reseed native vegetation	Multiple blocks	WDFW	N/A
Winter-run steelhead, coho, coastal cutthroat	Stream enhancement	10 acres	Cowlitz Indian Tribe	N/A
Straits Planning Unit				
Pileated woodpecker, coastal cutthroat trout, great blue heron, bald eagle, marbled murrelet, spotted owl	Coastal lowland forest restoration	115 acres	N/A, DNR project	Dabob Bay NAP/NRCA

Table 6: Summary of research and monitoring projects initiated or renewed in FY 2018 on DNR-managed land within the HCP boundary. Some projects initiated prior to FY 2018 were included if a significant portion of work was completed in FY 2018.

Primary species or habitat	Project type	Approximate project area on DNR land	Partner	Natural area (if applicable)
Chelan Planning Unit				
Upper Columbia spring Chinook	Habitat enhancement and monitoring	1 acre	Confederated Tribes and Bands of the Yakama Nation	N/A
Upper Columbia Steelhead	Habitat enhancement and monitoring	1 acre	Confederated Tribes and Bands of the Yakama Nation	N/A
North Puget Planning Unit				
California condor	Research to determine presence of historic nest sites	1 acre	Falcon Research Group	Cypress Island NAP/NRCA
OESF Planning Unit				
Salmon	Habitat monitoring	88 acres	WDFW	N/A
South Coast Planning Unit				
Red knot (shorebird)	Banding and tracking	25 acres	WDFW	Sand Island NAP
South Puget Planning Unit				
Nearshore invertebrates	Identification and inventory of multiple species	900 acres	Pacific Shellfish Institute	Woodard Bay NRCA
Elk	Hoof disease survey and monitoring	Multiple blocks	WDFW	N/A
Tick	Environmental surveillance and tick drag method	Multiple blocks	WDFW	N/A
Western pond turtle	Monitoring and management	40 acres	WDFW	N/A
Soil	Soil surveys	Statewide multiple blocks	USDA – Natural Resources Conservation Service	N/A
Rare plants	Plant distribution, abundance, and habitat survey	3,343 acres	University of Washington	N/A
Multiple Planning Units				
Wenatchee Mts. checker-mallow, Bradshaw's lomatium	Assessing and quantifying hydrologic conditions	500 acres	N/A, DNR project	Camas Meadows NAP, Lacamas Prairie NAP
Gray wolf	Study and management	Statewide, multiple blocks	WDFW	N/A
Elk, moose, cougar, lynx, bobcat, black bear, coyote, deer, multiple species of vole and mouse, bushy-tailed woodrat, snowshoe hare	Predator-prey study	Statewide, multiple blocks	WDFW	N/A

Primary species or habitat	Project type	Approximate project area on DNR land	Partner	Natural area (if applicable)
Black-tailed deer	Survival monitoring	Statewide, multiple blocks	WDFW	N/A
Coho salmon	Stream surveys	Statewide, multiple blocks	WDFW	N/A
Steelhead	Stream surveys	Statewide, multiple blocks	WDFW	N/A

Featured Project: Coastal Forest Restoration

With funding from the Washington State Recreation and Conservation Office, DNR began restoring approximately 895 acres of coastal forest in the Bone River NAP, Niawiakum River NAP, Elk River NAP, and Ellsworth Creek NRCA in Pacific and Grays Harbor Counties.

Restoration will focus primarily on thinning densely planted commercial forest stands that are 35–50 years old. Techniques such as variable density thinning and individual tree release will be used to create gaps in the forest canopy and foster the growth of multiple layers of native forbs, shrubs, and small trees. The majority of trees selected for thinning will either be girdled or topped and left standing as snags, or left on-site as downed woody debris.

Restoration goals include reducing stand density, increasing understory vegetation and plant diversity, increasing recruitment of woody debris on the forest floor, creating snags, and managing invasive plant populations to diversify forest structure and accelerate the natural progression to late successional forest (Figure 17). This will improve habitat quality for a variety of plant and animal species including the marbled murrelet, spotted owl, cavity-dwelling birds, amphibians, and resident herds of Roosevelt elk.



Figure 17: Late Successional Forest in Pacific County.
Photo courtesy of Joe Rocchio.

Forest Inventory

Since 2013, DNR’s forest inventory team has been developing the Remote-Sensing Forest Resource Inventory System (RS-FRIS) to replace the previous inventory system based on sample plots. RS-FRIS combines plot measurements taken in the field with data from remote sensing to provide information at a higher spatial resolution and lower cost than a conventional, sample plot forestry inventory. RS-FRIS data is being used to support a variety of DNR program areas including research and monitoring, habitat delineation, timber sales, and forest modeling.

In FY 2018, DNR’s forest inventory team measured 316 inventory plots on trust lands across the state. As of December 2018, Washington State’s LiDAR data covered approximately 48 percent of the state (Figure 18) and 95 percent of forested DNR-managed lands. In FY 2019, DNR will continue acquiring LiDAR data and conducting plot measurements to further expand coverage of RS-FRIS. With the completion of panels two and three during FY 2019, RS-FRIS Version 3.0 will be produced to provide updated inventory estimates across DNR-managed lands.

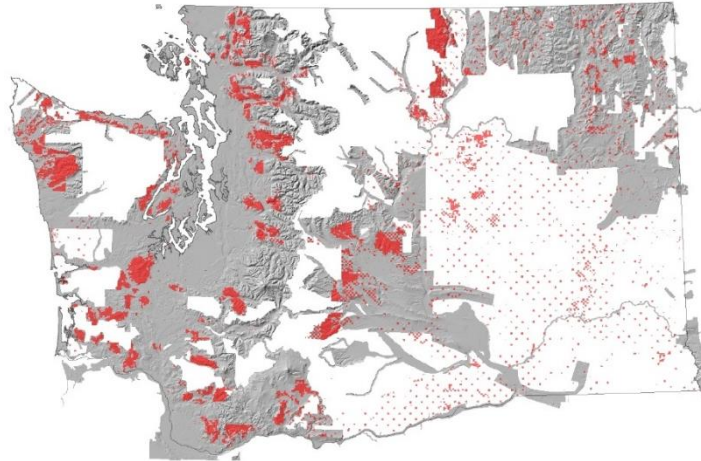


Figure 18: Washington State’s LiDAR Coverage (Gray) as of December 2018. DNR-managed lands are shown in red. Map courtesy of Jacob Beard.

Silvicultural Activity

Appendix: Background on Silvicultural Activity

Information and analysis provided in this section are based on activities designated as “complete” in DNR’s forest management activity tracking database, Land Resource Manager (LRM), as of December 4, 2018. LRM is a tabular database that integrates a Geographic Information System (GIS) and allows for the spatial tracking of individual forest management activities on the landscape.

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 (Figure 19). Table 7 shows completed acres of silvicultural activities for FY 2018 as well as the mean annual acres of each activity for the last five fiscal years within the area covered by the HCP.

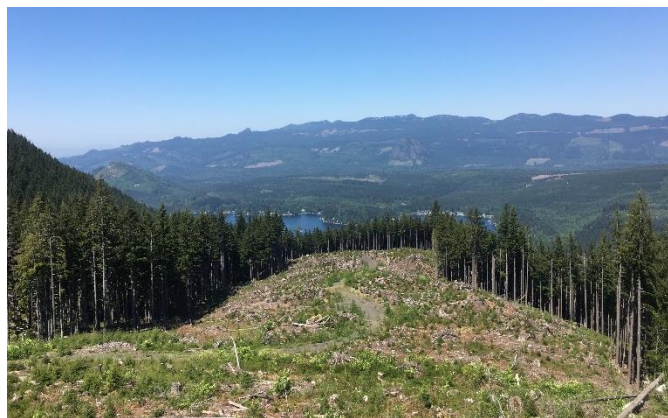


Figure 19: A Variable Retention Harvest in Northwest Region. This stand was harvested in 2013 and replanted in 2014. Photo courtesy of Grant Becker.

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. Thus, the number of timber sales sold may stay relatively stable from year to year. However, timber removals or levels of completed activities may vary based on when purchasers choose to harvest (and thus complete) the sale.

Variable retention harvest (VRH) acres in FY 2018 were about 6 percent below the five-year mean, variable density thinning (VDT) acres were 4 percent below the five-year mean, and non-VDT

commercial thinning acres were 67 percent below the five-year mean. The number of acres where uneven-aged management occurred on HCP lands was 11 percent higher than the five-year mean with most completed acres (94 percent) occurring in eastern Washington. Total completed harvest acres in FY 2018 is 15 percent below the five-year mean.

Forest Site Preparation

Total forest site preparation acreage in FY 2018 was three percent higher than the five-year mean. In westside planning units not including the OESF, aerial herbicide treatments were 13 percent above the five-year mean while ground herbicide treatments were 7 percent below the mean. In the OESF, site preparation was 25 percent lower than the five-year mean. In eastside planning units, mechanical site preparation was 175 percent higher than the mean because a new acquisition was treated to spur natural regeneration.

Forest Regeneration

Forest regeneration acreage in FY 2018 was eight percent higher than the five-year mean. Hand planting was the technique used on over 99 percent of the regenerated acres.

Vegetation Management

Acres of completed vegetation management in FY 2018 were 39 percent below the five-year mean. Ground herbicide and hand cutting treatments were 67 percent and 36 percent below the five-year mean, respectively, while hand-pulling treatments were nine percent higher than the mean.

Pre-Commercial Thinning

The total acreage of PCT completed in FY 2018 was 86 percent below the five-year mean, driven primarily by significant increases in the cost of contract labor. While there was a 12 percent increase in the amount of PCT completed in the OESF, there were zero acres completed in eastside planning units. In westside planning units not including the OESF, there were 89 percent fewer acres of PCT compared to the mean.

Table 7: Acres of Silviculture Activities Completed in FY 2014–FY 2018 on State Trust Lands Managed Under the HCP.

	FY 2018							FY 2018 Totals (Five-year Mean: FY14–18)			
	EAST ¹		WEST					East	West	OESF	Total
	Klickitat	Yakima	Columbia	North Puget	South Coast	South Puget	Straits				
Timber Harvest											
Commercial thinning	0	0	434	4	423	0	6	0 (177)	867 (1,904)	0 (553)	867 (2,633)
Seed tree removal cut	0	0	0	0	0	0	0	0 (51)	0 (0)	0 (0)	0 (51)
Selective product logging	0	0	0	0	0	0	0	0 (0)	0 (40)	0 (0)	0 (40)
Shelterwood intermediate cut	0	0	0	0	0	0	0	0 (23)	0 (0)	0 (0)	0 (23)
Shelterwood removal cut	0	0	0	0	0	0	0	0 (0)	0 (0)	32 (6)	32 (6)
Uneven-aged management	552	0	0	0	28	0	10	552 (483)	38 (51)	0 (0)	590 (534)
Variable density thinning	0	508	173	275	54	123	7	508 (723)	631 (737)	1,401 (1,181)	2,540 (2,642)
Variable retention harvest	4	20	2,892	1,550	1,662	1,632	893	24 (96)	8,628 (9,876)	1,687 (1,044)	10,339 (11, 017)
Total timber harvest	556	528	3,499	1,829	2,167	1,754	915	1,084 (1,522)	10,165 (12,608)	3,120 (2,785)	14,368 (16,945)
Forest Site Preparation											
Aerial herbicide	0	0	2,261	0	790	0	0	0 (0)	3,051 (2,692)	0 (0)	3,051 (2,692)
Ground herbicide	0	0	1,384	1,726	800	0	75	0 (0)	3,985 (4,278)	393 (526)	4,378 (4,803)
Ground mechanical	0	498	0	0	0	0	0	498 (181)	0 (0)	0 (0)	498 (181)
Total forest site preparation	0	498	3,645	1,726	1,590	0	75	498 (181)	7,036 (6,970)	393 (526)	7,927 (7,676)
Forest Regeneration											
Hand planting	26	0	3,992	2,961	3,733	1,098	813	26 (950)	12,597 (10,220)	721 (929)	13,344 (12,099)
Natural regeneration	0	0	0	0	0	0	0	0 (214)	0 (0)	9 (3)	9 (217)
Total forest regeneration	26	0	3,992	2,961	3,733	1,098	813	26 (1,164)	12,597 (10,220)	730 (932)	13,353 (12,316)
Vegetation Management											
Ground herbicide	0	0	0	417	0	0	516	0 (0)	933 (2,604)	1 (192)	934 (2,796)
Hand cutting	0	0	776	1,995	1,473	331	879	0 (121)	5,453 (8,675)	370 (315)	5,823 (9,111)
Hand pulling	0	0	20	0	825	0	172	0 (0)	1,017 (934)	0 (0)	1,017 (934)
Total vegetation management	0	0	795	2,412	2,298	331	1,567	0 (121)	7,404 (12,213)	371 (507)	7,774 (12,841)
Pre-Commercial Thinning											
Total pre-commercial thinning	0	0	339	126	280	0	14	0 (1,140)	759 (6,786)	421 (376)	1,180 (8,302)
Fertilization											
Ground fertilization	0	0	0	0	0	95	0	0 (0)	95 (56)	0 (0)	95 (56)
Grand Total	582	1,026	12,270	9,054	10,068	3,278	3,385	1,608 (4,157)	38,056 (48,852)	5,034 (5,126)	44,698 (58,135)

¹ There were no completed activities in the Chelan planning unit in FY 18.

Salvage

Table 8 compares acres of salvage harvest completed in FY 2018 to the five-year mean by harvest type. Overall, the total acreage of salvage harvest was 91 percent below the five-year mean. In westside HCP planning units including OESF, 47 acres were salvaged in FY 2018, ten percent below the five-year mean. There were no completed salvage harvests in eastside planning units in FY18. Acres of post-wildfire salvage harvest tend to fluctuate with the severity of the wildfire season.

Table 8: Acres Salvaged by Harvest Type in FY 2018 Compared to the Five-year Mean (FY14–18).

		FY 2018 (Five-year Mean: FY14–18)			
		East	West	OESF	Total
Harvest type	Commercial thinning	0 (0)	1 (0.2)	0 (0)	1 (0.2)
	Uneven-aged management	0 (174)	1 (2)	0 (0)	1 (176)
	Variable density thinning	0 (257)	0 (1)	0 (0)	0 (258)
	Variable retention harvest	0 (57)	20 (36)	25 (13)	45 (107)
	Total	0 (489)	22 (39)	25 (13)	47 (541)

Road Management Activity

Forest Roads Program

Appendix: Background on Road Management Activity

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. The information presented here is for calendar year 2017.

During the 2017 legislative session, the Forest Roads Program received \$2.3 million of the \$8.7 million requested for fish barrier correction and other road improvement projects. In addition, DNR requested and was allotted \$429,000 to repair storm damage in Northeast Region.

In 2017, 39 barriers were removed from the fish-barrier worklist, representing an investment of \$1.32 million. DNR removed or replaced 35 of the barriers, opening an estimated 17.5 miles of fish habitat on DNR-managed lands (Figure 20). The four remaining fish-passage barriers were



Figure 20: Fish-Barrier Removal on an Unnamed Tributary to the Middle Fork Nooksack River. This project replaced a 142" x 91" pipe arch that was retrofitted with baffles (left) with a 50-foot steel bridge (right). A total of 4.3 miles of salmon and trout habitat were opened up as a result of this project. Photos courtesy of Jason Stuart and Tamra Zylstra.

removed from the work list for one of the following reasons:

- The stream designation was downgraded from “fish” to “non-fish” following protocol survey requirements.
- The fish-passage barrier removal would result in very limited habitat gain (usually less than 200 meters). With consensus from WDFW and DNR Forest Practices, these culverts were reprioritized for replacement at the end of their useful life.

Through land transactions and inventory activities in 2017, DNR acquired 35 new fish passage barriers that need to be corrected. The Forest Roads Program is committed to remediating new barriers within six years of their identification. At the end of 2017, 81 fish barriers remained on DNR-managed lands.

On lands managed under the HCP, 57.2 miles of road were abandoned or decommissioned and 83.8 miles were constructed in 2017. There was a net increase of total road miles on HCP-managed lands from 10,399 to 10,493 due to land transactions, construction, and updates to the road inventory. Table 9 summarizes DNR’s road management activity on both HCP- and non-HCP-covered lands in 2017.

Table 9: Road Management Activity Summary for Calendar Year 2017. All mileage data has been rounded to the nearest tenth mile.

	Miles					Barriers
	New Road Constructed	Road Reconstructed	Road Abandoned	Road Decommissioned	Inventoried Road ¹	Fish Barriers Removed
Chelan	0	0	0	0	45.9	0
Columbia	20.1	9.5	5.4	0.5	1,301.7	8
Klickitat	0	2.9	0	0	583.1	0
North Puget	35.1	49.3	28.5	0.2	1,508.3	8
OESF	4.2	5.3	0	6.7	1,801.0	16
South Coast	13.1	5.8	1.7	0.1	1,702.2	3
South Puget	3.5	1.9	0	0.8	1,326.8	3
Straits	4.6	0.3	0.3	2.4	847.8	0
Yakima	3.2	2.7	2.3	8.3	1,376.3	0
TOTAL, HCP Covered Lands	83.8	77.7	38.2	19	10,493.1	38
Non-HCP Covered Lands	8.1	6	1.4	4.6	3,438.4	1

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

Easements

Appendix: Background on Easements

DNR grants easements across state trust lands to private 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. 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 2018, 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, irrigation infrastructure, railroads, and land use restrictions.

Road Easements, Road Use Permits, and Utility Easements

Table 10 reports easements granted in FY 2018 that created a new footprint (i.e. timber was cut to create open space). Easements granted during the reporting period that created no new footprint because they overlap with existing easements or agricultural leases are not reported. DNR did not grant any utility easements that created a new footprint in FY 2018.

Table 10: Road Easements and Road Use Permits (New Footprint) Granted in FY 2018.

		North Puget	OESF	Total
Road easements and road use permits	Miles	3.72	0.20	3.92
	Acres	27.02	0.04	27.06

Land Transaction Activity

Appendix: Background on Land Transaction Activity

Below is a summary of land acquisitions, dispositions, and transfers completed in FY 2018 by HCP planning unit. Planning units not listed had no transaction activity. All newly acquired parcels listed in this section are 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.

Because the narrative portion of this section incorporates acreage data from land surveys conducted during transactions and Table 11 incorporates numbers from DNR’s GIS layers, the numbers may not match exactly. The acreage data in the narrative is rounded to the nearest whole acre.

Activity by HCP Planning Unit

Columbia

Disposed: DNR sold one five-acre parcel to the City of Battle Ground that had been leased for a water reservoir.

North Puget

Acquired: DNR purchased 368 forested acres in Skagit County for the school trust and 53 acres in King County for the Middle Fork Snoqualmie NRCA for a total of 421 acres.

Disposed: DNR sold 103 acres to San Juan County for a park and sold four acres of primarily pasture land in Skagit County to resolve a trespass, for a total of 107 acres.

South Coast

Acquired: DNR acquired 38 acres of forestland in Grays Harbor County for the Charitable, Educational, Penal, and Reformatory Institutions and state forest trusts. The Chehalis River Surge Plain NAP, also in Grays Harbor County, acquired 1,469 acres of primarily wetlands.

South Puget

Acquired: DNR acquired a total of 88 acres for three natural areas. Stavis NRCA in Kitsap County acquired 78 acres, and Kennedy Creek NAP and Schumacher Creek NAP each acquired five acres in Mason County.

Straits

Acquired: DNR acquired 214 acres for Dabob Bay NAP/NRCA in Jefferson County.

Yakima

Disposed: DNR sold 1,275 acres in Chelan County to WDFW.

Table 11 contains information on acquisitions and disposals completed in FY 2018 within the HCP boundary. Mileage data is rounded to the nearest tenth mile and acreage data is rounded to the nearest whole acre.

Table 11: Acquisitions and Disposals Completed in FY 2018 within the HCP Boundary.

		HCP Planning Unit						Totals
		Columbia	North Puget	South Coast	South Puget	Straits	Yakima	
		Acquired Lands¹						
Stream miles by stream type	Type 1	-	-	6.7	0.1	-	-	6.8
	Type 2	-	-	1.0	-	-	-	1.0
	Type 3	-	1.4	0.1	0.3	0.8	-	2.7
	Type 4	-	-	0.1	0.1	-	-	0.2
	Type 5	-	0.6	1.6	0.1	2.9	-	5.2
	Type 9	-	0.5	0.8	0.3	-	-	1.6
Total miles acquired		-	2.5	10.3	0.9	3.8	-	17.5
Acres acquired in rain-on-snow zones		-	-	-	-	-	-	-
Acres per asset class²	Forested	-	369	39	-	-	-	408
	Conservation	-	55	1,449	88	214	-	1,806
Total acres acquired		-	424	1,488	88	214	-	2,214
		Disposed Lands						
Stream miles by stream type	Type 1	-	-	-	-	-	-	-
	Type 2	-	-	-	-	-	0.2	0.2
	Type 3	-	-	-	-	-	2.6	2.6
	Type 4	-	-	-	-	-	0.2	0.2
	Type 5	-	-	-	-	-	1.7	1.7
	Type 9	-	-	-	-	-	5.9	5.9
Total miles disposed		-	-	-	-	-	10.8	10.8
Acres disposed in rain-on-snow zones³		-	-	-	-	-	689	689

		HCP Planning Unit						Totals
		Columbia	North Puget	South Coast	South Puget	Straits	Yakima	
Acres per age class	Open (0–10 years)	-	-	-	-	-	-	-
	Regeneration (11–20 years)	-	-	-	-	-	94	94
	Pole (21–40 years)	-	-	-	-	-	-	-
	Closed (41–70 years)	-	-	-	-	-	125	125
	Complex (71–100 years)	4	99	-	-	-	475	578
	Complex (101–150 years)	-	-	-	-	-	475	475
	Functional (150+ years)	-	-	-	-	-	-	-
	Non-forested	1	7	-	-	-	106	114
	Unknown	-	-	-	-	-	-	-
Total acres disposed		5	106	-	-	-	1,275	1,386

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 Rain-on-Snow (ROS) data is derived from DNR's corporate GIS layer.

Natural Areas Program

Appendix: Background on the Natural Areas Program

In FY 2018, the Natural Areas Program protected an additional 1,824 acres in Natural Area Preserves (NAPs) and Natural Resource Conservation Areas (NRCAs), all within the area covered by the HCP. These protection efforts added to six existing natural areas. The most significant of these were:

- Chehalis River Surge Plain NAP:** DNR added 1,469 acres to the Chehalis River Surge Plain NAP, expanding this preserve by nearly one-half. These lands, including a large inholding, contain high-quality surge plain wetlands and associated Sitka spruce forest (Figure 21). This site also supports osprey, bald eagles, and the state-listed sensitive Olympic mudminnow.
- Dabob Bay NAP/NRCA:** Approximately 214 acres were added to the Dabob Bay Natural Area to provide additional protection for habitats supporting listed salmon and forage fish species. The lands acquired at the site include more than one-half mile of fish-bearing stream and riparian habitat, as well as adjacent upland forest.
- Stavis NRCA:** DNR added 78 acres of low-elevation forest, wetlands, and riparian habitat to the Stavis NRCA, including a nearly three-quarter-mile reach of stream supporting threatened Puget Sound steelhead and chinook salmon. This NRCA also protects high-quality lowland forest communities and wetlands, coho and fall chum salmon, and forage fish spawning habitat.



Figure 21: Mainstem of the Chehalis River and Riparian Forest. Photo by Roberta Davenport.

- **Middle Fork Snoqualmie NRCA:** A 53-acre parcel was added to the Middle Fork Snoqualmie NRCA to enhance protection of forest and riparian habitat along a half-mile reach of the South Fork Snoqualmie River.

In addition to land acquisitions, the Natural Areas Program continued to actively manage and enhance habitat on natural areas in FY 2018 to benefit federally listed species such as Bradshaw’s lomatium (Lacamas Prairie NAP/NRCA), Wenatchee Mountains checker-mallow (Camas Meadows NAP), island marble butterfly (Cattle Point NRCA), Oregon spotted frog (Trout Lake NAP), and Puget Sound/Hood Canal salmon runs (Dabob Bay NAP/NRCA).

Table 12 lists the natural areas that are located within the HCP boundary. Natural areas in bold text are composed primarily of mature forests and/or late-seral forests.

Table 12: Acres Added to Natural Areas within HCP-Covered Lands in FY 2018.

Natural Area	County	Acres Added in FY 2018 ¹	Total Current Acres
Admiralty Inlet NAP	Island	-	79.5
Ashford NRCA	Pierce	-	78.4
Bald Hill NAP	Thurston	-	313.7
Bone River NAP	Pacific	-	2,720.0
Camas Meadows NAP	Chelan	-	2,017.8
Carlisle Bog NAP	Grays Harbor	-	310.0
Cattle Point NRCA	San Juan	-	112.1
Charley Creek NAP	King	-	1,966.0
Chehalis River Surge Plain NAP	Grays Harbor	1,469.2	4,493.6
Clearwater Bogs NAP	Jefferson	-	504.1
Clearwater Corridor NRCA	Jefferson	-	2,323.0
Columbia Falls NAP	Skamania	-	1,233.8
Cypress Highlands NAP	Skagit	-	1,072.4
Cypress Island NRCA	Skagit	-	4,135.1
Dabob Bay NAP/NRCA	Jefferson	213.8	3,169.6
Dailey Prairie NAP	Whatcom	-	228.8
Devils Lake NRCA	Jefferson	-	80.0
Elk River NRCA	Grays Harbor	-	5,560.0
Ellsworth Creek NRCA	Pacific	-	557.0
Goose Island NAP	Grays Harbor	-	12.0
Granite Lakes NRCA	Skagit	-	603.2
Gunpowder Island NAP	Pacific	-	152.0
Hamma Hamma Balds NAP	Mason	-	957.0
Hat Island NRCA	Skagit	-	91.2
Hendrickson Canyon NRCA	Wahkiakum	-	159.0
Ink Blot NAP	Mason	-	183.6
Kennedy Creek NAP/NRCA	Mason	4.7	217.6
Kings Lake Bog NAP	King	-	309.2
Kitsap Forest NAP	Kitsap	-	571.9
Klickitat Canyon NRCA	Yakima	-	2,335.2
Lacamas Prairie NAP/NRCA	Clallam	-	201.1

Natural Area	County	Acres Added in FY 2018 ¹	Total Current Acres
Lake Louise NRCA	Whatcom	-	137.7
Lummi Island NRCA	Whatcom	-	671.5
Merrill Lake NRCA	Cowlitz	-	114.2
Middle Fork Snoqualmie NRCA	King	53.1	9,198.4
Mima Mounds NAP	Thurston	-	640.5
Monte Cristo NAP	Klickitat	-	1,151.0
Morning Star NRCA	Snohomish	-	37,841.9
Mount Si NRCA	King	-	13,446.0
Naselle Highlands NRCA	Pacific	-	108.0
Niawiakum River NAP	Pacific	-	1,097.8
North Bay NAP	Grays Harbor	-	1,214.9
Oak Patch NAP	Mason	-	17.3
Olivine Bridge NAP	Skagit	-	148.0
Point Doughty NAP	San Juan	-	56.5
Queets River NRCA	Jefferson	-	601.0
Rattlesnake Mtn Scenic Area	King	-	1,851.4
Rocky Prairie NAP	Thurston	-	35.0
Sand Island NAP	Grays Harbor	-	8.0
Shipwreck Point NRCA	Clallam	-	471.8
Schumacher Creek NAP	Mason	5.1	498.8
Skagit Bald Eagle NAP	Skagit	-	1,546.0
Skamokawa Creek NRCA	Wahkiakum	-	293.6
Skookum Inlet NAP	Mason	-	142.6
Snoqualmie Bog NAP	King	-	110.5
South Nemah NRCA	Pacific	-	2,439.5
South Nolan NRCA	Jefferson	-	213.0
Stavis NRCA	Kitsap	77.8	2,986.9
Stevenson Ridge NRCA	Skamania	-	421.3
Table Mountain NRCA	Skamania	-	2,836.5
Tahoma Forest NRCA	Lewis	-	230.0
Teal Slough NRCA	Pacific	-	8.4
Trout Lake NAP	Klickitat	-	2,014.0
Washougal Oaks NAP/NRCA	Clark	-	264.2
West Tiger Mountain NRCA	King	-	3,907.9
Whitcomb Flats NAP	Grays Harbor	-	5.0
White Salmon Oak NRCA	Klickitat	-	551.2
Willapa Divide NAP	Pacific	-	587.0
Woodard Bay NRCA	Thurston	-	901.8
	Total Acres	1,823.7	125,517.0

¹Acres data comes from the TransactionsAll database maintained by the Land Transactions Program. This data represents acreage determined through surveys at the time of transaction and may not necessarily match the "GIS acres" of transacted land as calculated by DNR's GIS system.

Table 13 lists the federally threatened and endangered species found in natural areas covered by the HCP, and Table 14 lists other species of concern in these areas.

Table 13: 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
Oregon Spotted Frog	Threatened	Trout Lake NAP
Eulachon	Threatened	Dabob Bay NAP/NRCA
Mazama Pocket Gopher	Threatened	Rocky Prairie NAP
Bradshaw’s Lomatium	Endangered	Lacamas Prairie NAP/NRCA
Golden Paintbrush	Threatened	Rocky Prairie NAP, Admiralty Inlet NAP
Wenatchee Mts. Checker-Mallow	Endangered	Camas Meadows NAP

Table 14: Special Status Species Located in Natural Areas Covered by the HCP.

Species	Natural Area ¹
Federal Candidate	
Island Marble Butterfly	Cattle Point NRCA
Federal Species of Concern	
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

Species	Natural Area ¹
Gorge Daisy	Columbia Falls NAP
Harlequin Duck	Morning Star NRCA
Hatch's Click Beetle	Kings Lake Bog NAP
Howell's Daisy	Columbia Falls NAP, Table Mountain NRCA
Larch Mountain Salamander	Table Mt. NRCA, Columbia Falls NAP
Makah Copper	North Bay NAP, Carlisle Bog NAP, Clearwater Bogs 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, Mt. 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
Lewis's Woodpecker	Camas Meadows NAP
Bog Idol Leaf Beetle (Formerly Long-horned Leaf Beetle)	King's Lake Bog NAP
Olympia Oyster	Dabob Bay NAP/NRCA, Woodard Bay NRCA
Pacific Herring	Dabob Bay NAP/NRCA, Stavis NRCA, Elk River NRCA
Pileated Woodpecker	Table Mountain NRCA, Morning Star NRCA, Kitsap Forest NAP, and others
Puget Blue	Rocky Prairie NAP
Purple Martin	Woodard Bay NRCA, Kennedy Creek NAP
Sand Verbena Moth	Cattle Point NRCA
Western Toad	Dabob Bay NAP/NRCA, Morning Star NRCA, Oak Patch NAP, Stavis NRCA
White-headed Woodpecker	Camas Meadows NAP

Species	Natural Area ¹
Vaux's Swift	Numerous sites

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.

Non-Timber Management Activity

Special Forest Products

Appendix: Background on Special Forest Products

DNR's South Puget, Olympic, and Pacific Cascade region offices auction leases and sell permits to gather special forest products in the OESF, South Coast, South Puget, Columbia, and Straits HCP planning units. These leases and permits provide small businesses and individuals access to gather a variety of valuable non-timber forest products including Christmas trees, brush, boughs, beargrass, evergreen huckleberry, moss, salal, and sword fern, though not every lease or permit includes all these products.

DNR region offices may also offer direct sales of some of the same special forest products. In South Puget Region and Pacific Cascade Region, direct sales are made for products gathered from areas too small to be offered under a lease. Table 15 summarizes DNR's sales of special forest products on HCP-covered forestlands in FY 2018.

Table 15: Special Forest Product Sales on HCP-Covered Areas in FY 2018.

Region	Permits		Leases		Direct Sales	
	Occurrences	Acres	Occurrences	Acres	Occurrences	Acres
South Puget	179	91,723	23	69,469	2	822
Olympic	75	204,556	-	-	-	-
Pacific Cascade	64	220,570	-	-	2	100
Total	318	516,849	23	69,469	4	922

Leases

Appendix: Background on Leases

Grazing Permits and Leases

In FY 2018, there were approximately 270 acres of grazing leases on the westside. Most of this land is not forested and is therefore not managed under the HCP. There were no grazing permits active on the westside in FY 2018.

In Northeast Region, there were approximately 2,754 acres of grazing leases and no grazing permits on forested land covered by the HCP in FY 2018. In Southeast Region as of December 10, 2018, there were 90,997 acres of grazing leases and 74,548 acres of grazing permits on forestlands covered by the HCP.

Communication Sites and Leases

In FY 2018, there were 71 leased communication sites within the HCP boundary, totaling 77.1 acres. There were a total of 287 leases from individual tenants on the 71 communication sites.

Valuable Material Sales

Appendix: Background on Valuable Material Sales

In FY 2018, DNR had six active sand, gravel, and rock contracts within the HCP boundary, totaling approximately 665 acres. Table 16 summarizes those contracts. These contracts were approved by the Board of Natural Resources and awarded through a public auction process.

Table 16: Sand, Gravel, and Rock Contracts Active in FY 2018.

Lease Name	Commodity	HCP Planning Unit	Acres
Lewis Gravel Pit – Winthrop	Sand, gravel, rock	Chelan	40
Livingston Quarry	Road rock	Columbia	170
Glenwood Pit ¹	Sand, gravel	Klickitat	40
Kilowatt Quarry	Road rock	Klickitat	15
High Rock	Sand, gravel, rock	North Puget	320
Jordan Road	Sand, gravel	North Puget	80
Total Acres:			665

¹ The Glenwood Pit has been mined out and is in the process of being reclaimed.

In addition to the contracts listed above, DNR occasionally sells valuable material through 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.

Recreation Program

Appendix: Background on Recreation Program

In calendar year 2018, DNR’s recreation program worked with Washington Conservation Corps (WCC) crews and many volunteer groups to complete numerous projects across the DNR landscape. These projects included building over 50 miles of new trail, performing maintenance on over 160 miles of trail, installing new bridges, closing unauthorized trails and access points, and removing garbage. This work helped to enhance the recreational experience, keep people safe and informed, and protect resources from erosion and overuse. Highlights are summarized below.

Development

Northwest Region

Blanchard Forest, Skagit County: Over a combined 15 miles of trails, WCC crews and many volunteers maintained culverts, cleared ditches and drain dips, and cleaned bridges to reduce soil erosion and minimize the impact of recreational use. They also constructed dirt turnpikes to reduce impacts to wetlands and reduce trail braiding and sediment erosion to nearby lakes and streams.

Harry Osborne Forest, Skagit County:

- DNR completed a bridge replacement project on the Mack Johnson Trail to improve safety and reduce degradation to the stream bank (Figure 22).



Figure 22: New Bridge on the Mack Johnson Trail.
Photo courtesy of Rick Foster.

- On a combined eight miles of trail, WCC crews and volunteers maintained culverts and cleared ditches and drain dips to reduce soil erosion and minimize the impacts of recreational use.
- WCC and volunteers reconstructed sections of JR Trail, Red Cabin Creek Trail, and Jack Sims Trail by hardening the trail tread, resurfacing trails with gravel, and installing drainage features to reduce impacts to nearby wetlands and streams.
- DNR rerouted and rehabilitated 1,000 feet of trail away from a steep eroded trail to reduce impacts to a nearby stream.

Morning Star NRCA, Snohomish County: DNR staff, WCC crews, and Washington Trail Association (WTA) volunteers completed trail maintenance and improvements on 12 miles of hiking trail. This work included the installation of rock turnpikes, stone steps, water bars, and trail tread improvements to minimize erosion and improve public safety.

North Mountain Bike Trail System, Skagit County: DNR worked with the City of Darrington and the Evergreen Mountain Bike Alliance to continue construction on approximately ten miles of trail within the upper elevation area of the planned non-motorized trail system. New trails are slated to open during summer 2019.

Point Doughty NAP, San Juan County: DNR initiated the procurement process for fabricated stairs to replace old stairs that provide beach access. Work also includes trail and campsite improvements and new signage. This will help improve public safety, reduce erosion, and educate users.

Reiter Foothills Forest, Snohomish County: DNR and WCC crews completed roughly 0.25 mile of heavy rock work on an ATV trail to control erosion. Approximately 1.3 miles of shared ATV and motorcycle trail was completed, and 1.6 miles of 4x4 trail was constructed that was primarily covered with large rock to minimize erosion and create a challenging rock-crawler route. DNR formally named two vista sites, Moon Landing and Osprey Point, within the Reiter Foothills Forest (Figure 23).



Figure 23: View from Osprey Point Vista. Photo courtesy of Ben Hale.

Walker Valley ORV Area, Skagit County: The Recreation Program completed a variety of projects in 2018 that contribute to a more environmentally sustainable trail system:

- DNR inspected 36 miles of ORV trails to identify repairs and prevent sediment delivery to streams. DNR also inspected 22 trail bridges for safety and water quality.

- In partnership with volunteers, DNR conducted a public works project to harden 800 feet of the Timber Tamer 4x4 trail with large boulders to reduce erosion.
- DNR conducted 54,000 feet of trail maintenance including 900 feet of heavy equipment maintenance along roads and ditch lines where ORV traffic had caused damage.
- Five hundred feet of short trail re-routes were completed to increase public safety and prevent erosion.
- Two significant trail-hardening projects were initiated in 2018 on the Muddled Meanderings Trail (approximately 3,000 feet) and the Centennial Trail (approximately 3,500 feet). Both projects will improve stream health by reducing erosion.

Olympic Region

Bear Creek Campground, Clallam County: With the help of WCC crews, the Recreation Program constructed 80 feet of split-rail fence along steep riparian sections of the Sol Duc River to prevent trail braiding that results in a loss of vegetation and increased erosion potential. DNR is also installing new fire rings that conform to DNR Firewise design standards.

Foothills ORV and Sadie Creek Multi-Use Trails, Clallam County: Working with WCC crews, Adopt-a-Trail volunteer groups, and DNR’s maintenance and operations crew, the Recreation Program completed a variety of projects that provide a safer experience for the user while promoting environmental stewardship. Some examples include installation and maintenance of multiple culverts and 500 feet of trail hardening to reduce seasonal influx of sediment into nearby streams. DNR also installed and maintained 20 water dips and bars to improve drainage and reduce soil erosion, and installed signs and barriers to prevent access to and development of unauthorized spur trails.

Minnie Peterson, Cottonwood, and Hoh Oxbow Campgrounds, Jefferson County: The Recreation Program is installing new fire rings at each campsite that conform to DNR Firewise design standards.

Striped Peak Trail, Clallam County: Working in conjunction with the Peninsula Chapter of the Backcountry Horsemen of Washington and the WCC, DNR repaired a 50-foot section of trail in a very steep cliff area directly above the Strait of Juan De Fuca (Figure 24). Large cedar logs were used for support beams and railings. This trail is extremely popular and the repairs were critical to maintain safe and sustainable user access.

Olympic Region, All Counties: Volunteers cleaned up DNR-managed river access points and target shooting areas, gathering over 2,200 pounds of trash.

Pacific Cascade Region

Radar Ridge Block, Western Lake, Pacific County: DNR removed a multi-angle bridge that was damaged by fallen trees. The trail was re-routed onto a newly constructed 12-foot wooden bridge. This will enhance both public safety and resource protection.



Figure 24: Repair Work on the Striped Peak Trail.
Photo courtesy of Justin Zarzeczny.

Salmon Creek Block, Tunerville Campground, Pacific County: A new bridge was installed on Salmon Creek that provides more direct and safe access to Tunerville Campground. Several campsites were upgraded with new picnic tables, fire rings, and gravel.

Yacolt Burn State Forest, Clark County: DNR hosted the annual “Pick up the Burn” event that removed 41 tires and 20 cubic yards of garbage from the forest. Several other projects were completed in different areas of the Yacolt Burn State Forest:

- **Tarbell Trail System, Clark County:** A collapsed bridge was replaced with a new 40-foot fiberglass bridge on Grouse Creek, and handrails were upgraded on the Hidden Falls and Coyote Creek bridges. The Recreation Program brushed fifteen miles of trail and replaced bridge decking and puncheons. Construction continued on approximately four miles of new non-motorized trail.
- **Jones Creek and Hagen Creek Trail Systems, Clark County:** Re-routes and grade adjustments were made on the Skyline motorized trail to reduce erosion, and construction continued on approximately two miles of new 4x4 trail on the Hagen Creek Trail System. DNR also extracted a vehicle from a stream that had accessed an ATV trail without authorization.
- **Cold Creek Campground and Day-Use Area, Clark County:** DNR upgraded and installed three culverts, added six parking spots, re-roofed a shelter, and made improvements to a bridge in the day-use area. Two entrance gates to the campground and day-use area were replaced.
- **Rock Creek Campground and Day-Use Area, Clark County:** DNR upgraded and installed four culverts and added three stalls in the day-use area. The entrance gate to the campground was replaced.

South Puget Sound Region

Capitol State Forest, Thurston and Grays Harbor Counties:

- DNR closed and rehabilitated one-half mile of unsanctioned motorized trail and replaced two undersized buried culverts on the Divide North ORV trails.
- DNR installed bridges on the North Slope Trail System with the help of volunteers.
- Recreation and timber sales staff met with trail recreationists in the field to discuss leave trees on the Chameleon and Thunderstruck trails (Figure 25).
- DNR instituted timing restrictions on target shooting at the Triangle Pit and installed new signage to educate users. The restrictions are intended to benefit wildlife, recreationists, and nearby residents.
- DNR installed signage and performed education and enforcement on a new 3.5-mile target shooting closure area in the northern portion of the forest.



Figure 25: DNR Staff and Recreationists Discuss Leave Tree Placement. Photo courtesy of Phil Wolff.

Elbe Hills State Forest, Pierce County: Recreation staff conducted maintenance on 12 bridges, 40 miles of non-motorized trail, 13 miles of ORV trail, seven day-use areas, four trailheads, and two campgrounds. Three-quarters of a mile of trail was fully reinforced with rock for tread protection and erosion prevention.

Tahoma State Forest, Lewis County: Recreation staff conducted maintenance on 50 miles of winter-use trail and three ski huts. The front room on the “Yurt” ski hut was replaced.

Middle Fork Snoqualmie NRCA, King County: DNR’s Recreation and Natural Areas programs coordinated to develop 3.5 miles of new trail to improve hiking and rock climbing access. The new Dirty Harry’s Peak Trail was restored and renovated, and segments of an unsustainable non-sanctioned former trail were re-routed, improving long-term sustainability and access for the hiking and rock climbing communities. DNR’s Natural Areas Program completed restoration plantings around storm water retention areas at the new Granite Creek Trailhead and installed a self-contained outhouse at the Champion Beach day-use river access site.

Mount Si NRCA, King County: DNR’s Natural Areas program completed restoration plantings around storm water retention areas at the new Mount Teneriffe Trailhead. DNR’s Recreation and Natural Areas programs coordinated to begin construction on a new 1.5-mile Oxbow Loop hiking trail, including completion of an 80-foot trail bridge and installation of a self-contained outhouse at the trailhead parking area.

Raging River State Forest, King County: The Recreation Program finished construction of 17 miles of new trail that officially opened in the spring of 2018.

Tahuya and Green Mountain State Forests, Mason and Kitsap Counties: Twenty gatekeepers were built to assist with enforcing size limitations of vehicles on motorized trails. A gatekeeper is a wooden structure built to the width of a bridge and placed at each trailhead so users can determine whether their vehicle will fit on the bridge (Figure 26). They are intended to prevent users from driving through streams because their vehicle is too wide to cross the bridge. Thirty unauthorized access points were closed within the Green Mountain and Tahuya State Forests and 1,000 feet of fencing was repaired. Over 2,000 feet of unauthorized trails were closed in the Tahuya State Forest.



Figure 26: DNR Staff Test a Gatekeeper. Photo courtesy of Eric Haggstrom.

Tiger Mountain State Forest, King County: The Recreation Program completed and opened two new mountain bike trails totaling 1.5 miles in the eastern zone of the forest.

Southeast Region

Ahtanum State Forest, Yakima County: The Recreation Program made significant improvements to the Ahtanum Campground by redesigning several sites and placing barrier rock and crushed gravel to reduce impacts to Middle Fork Creek. DNR also held two major volunteer cleanup events and closed several unauthorized trails to reduce impacts to streams and habitat.

Wenas Valley-Cascade Camp, Yakima County: DNR re-routed 1.5 miles of road through this popular dispersed camping area, restoring streamside habitat and reducing sediment delivery. DNR also held a one-day cleanup event that drew more than 500 hours of volunteer time.

Planning and Design

Northwest Region

Baker to Bellingham Recreation Plan, Whatcom County: The [Baker to Bellingham Non-Motorized Recreation Plan](#) was completed in 2018. Input from committee members, user groups and the public were all considered in the final plan. Implementation will begin in 2019 once grants are secured, and a collaborative relationship will be maintained with user groups and neighbors as development occurs.

Cypress Island NRCA, Skagit County: DNR began the design and permitting for additional mooring buoys in locations where boats currently anchor. This project is intended to protect eelgrass and other underwater habitat from impacts associated with anchoring.

Lummi Island NRCA: DNR began the design and permitting phase of beach access renovation and toilet replacement. This project will replace and renovate failing beach access stairs, renovate eroding trail segments, and upgrade toilet facilities. Protection of cultural resources and public safety are the main objectives of the project.

Morning Star NRCA, Snohomish County: DNR completed the [Morning Star Trails Plan](#) and began implementation. This grant-funded planning process was designed to address resource impacts associated with past and current public use, to improve public safety, and to help educate users about DNR's conservation mission in the Morning Star NRCA. The process began in February 2017 with formation of the Trails Planning Committee comprised of stakeholders from user groups, volunteers, other agencies, and conservation groups. DNR staff met with the committee multiple times over the course of two years and hosted two field trips. Implementation of the plan began in the spring of 2018 with the design of a sustainable backcountry toilet in Gothic Basin, a landscape in which no toilet facilities currently exist. Additional planning and design work was conducted in the NRCA to facilitate safe and sustainable backcountry recreation opportunities for the public.

South Puget Sound Region

Tiger Mountain State Forest, King County: DNR designed and permitted expansion of the east Tiger Mountain State Forest trail system, including new community connections and a planned trail link to the equestrian trail system. In addition, a day-use viewpoint shelter was designed that will sit near the summit of East Tiger Mountain. Further progress on the Tiger Summit Trailhead expansion design was also accomplished.

Raging River State Forest, King County: DNR produced design documents for the new Raging River Trailhead and began Phase 2 of the trail system development that involves ten additional miles of trail that will improve recreational access for mountain bikers, hikers, and equestrian visitors.

Green Mountain State Forest, Kitsap County: Community outreach continued for concept planning, design, and layout of new trail system connections. In addition, DNR continued planning the renovation of the Green Mountain Summit Vista and a new access road trailhead.

Elbe ORV Campground Design and Construction: DNR began the final design of a new 10-site ORV campground that will be developed a few miles northwest of the current campground. The current campground is located in NSO Movement Plus Habitat, which will be restored after the campground is relocated.

HCP Implementation Documentation

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:

- **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 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.

Click [here](#) for documentation of consultations and other discussions from FY 2018.

Appendix A: Background

This appendix contains background information about DNR-managed forestlands under the *State Trust Lands Habitat Conservation Plan*.

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 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.



The Changing Landscape

DNR uses harvest methods that promote development of structurally diverse forests. These harvest methods, in combination with the HCP's northern spotted owl, riparian, and other habitat conservation strategies, promote biodiversity and fundamentally change the landscape from past forest practices.

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. 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.)

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

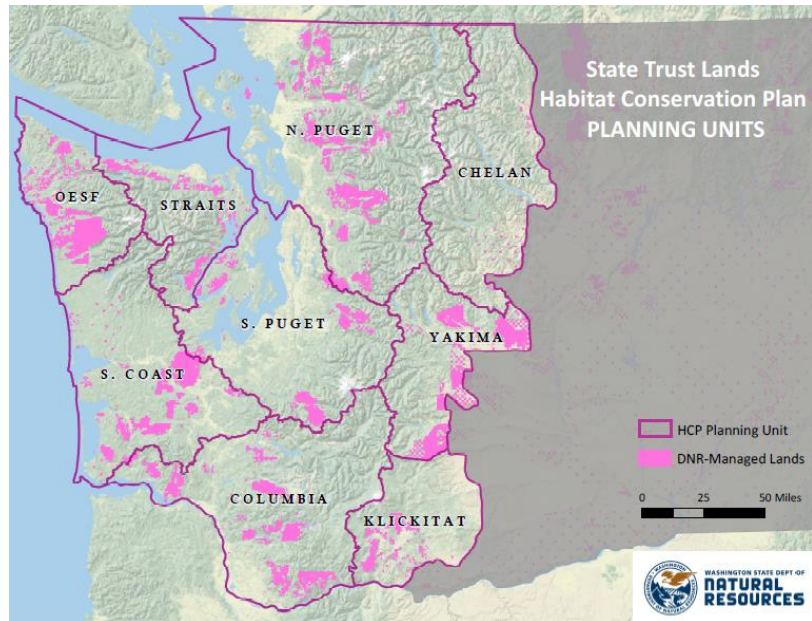
complex, healthy, resilient forest ecosystem capable of supporting native species. The HCP was signed in January 1997.

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 (Map 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.



Map A-1: HCP Planning Units

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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 more effectively and economically mitigate incidental take. 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	Subject
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

¹A comprehensive review was not completed for the FY 2015 report due to staffing levels.

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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).
- **Dispersal management areas:** Areas important for facilitating northern spotted owl dispersal (movement of young owls from nesting sites to new breeding sites).
- **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 courtesy of USFWS.

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, and Table A-3 includes the definitions of each habitat type as well as the data queries DNR uses to identify it.

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.

Northern Spotted Owl 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 other westside planning units	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

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 to Interpret Habitat Definitions
High-Quality Nesting	At least 31 trees per acre are greater than or equal to 21 inches diameter at breast height (dbh) with at least 15 trees, of those 31 trees, per acre greater than or equal to 31" dbh	(Live trees \geq 21" diameter class) \geq 31 trees per acre and
		(Live trees \geq 31" diameter class) \geq 15 trees per acre and
	At least 12 snags per acre larger than 21" dbh	(Snags \geq 21" diameter class and \geq 16' tall) \geq 12 trees per acre and
	A minimum of 70% canopy closure	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	A minimum of 5% ground cover of large woody debris	(Down wood \geq 4" diameter class) \geq 2,400 ft. ³ per acre
At least three of the 31 trees \geq 21" dbh have broken tops	Not in query	
Type A	A multi-layered, multispecies canopy dominated by large (\geq 30" dbh) overstory trees (typically 15–75 trees per acre)	(FVS-derived number of canopy layers) \geq 2 and
		(Primary species \geq 4 diameter class) $>$ 10% and (Primary species \geq 4 dbh) \leq 80% (multispec = yes) and
		(Live trees \geq 30" diameter class) \geq 15 trees per acre and \leq 75 trees per acre and
	Greater than 70% canopy closure	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	More than two large snags per acre, 30" dbh or larger	(Snags \geq 30" diameter class and \geq 16' tall) \geq 2.5 trees per acre and
Large accumulations of fallen trees and other woody debris on the ground	(Down wood \geq 4" diameter class) \geq 2,400 ft. ³ per acre	
A high incidence of large trees with various deformities such as large cavities, broken tops, and dwarf mistletoe infection	Not in query	
Type B	Few canopy layers, multispecies canopy dominated by large (greater than 20" dbh) overstory trees (typically 75–100 trees per acre, but can be fewer if larger trees are present)	(FVS-derived number of canopy layers) \geq 2 and
		Primary species $>$ 10% and primary species \leq 80% (multispec = yes) and
		(Live trees \geq 20" diameter class) \geq 75 trees per acre and \leq 100 trees per acre and
	Greater than 70% canopy closure	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	Large (greater than 20" dbh) snags present	(Snags \geq 20" diameter class and \geq 16 ft. tall) \geq 1 tree per acre and
Accumulations of fallen trees and other woody debris on the ground	(Down wood \geq 4" diameter class) \geq 2,400 ft. ³ per acre	

Appendix A

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used to Interpret Habitat Definitions
	Some large trees with various deformities	Not in query
MoRF	Forest community dominated by conifers, or in mixed conifer/hardwood forest, community composed of at least 30% conifers (measured as stems per acre dominant, co-dominant, and intermediate trees)	(Live conifers \geq 4" diameter class) \geq 30% of all live trees per acre and
	At least 70% canopy closure	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	Tree density between 115 and 280 trees greater than 4" dbh per acre	(Live trees \geq 4" diameter class) \geq 115 and \leq 280 trees per acre and
	Dominant and co-dominant trees at least 85' tall	(Largest 40 live trees per acre) \geq 85' tall and
	Minimum of 5% ground cover of large down woody debris	(Down wood \geq 4" diameter class) \geq 2,400 ft. ³ per acre and
	At least three snags or cavity trees per acre that are at least 15" dbh	(Snags \geq 15" diameter class and \geq 16 ft. tall) \geq 3 trees/acre and
	At least two canopy layers	(FVS-derived number of canopy layers) \geq 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 \geq 4" diameter class) \geq 30% of all live tree/acres and
	At least 70% canopy closure	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	Tree density of between 115 and 280 trees greater than 4" dbh per acre	(Live trees \geq 4" diameter class) \geq 115 and \leq 280 trees per acre and
	Dominant and co-dominant trees at least 85' tall	(Largest 40 live trees/acre) \geq 85' tall and
	At least three snags or cavity trees per acre that are at least 20"	(Snags \geq 20" diameter class and \geq 16 ft. tall) \geq 3 trees per acre and
	Minimum of 5% ground cover of large down woody debris	(Down wood \geq 4" diameter class) \geq 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 \geq 4" diameter class) \geq 30% of all live trees per acre and
	At least 70% canopy closure	(Relative density of live trees \geq 4"diameter class) \geq 48 and
	Tree density between 115 and 280 trees greater than 4" dbh per acre	(Live trees \geq 4" diameter class) \geq 115 and \leq 280 trees per acre and
	Dominant and co-dominant trees at least 85 feet tall	(Largest 40 live trees/acre) \geq 85' tall and
	Snags greater than or equal to 2 per acre (greater than or equal to 20 inches dbh and 16" tall) OR \geq 10% of	(Snags \geq 20" diameter class and \geq 16 ft. tall) \geq 2 trees per acre or

Habitat Type	Habitat Definitions (HCP p. IV.11-12 and WAC 222-16-085)	Data Query Used to Interpret Habitat Definitions
	the ground covered with 4" diameter or larger wood, with 25–60% shrub cover	(Down wood \geq 4" diameter class) \geq 4,800 ft. ³ per acre
Movement	Canopy closure at least 70%	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	Quadratic mean diameter of 11" dbh for the 100 largest trees per acre in a stand	(Largest 100 live trees per acre) \geq 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 \geq 4" diameter class) \geq 30% of all live trees per acre and
	Tree density no more than 280 trees per acre \geq 3; 5" dbh	(Live trees \geq 4" diameter class \leq 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) \geq 85' tall
	At least four trees per acre from the largest size class retained for future snag and cavity tree recruitment	Not in query
Dispersal	Canopy cover at least 70%	(Relative density of live trees \geq 4" diameter class) \geq 48 and
	Quadratic mean diameter of 11" dbh for 100 largest trees per acre in a stand	(Largest 100 live trees per acre) \geq 11" QMD and
	Top height of at least 85'	(Largest 40 live trees per acre) \geq 85' tall
	At least four trees per acre from the largest size class retained for future snag and cavity tree recruitment	Not in query
Old Forest	Stands classified as the old forest habitat type were identified through implementation of the interim marbled murrelet conservation strategy. As part of the strategy, DNR conducted map and field reviews to delineate remnant patches of older forest to estimate how much potential murrelet habitat was present in the OESF. While over 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 forest land planning).
- For the Klickitat HCP Planning unit, SOMUs are based on sub-landscapes which were defined through an [amendment to the HCP](#). Sub-landscapes are used only in this unit.

The NSO conservation strategy in the HCP involves maintaining thresholds of habitat in each SOMU. Most designated NRF 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
	50% of each NRF SOMU		High-quality habitat	High-quality nesting Type A Type B
			Sub-mature habitat	Sub-mature
South Puget	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
	50% of each NRF SOMU		High-quality habitat	High-quality nesting Type A Type B
			Sub-mature habitat	Sub-mature
All Other Westside Planning Units	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 NRF 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,” in 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.

However, DNR acknowledges that 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 NRF 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](#) that will guide management of over 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 2009–2109, 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 more accurately map NSO habitat across the OESF.

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Northern Spotted Owl Conservation in the Klickitat HCP 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 NRF management areas are not—nor will they ever be—capable of sustaining northern spotted owl habitat. This makes 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, Administrative Amendment to the Northern Spotted Owl Conservation Strategy for the Klickitat HCP Planning Unit](#)) 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.

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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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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.

Following extensive research and input from an independent science team, DNR now has enough information to develop a long-term strategy. Although previously delayed by budgetary and staffing shortfalls, development of the long-term conservation strategy resumed as a top agency priority.

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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.

Adaptive Management and the 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



Marbled Murrelet Nest

Marbled murrelets nest on large limbs covered with moss or other natural substances that create a relatively flat platform. Their nests are usually in mature or old conifer forests. Photo courtesy of Tom Bloxton.

- 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 is focused on activities in the OESF. Unlike the state-wide 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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Monitoring, Research, and Adaptive Management

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 owls, marbled murrelets, and other species addressed by the HCP and how they are affected by land management. 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 DNR’s management.

The HCP’s adaptive management process allows changes to DNR’s forest management 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 *Administrative Amendment to the Northern Spotted Owl Conservation Strategy for the Klickitat HCP Planning Unit*, and a [legacy tree procedure for eastern Washington](#) that protects old-growth trees and stands.

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 or not the HCP is being implemented properly on the ground, and is sometimes referred to as compliance monitoring.

- **Effectiveness monitoring** determines whether or not the HCP strategies are producing the desired habitat conditions.
- **Validation monitoring** determines whether or not 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 WMZs and RMZs.

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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 to effectively implement the conservation strategies to reach the goals of the HCP.

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 NRF 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 VDTs 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 signed an agreement with the USFS to add six unmanaged or minimally managed watersheds on the western Olympic National Forest to the network of reference sites.

Nine habitat attributes such as 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.

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 on 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 OESF is unique among HCP planning units in both management and purpose. This working forest is managed under an experimental approach called “integrated management”. Rather than dividing the land base into one area for harvest and another for ecological values, DNR manages the entire land base for both. This is achieved through innovative silviculture, landscape-level planning, intentional learning, effective information management, communication, and application of new knowledge into operations (i.e. adaptive management). The OESF was founded to implement and learn from this experimental approach. New knowledge is applied to continually 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 long-term vision for the OESF is a productive, resilient, and biologically diverse commercial forest in which both revenue generation for trust beneficiaries and ecological values are maintained through integrated management. The OESF Research and Monitoring Program helps achieve this vision by implementing and coordinating research and monitoring projects; establishing and maintaining research partnerships; managing research and monitoring information; linking management activities and new knowledge through a structured adaptive management process; and fostering communication, outreach, and education.

Past and Current Research and Monitoring in the OESF

Silviculture and fish research has been conducted on state trust lands on the western Olympic Peninsula since the 1970s. After the designation of the OESF in 1992, the research and monitoring activities intensified and broadened to cover forest and wildlife ecology, geology, and riparian management among other topics. The majority of the past research and monitoring activities are listed in the OESF [Research and Monitoring Catalog](#), published by DNR in 2008. Information on [recently completed](#) and [ongoing](#) 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.

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 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.

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 and stores

all scientific and administrative documents on projects implementation. The database is available on DNR's intranet and is linked to DNR's statewide GIS layer on research areas.

The OESF Research and Monitoring Program is currently supplying environmental data to two online databases:

- Stream temperature data from 50 sites in the OESF and four sites in the Olympic National Park are available at the [NorWeST webpage](#).
- Air temperature and precipitation data from the local NOAA stations and stream discharge data from the local USGS stations are available at the [CLIMDB/HYDRODB webpage](#).

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

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 step-by-step process and identifies the parties responsible for implementation.

Communication, Outreach, and Education

Through effective communication, DNR builds public confidence in the sustainability of forest management practices in the OESF and the effectiveness of the HCP conservation strategies.

The OESF Research and Monitoring Program publishes a biannual electronic newsletter ("[The Learning Forest](#)," a joint effort with the University of Washington ONRC, to share scientific knowledge on 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](#) and ONRC websites.

The purpose of the annual OESF science conference is to communicate results of research and monitoring activities taking place in the OESF and their relevance to land management uncertainties faced by DNR and other land managers. The conference takes place in Forks at the end of April and is attended by natural resource specialists, land managers, students, scientists, and the public.

Several pages on [DNR's 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, developing 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.

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Silvicultural Activities

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.

Selecting Silvicultural Activities

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.

The silvicultural prescription defines desired outcomes (objectives) and how DNR plans to accomplish them (via silvicultural activities) in a forest management unit over an entire rotation. A forest management unit is a contiguous area that is ecologically similar enough to be managed to meet common objectives, and a rotation is the length of time between stand replacement harvests.

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 NRF 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 rotation objectives.

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 reassess it to ensure it is on track to meet its objectives.

Tracking Silvicultural Activities

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, 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.

Descriptions of Silvicultural Activities

Timber Harvest

DNR tracks each of the following types of harvests:

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



A Variable Density Thinning in the OESF

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 more 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 clearcut, in which all or nearly all of the existing stand is removed.
- **Clearcut:** According to Washington forest practices rules, a clearcut is a harvest method in which the entire stand of trees is removed in one timber harvest operation. In the 1990s, DNR began doing variable retention harvest instead of clearcuts on the majority of its timber sales. However, between the adoption of the HCP in 1997 and fiscal year 2008, variable retention harvests were still reported as clearcuts even though the vast majority of those harvests met the definition of variable retention harvest. From 2009 on, very few acres have been reported as clearcuts and this harvest type is no longer recorded in LRM. As such, clearcut was removed from the silviculture activity tables starting in the FY 2018 HCP Annual Report.

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 (FPA) 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.

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.

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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 “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 received RMAP block extensions in the following HCP units: South Puget, OESF, Straits, South Coast, Columbia and Yakima. The RMAP work in the other three planning units was completed by the 2016 deadline.

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 forest land 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.

As part of meeting HCP annual reporting requirements, DNR tracks and reports the number of road miles constructed (newly built roads), reconstructed (existing roads improved to a timber-haul standard), decommissioned (roads stabilized and made impassable to vehicular traffic), or abandoned (roads stabilized and abandoned to forest practices standards), as well as total active forest road miles and the 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 time of the construction season. Most road work is subject to a hydraulic “work window” that limits in- or near-stream work to the summer (typically June 15 through September 30).

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Easements and Road Use Permits

DNR generally 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



DNR Staff Reviewing a Proposed Easement

Photo courtesy of Kaerlek Janislampi.

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.

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 are found to qualify, DNR determines whether they should be designated as northern spotted owl NRF or dispersal management areas. DNR also assess 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 Program \(TLT\)](#), 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 WDFW, the State Parks and Recreation Commission, county governments, city governments, or the 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 that are 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

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 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 163,000 acres in 56 NAPs and 38 NRCAs. More than 125,000 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 43 special status species. This total includes 80,120 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*).

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 only Washington population of Bradshaw's lomatium (*Lomatium bradshawii*); 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



Golden Paintbrush at Rocky Prairie NAP

DNR's natural areas provide habitat for federally listed species such as the Golden Paintbrush (*Castilleja levisecta*). Photo courtesy of David Wilderman.

(*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*) that depend on forested talus slopes; birds like the harlequin duck (*Histrionicus histrionicus*) that are 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 that depend on 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 and provide important foraging and cover habitat for anadromous fish during the critical transition from a freshwater to a marine environment. In addition, estuaries help dissipate potentially damaging wave energy before it reaches the land and provide a sink for sediments and wastes derived from both 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 Makah copper butterfly (*Lycaena mariposa charlottensis*).



Oregon Spotted Frog

DNR's natural areas provide habitat for Oregon spotted frogs (*Rana pretiosa*) and other amphibians. Photo courtesy of W.P. Leonard.

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 near-shore habitats at Stavis, Cypress Island, and Woodard Bay NRCAs by removing bulkheads, fill, and creosote-treated structures.

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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 do not fall into 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 exploration leases allow a lessee to reserve the right to explore for underground deposits. With a DNR-approved plan of operations and the proper drill permit, the lessee has the sole and exclusive right to explore for, drill, extract, or remove oil and gas. However, any proposed on-the-ground activities must undergo State Environmental Policy Act (SEPA) review and have a plan of operations, which must be approved by DNR.

If the lessee wants to actively drill or thump (measure seismological tremors caused by the dropping of large weights or detonation of explosives), the lessee must obtain an “active” lease, which also includes acquiring a drilling permit. Regulations exist to protect water and air quality, and any exploration holes must be plugged following use. Any new permits are subject to SEPA review. 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. 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. In 1996, when the HCP was written, there were no active mining operations (activities that actually extract minerals) on lands managed under the HCP. There have not been any since.

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.

Communication Site Leases

Communication site leases allow private and public entities to build new towers or attach communication equipment to existing towers (for example, cell phone 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.

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.

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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 utilize existing rock pits or develop new ones according to the specifications in the contract. DNR rarely sells rock from these pits to third parties.

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Recreation Sites

Recreation sites allow public recreation on forested state trust lands as 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 is developing 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.

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Appendix B: Glossary

This appendix contains a glossary of terms used in this annual report.

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

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

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

Curtis relative density: See relative density.

D

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

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

Decommissioned road: A road made impassible to vehicles.

Desired future condition: 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 or not 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-practice 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) which 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 hand-held 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 resource conservation area: A state-designated area managed to protect an out-standing example of a native ecosystem or natural feature; habitat for endangered, threatened, or sensitive species; or a scenic landscape.

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 five 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 United States 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 ten 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 delimiting.

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's 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 one 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.