

**Biological Assessment of Impacts to
Terrestrial Threatened Species From the
Greater Prairie Creek Ecosystem Restoration Program
In Redwood National and State Parks**

12 April 2019

Table of Contents

Introduction	3
Consultation to Date	3
Current Management Direction	4
Description of the Proposed Action	5
1. Implementation Phases	9
2. Within Season Work Timing	15
3. Forest Restoration	15
4. Operational Method	21
5. Aquatic Restoration	25
6. Logging Road and Log Landing Reconstruction, Maintenance and Removal	28
7. Measure to Minimize Impacts to Listed Species	32
8. Annual Post Project Reporting	33
9. Minor Variance Process	33
Status and Distribution of Listed Species	34
Impacts to Threatened and Endangered Species	36
Determination	41

I. INTRODUCTION

The purpose of this biological assessment (BA) is to review the proposed Redwood National and State Parks (RNSP or parks) action, Greater Prairie Creek Ecosystem Restoration Program (GPCERP), in sufficient detail to determine if the proposed action may affect any terrestrial federal threatened or endangered species and/or their critical habitats. This BA is prepared in accordance with legal requirements set forth under section 7 of the Endangered Species Act (19 U.S.C. 1536 (c), 50 CFR 402), and meets the criteria for formal consultation with the United States Fish and Wildlife Service (USFWS). Proposed actions will occur within Redwood National Park and Prairie Creek Redwoods State Park (both part of RNSP) over the next 10 to 15 years.

II. CONSULTATION TO DATE

RNSP's list of endangered, threatened, proposed and candidate species that may be present in the proposed program area or may be affected by program activities includes two species currently listed as threatened in Humboldt County.

Northern Spotted Owl (*Strix occidentalis caurina*)
Marbled Murrelet (*Brachyramphus marmoratus*)

One species that occurs in the parks, the bald eagle (*Haliaeetus leucocephalus*), is listed as endangered by the State of California but is not federally listed. The bald eagle will not be impacted by proposed program activities so will not be considered in this document.

The Humboldt marten (*Martes caurina humboldtensis*) is currently proposed to be listed and is listed as endangered under California's Endangered Species Act (CESA). This species will be addressed in this document in the event it is proposed for federal listing as threatened or endangered during the lifespan of the consultation and for CESA regulatory purposes.

Critical habitat for the marbled murrelet and northern spotted owl is not designated within Redwood National Park. Critical habitat for the marbled murrelet is designated within Prairie Creek Redwoods State Park.

The program was first presented to the USFWS at an Interagency Consultation Team meeting on 8 February 2017. A status update was provided during a telephone conference with the USFWS on 17 August 2017. RNP Fish and Wildlife biologist Keith Bensen and USFWS Arcata Fish and Wildlife Office Botanist Clint Pogue met on 11 September 2017 to discuss preliminary effects determinations. An update was made at another ICT meeting on 30 November 2017. A further update about draft biological assessment preparation status was provided to the USFWS via teleconference on 27 February 2018. A field meeting occurred on 14 March 2018. Multiple discussions between Clint Pogue and Keith Bensen occurred from August through December 2018 by telephone and at informal meetings at the Arcata Fish and Wildlife Office.

III. CURRENT MANAGEMENT DIRECTION

Please refer to *Threatened, Endangered, Proposed, and Candidate Species in Redwood National and State Parks, Biological Assessment Reference Document* (RNSP 2013) for a detailed summary of laws and policies that influence management direction in Redwood National and State Parks (RNSP).

The *General Management Plan/General Plan and Environmental Impact Statement/Report for Redwood National and State Parks* (USDI and CDPR 2000) provides comprehensive guidance for managing the national and state parks as one complex with similar resources. The General Management Plan/ General Plan (GMP) provides overall vision and direction for the parks and identifies future planning needs. The GMP identifies individual action plans needed to address specific park actions such as estuary, second growth, trail, fire and fuels, vegetation, back-country visitor use, and transportation management.

Watershed Restoration

The GMP states that watershed restoration in RNSP will involve “treating abandoned logging and ranch roads...” through landform restoration which involves the complete or partial removal of major and some minor roads and road decommissioning (p. 37).

Specific to Redwood National Park, Public Law 95-250 was signed on March 27, 1978 adding 48,000 ac to Redwood National Park. This legislation authorized “...a program for rehabilitation of areas within...the park contributing significant sedimentation because of past logging disturbances and road conditions and, to the extent feasible, to reduce risk of damage to stream side areas adjacent to Redwood Creek...” In 1978 a watershed rehabilitation program was initiated that concentrates on preventing human-induced erosion and encourages the return of natural vegetation patterns in the watersheds.

In the mid-2000s, in response to changing conditions, new road and resource information, and advances in technology, Redwood National Park initiated a process of updating the long-term road access network and road classifications along with sub-watershed treatment prioritization. This was done by analyzing resources-at-risk (e.g. salmonids, old-growth redwoods) and sediment threat from roads for each sub-watershed in Redwood Creek within the park. Road treatment prioritization was developed at the sub-watershed level as this was viewed as the most appropriate scale to evaluate aquatic and riparian resource degradation. The prioritization was based on an approach that would protect the best existing aquatic and riparian habitats that are under the greatest threat of impacts from failing roads. The document *Road Strategy: Access and Treatment Priorities for Parkland in the Redwood Creek Watershed* (approved and signed by park superintendents on April 4, 2005) describes in detail the sub-watershed prioritization methods, results and recommendations. The park has been following this priority for the past decade and anticipates following the priorities outlined for the next few years.

Second Growth Forest Management

The GMP states that second growth forest management in RNSP will involve “Silvicultural methods such as thinning, replanting and burning... to reduce the time in which the forest re-attain characteristics and processes found in mature, naturally occurring forests” (p. 44).

IV. DESCRIPTION OF THE PROPOSED ACTION

Description of Action Area and Program Area—

The action area for this analysis is 0.25 miles beyond the program area. The action area for the proposed restoration program is approximately 11,000 acres. The program area is approximately 9,160 acres.

The Greater Prairie Creek Ecosystem Restoration Program (GPCERP) is located primarily in the lower portions of the Prairie Creek watershed within Redwood National Park and Prairie Creek Redwoods State Park. The program area includes 9,160 acres that would be restored and incorporates the following sub-basins: Skunk Cabbage Creek, Berry Glen, Little Lost Man Creek, Streelow Creek, May Creek, Home Creek, Boyes Creek, and a portion of Redwood Creek along Bald Hills Road. This area also includes the Gold Bluffs watersheds from Squashan Creek to the north to Major Creek to the south. The restoration area contains small isolated stands of old growth redwood and is bordered in most areas by larger contiguous stands of old growth redwood forest as well as one isolated second growth stand surrounded by old growth redwood forest in the northern section of Prairie Creek Redwoods State Park (Figures 1 and 2).



Figure 1. Location of Greater Prairie Creek Ecosystem Restoration Program area.

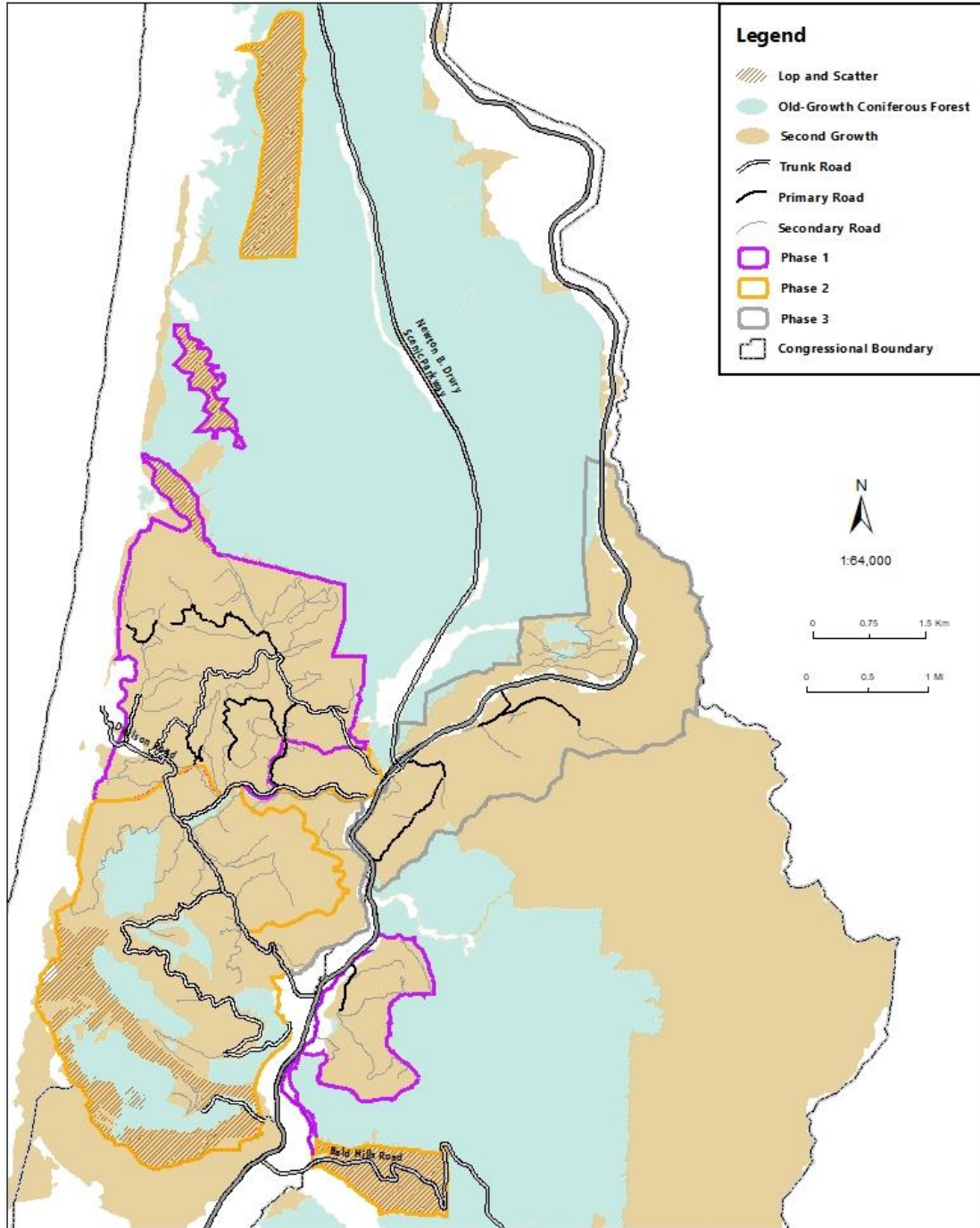


Figure 2. Map of program area with program phases, roads, streams, old growth, and second growth (restoration areas) designated. Tan areas to be thinned within gray lines will have biomass removed, hatched areas will be thinned and lopped and scattered.

The program area is located within the redwood forest zone where natural, old-growth stands are dominated by redwood and lesser components of Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), tanoak (*Neolithocarpus densiflorus*), western hemlock (*Tsuga heterophylla*) and grand fir (*Abies grandis*). The program area is also within the marine influence climate zone which is dominated by wet winters and relatively damp, foggy summers as compared to more inland portions of the parks. The program area was extensively logged from the 1930's until the expansion of Redwood National Park in 1978. These second growth stands have been unmanaged since the 1970s and consist of unnaturally dense forests where growth is hindered, tree species composition has shifted, and biodiversity is low. Unmaintained logging roads, skid trails, and stream crossings have eroded since construction, leading to fill material entering nearby stream channels and stream crossing subsidence. These historical uses have degraded aquatic habitat and the main stem of lower Prairie Creek is without large pieces of wood needed for fish habitat.

The program area is a high priority for restoration because of its location in context with the surrounding landscape. To the north and south lie two of the largest remaining redwood old growth forests, and addressing issues related to forest structure, species compositions, and understory stand development in the planning area would accelerate the connectivity of habitat between these two large old growth redwood forest patches. Restoration would shorten the time for the development of late seral forest habitat conditions.

National Park Service (NPS) and California Department of Parks and Recreation (CDPR) staff began prioritizing second-growth forests in the park for restoration in 2003 based on stand density index, number of trees, basal area, species composition, crown ratio, average stand height, average shrub cover, redwood regeneration, road access, proximity to intact old-growth forests, and the presence of old-growth trees left after original logging. The NPS implemented large-scale thinning treatments in the South and Middle Forks of Lost Man Creek from 2009 to 2011 and 2015 to the present, respectively (NPS 2008, 2014).

Proposed Action

Please note - a summary list of minimization measures described in the following paragraphs is located at the end of the Proposed Action section.

The NPS and CDPR are proposing to continue restoration efforts in the GPCERP area through a combination of forest and aquatic restoration and road removal activities. The ecosystem restoration activities will be phased geographically over three time periods or phases. Phase 1 restoration activities will be described at the project detail level while Phases 2 and 3 will be described programmatically as restoration activities will be identical to those in Phase 1, but in different locations and at later times in sequence (Figure 3). Restoration activities are grouped into three major categories: forest restoration – thinning second growth stands; watershed restoration – removing old logging and skid roads and stream crossings; aquatic restoration – placing large wood in streams.

Northern spotted owl surveys will be conducted to protocol (USFWS 2011) two years prior to any restoration work within the GPCERP program area. Areas will be resurveyed if two years lapse before restoration activities are completed.

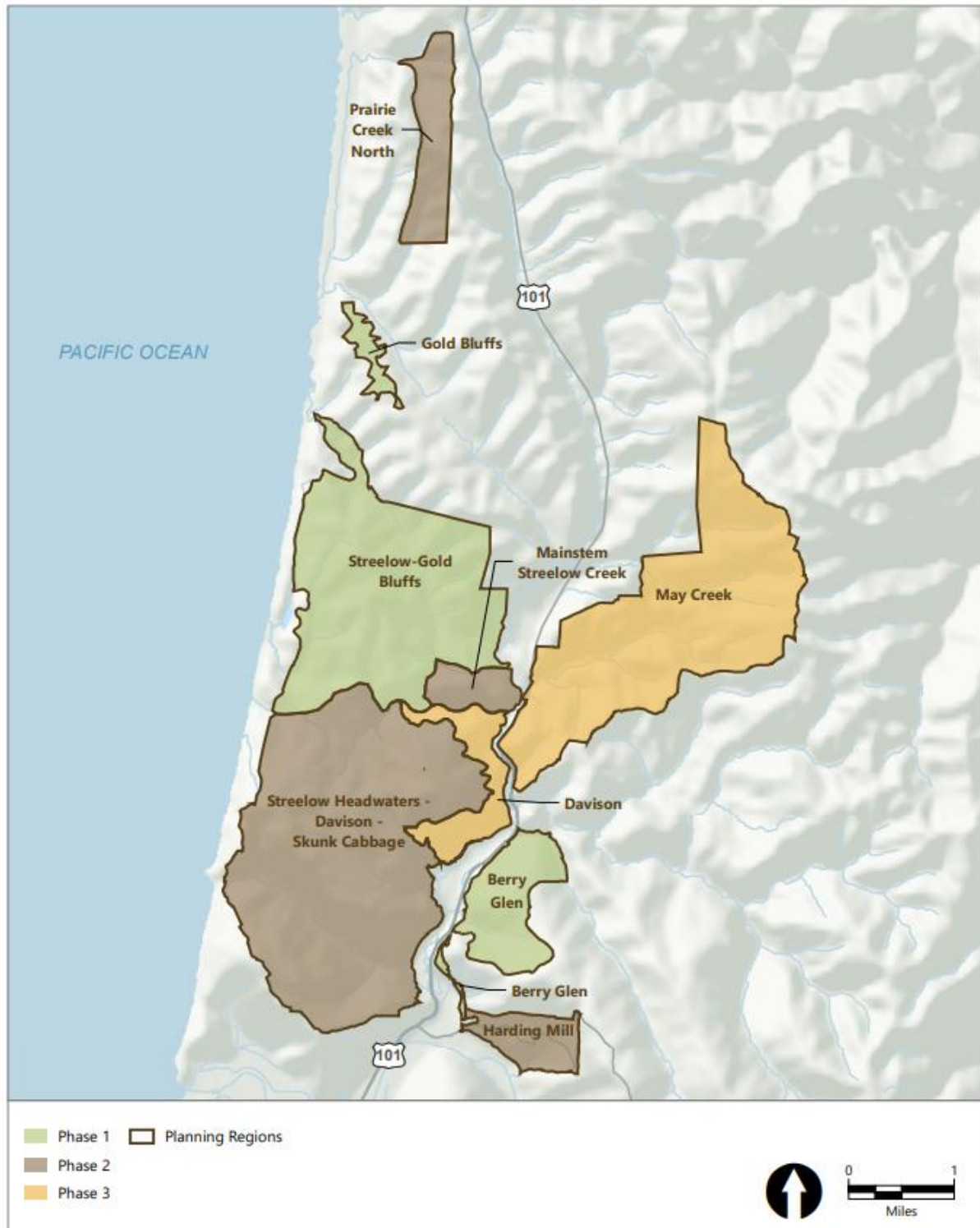
1. Implementation Phases

Ecosystem restoration activities will occur throughout the program area in three sequential phases taking place over approximately the next 10 to 15 years. Phases were determined based on a combination of factors, including the urgency in addressing stream sedimentation threats or problems, proximity to old growth stands, and forest stand density.

The overall sequence through the various sub-areas (Figure 3):

- Phase 1: Streelow-Gold Bluffs and Berry Glen areas.
- Phase 2: Harding Mill, Mainstem Streelow Creek, Prairie Creek North, and Streelow Headwater-Davison-Skunk Cabbage areas.
- Phase 3: Davison and May Creek areas.
- All Phases: Large wood placement will occur within the main-stem of Prairie Creek and the tributary creeks of North Fork Streelow Creek and May Creek as wood becomes available throughout any program phase. Riparian and wetland plantings will also occur along main-stem Prairie Creek during any phase after placement of large wood.

Direct road access by heavy equipment will not be required for lop-and-scatter forest restoration treatment (described in the Forest Restoration section in detail below) areas because biomass will not be removed from these areas. Therefore, lop-and-scatter treatment, which occur in portions of the Gold Bluffs Beach area, and all of Prairie Creek North and Harding Mill areas (Figure 3), and as an option in all other areas, could occur during any phase.



Publish Date: 2018/07/16, 1:40 PM | User: jsfox
 Filepath: \\orcas\gis\Jobs\SaveTheRedwoodsLeague_1808\Maps\InternalScoping\Fig2_Units_Phases.mxd

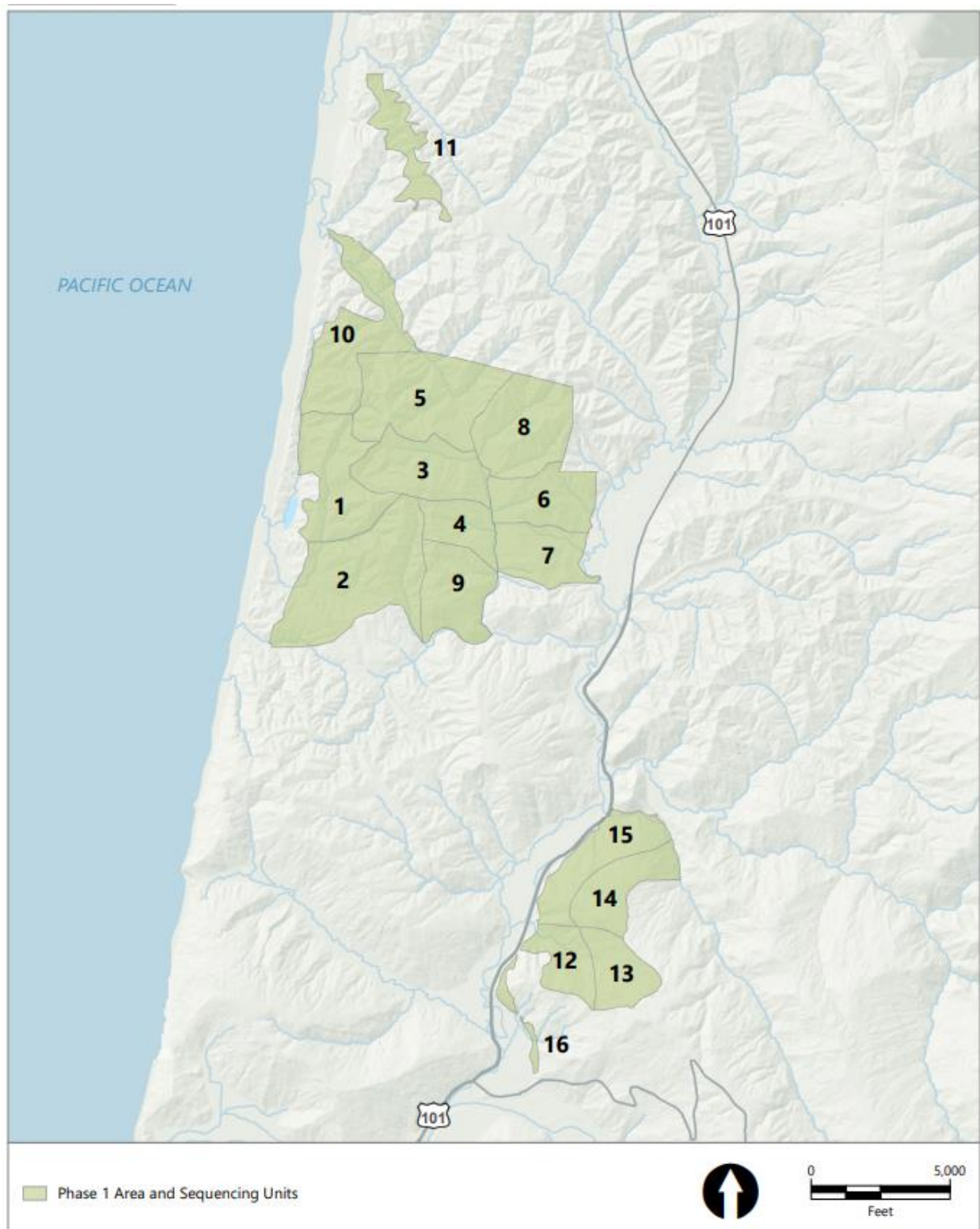
Figure 3. Map of phase areas throughout Greater Prairie Creek Ecosystem Restoration Program area.

Sequencing within each phase will be based on a road-shed approach (i.e., road flow from secondary roads to main haul roads). Specifically, the most distant areas within a road-shed will be prioritized, and work, including forest and aquatic restoration as well as road removal, will progress back towards the direction of the entry point. Each phase will consist of a series of implementation planning sequence sub-units developed to facilitate treatment operations and planning. Treatments within each sub-unit will vary based on stand conditions, topography, access, and landscape context. The implementation planning sequence for Phase 1 is shown on Figure 4. The order of ecosystem restoration activities within a given implementation planning sub-unit that uses heavy equipment will occur as shown in Table 1. Phases 2 and 3 will be based on the same assumptions and approaches as Phase 1.

Table 1. Order of restoration activities within each phase.

Order	Activity	Description
1	Site Access and Preparation	Repair/maintain roads leading to the unit
		Repair stream crossings to ensure roads leading to unit are stable
2	Forest and Aquatic Restoration	Complete forest thinning treatment
		Place large wood in tributaries
		Maintain and winterize main haul roads as needed between field seasons
3	Road Removal or Maintenance Activities	Complete road removal activities
		Repair roads to be maintained

Phase 1 treatment areas would include Streelaw-Gold Bluffs and Berry Glen (Figure 3) and occur in order from units 1-10, 11 as a stand-alone unit, 12 – 15 separately, and unit 16 as a stand-alone unit (Figure 4). Phase 1 activities would be expected to commence in fall 2019 or summer 2020. It is estimated that a maximum of four to six units will be restored during a single operating season. The main haul roads for Phase 1 will require maintenance throughout the duration of Phase 1 (Figure 2). Table 2 provides a detailed overview of the restoration activities, sequencing, and anticipated schedule for the Phase 1 units.



Publish Date: 2018/07/10, 12:06 PM | User: jsfox
Filepath: \\orcas\gis\Jobs\SaveTheRedwoodsLeague_1808\Maps\InternalScoping\Fig3_Phase1_Units.mxd

Figure 4. Map of sequencing units within Phase 1. Areas will be completed in order for units 1 – 10 and 12 – 15 separately. Units 11 and 16 are stand-alone units to be treated separately.

Table 2. Phase 1 restoration sequencing and anticipated schedule (see Figure 4 for locations of units and Figure 2 for locations of roads).

Unit	Site Access and Preparation	Forest Restoration	Aquatic Restoration	Road Removal	Anticipated Schedule
1	All road maintenance from Wolf Creek to E-Camp (Roads 245, 450, 453, Davison, E-Camp). Install two bridges along E-Camp Road; install one bridge near the intersection of Roads 245 and 450	Biomass removal: 233 acres	Stockpile wood	E-camp road; Remove temporary bridges, and place at Road 246 and Phase 2	2019–2020
2	Same as Unit 1	Biomass removal: 398 acres	Stockpile wood	Roads 452, 453, Davison Spur H, and 450 to unit 3	2019–2020
3	Same as Unit 1	Biomass removal: 215 acres	Stockpile wood, place wood	Remaining Road 450, NW Streelow Road	2019–2021
4	Maintain Roads 246, 246-1, 454, 240 North, and 240 North Spur; install one bridge near the intersection of Roads 245 and 240	Biomass removal: 102 acres	Stockpile wood, place wood	Road 240 North Spur, and Road 454; remove temporary bridge and place in Phase 2	2019–2021
5	Maintain NW Streelow, Squashan Headwaters Road, and Road 247	Biomass removal: 329 acres	Stockpile wood	Squashan Headwaters Road	2021–2023
6	Maintain Road 245-4	Biomass removal: 166 acres	Stockpile wood, place wood	Road 245-4	2021–2023

Unit	Site Access and Preparation	Forest Restoration	Aquatic Restoration	Road Removal	Anticipated Schedule
7	Maintain Roads 245-3 and 245-2	Biomass removal: 145 acres	Stockpile wood, place wood	Roads 245-3 and 245-2	2021–2023
8	Road 245-5 system, Road 245-6 system, Remove big stream crossings	Biomass removal: 242 acres	Stockpile wood	Roads 245-5 system, 245-6 system, and 247	2021–2023
9	Maintain Road 246; Move one bridge from E-Camp to intersection of Roads 245 and 246	Biomass removal: 178 acres	Stockpile wood, place wood	Roads 246-1, 246, 240 North	2022–2023
10	N/A	Lop-and-scatter: 264 acres	Stockpile wood	N/A	2020–2023
11	N/A	Lop-and-scatter: 108 acres	Stockpile wood	N/A	2020–2023
12	Maintain Off-Highway Road A and Berry Glen Road	Biomass removal: 107 acres	Stockpile wood	Berry Glen Road	2019–2021
13	N/A	Biomass removal: 118 acres	Stockpile wood	Off-Highway Road A to Units 14/15	2019–2021
14	Maintain Off-Highway Road C	Biomass removal: 145 acres	Stockpile wood	Off-Highway Road C	2019–2021
15	Maintain Off-Highway Road B	Biomass removal: 171 acres	Stockpile wood	Off-Highway Road B and remaining Off-Highway Road A	2020–2021
16	N/A	Biomass removal: 23 acres	Remove and stockpile hybrid Monterey pine	N/A	2019–2021

Ecosystem restoration activities in future Phases 2 and 3 will be implemented like those undertaken under Phase 1*, using the following approach:

- Sequencing units will be delineated within planning areas such that one or two units per season can be completed.
- Sequencing will be determined using the road-shed approach, which would be based on road flow and intersections between the main haul roads and secondary roads. This approach would prioritize the areas within a road-shed that are the farthest away and work back towards the entry point.
- Road and bridge improvements will be identified and incorporated into the sequencing for each planning area.
- Activities within the sequencing units would progress as detailed in Table 1.

2. Within Season Work Timing

In all phases, **work with any heavy equipment** (e.g. bulldozer, excavator, feller buncher, skyline yarder, logging truck) will occur during any day within the “normal operating period” from 15 June until 15 October. If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA’s *Fall Transition Season Precipitation and Hydrology Decision Support Service* notifications would be consulted as they become available to ensure the project is completed or fully winterized prior to the onset of fall rain. If northern spotted owl surveys determine that there is an active breeding pair of owls, then no activities will occur from February 1 to September 14 within 0.25 miles of the nest.

Use of high clearance pickups and SUV’s, chainsaws and ATV’s by hand crews accessing stands to fell trees or park staff monitoring contractors will occur anytime during the year except as specified at specific locations below. Any above ambient noise producing work (e.g. heavy equipment, trucks, chainsaws) occurring within 500 feet to 0.25 miles (depending on loudness of equipment being used) of suitable marbled murrelet breeding habitat (Figure 2) will be restricted to between two hours after sunrise to two hours before sunset during the marbled murrelet noise restriction period (24 March to 15 September) in order to minimize disturbance to nesting murrelets.

3. Forest Restoration

The second growth forest thinning silvicultural prescription that will be used is variable density thinning (VDT), that creates uneven variation of tree spatial pattern over areas and time. VDT focuses on the enhancement of spatial heterogeneity across the landscape by prescribing fine-

scale variation to the forest structure. VDT incorporates a mixture of silvicultural treatments, including the following:

- Low thinning (thinning from below) focuses on the removal of trees from the lower crown classes (i.e., suppressed, intermediate, and co-dominant crown classes) to benefit trees in the upper crown classes (i.e., co-dominant and dominant crown classes), and generally removes the smallest diameter trees. Trees in the lowest diameter class (generally less than 24 inches) will be removed first, with successively larger trees removed until the basal area retention is met.
- Crown thinning focuses on the removal of trees from the dominant or co-dominant crown classes to benefit adjacent trees of the same crown class. While the range of diameter class vary from stand to stand, most trees cut would be in the middle diameter class (8 to 30 inches) as opposed to the smaller diameter class cut in the low thinning method.
- Gaps (heavily thinned areas with few trees and up to one-half-acre in size) will be used to establish and maintain a new cohort of trees, encourage a robust assemblage of understory vegetation, and promote landscape-scale heterogeneity. All trees larger than 30 inches in diameter would be retained in gaps (an average of 10 per acre), and no more than 10% of the area within in any unit will be treated with forest gaps. Road restoration corridors will be incorporated into gap distribution across the landscape.
- Skips refer to areas where few to no trees will be cut and may be established at the same size and frequency as gaps to further increase stand heterogeneity.
- Conifer release removes competition from around individual trees or small groups of trees that are retained. For example, every tree that falls within the drip line of a retention tree or retention group would be cut. This method may be implemented in hardwood-dominated stands to release conifers.

Forest thinning treatments will vary in intensity to encourage heterogeneity throughout the program area. Regardless of thinning method, no tree with a diameter greater than 30 inches will be cut, except for the removal of non-native species (e.g., hybrid Monterey pine) or if a tree is located directly on a road. Different thinning methods will be identified in the field based on site-specific conditions to further promote landscape-scale heterogeneity. The thinning method will vary according to current conditions and landscape context, per the following treatment considerations:

- In some areas, previous logging activities have altered the species composition (e.g., redwood is underrepresented, excessive alder in-growth, Sitka spruce located in inland areas). Thinning treatments would aim to shift species composition, which can result in patchy thinning severities and removal of undesired trees species (e.g., exotic and overrepresented tree species).

- While there is no upper limit to implementing forest thinning operations on steep slopes, the thinning severity may be reduced to maintain slope stability.
- Existing snags and logs will be retained as practicable, and following forest thinning operations, additional snags may be created by girdling selected trees.

Table 3 summarizes existing and post-treatment stand characteristics for trees greater than 4.5 inches diameter at breast height (DBH) within the entire program area. When averaged across an entire forest inventory unit (unit locations shown in Figure 5),¹ treatments will not exceed a 50% reduction in the basal area, and the basal area will be reduced by 40% or less in most locations. All treatments will generally retain more than 100 trees per acre. Canopy cover will average 60% across forest inventory units.

Table 3. Existing and Post-Treatment Stand Characteristics including: square feet basal area (sf), trees per acre, quadratic mean diameter (QMD), and thousand board feet volume (mbf) (see Figure 5 for forest inventory unit locations).

Forest Inventory Unit	Existing Conditions				Post-Treatment Conditions			
	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)
Davison A	483	364	15.6	76.0	353	150	20.7	60.6
Davison B	467	175	22.1	83.5	399	106	26.2	73.6
Davison C	535	184	23.1	108.6	480	136	25.4	101.5
Streelaw Headwaters North A	494	392	15.2	62.0	294	108	22.4	44.7
Streelaw Headwaters South B	499	354	16.1	70.0	298	97	23.8	45.8
Major Creek	426	101	27.8	95.3	390	90	28.2	88.2
North Fork Streelaw Creek D	435	363	14.8	87.9	273	153	18.1	56.8
North Fork Streelaw Creek C	490	327	16.6	71.8	295	154	18.7	44.0

¹ “Forest inventory units” correspond to watershed-based forested units delineated by similar vegetation type, age, physical attributes, or management history.

Forest Inventory Unit	Existing Conditions				Post-Treatment Conditions			
	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)
North Fork Streelow Creek A	489	221	20.1	63.4	400	150	22.1	55.0
North Fork Streelow Creek B	446	184	21.1	84.1	367	102	25.7	74.7
Gold Bluffs Beach A	372	204	18.3	45.6	247	76	24.5	35.3
Gold Bluffs Beach B	356	142	21.4	89.0	298	74	27.2	83.5
Gold Bluffs Beach C*	345	156	20.2	-	270	107	21.5	-
Berry Glen B	365	367	13.5	45.4	215	210	13.7	29.7
Berry Glen A	399	304	15.5	72.9	239	151	17.0	36.5
Harding Mill*	335	249	15.7	-	316	217	16.3	-
May Creek F	360	306	14.7	39.3	268	137	19.0	37.3
May Creek B	409	341	14.8	67.0	246	115	19.8	42.7
May Creek A	436	393	14.3	66.2	258	165	17.0	42.0
May Creek C	468	512	13.0	46.5	280	228	15.0	31.5
May Creek D	431	327	15.5	60.3	324	166	18.9	50.7
May Creek E	536	316	17.6	95.8	345	124	22.6	69.1
Prairie Creek North*	428	187	20.5	-	341	112	23.6	-

Forest Inventory Unit	Existing Conditions				Post-Treatment Conditions			
	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)	Basal Area per Acre (sf)	Number of Trees per Acre	QMD	Volume per Acre (mbf)
Skunk Cabbage C	280	223	15.2	-	241	150	17.2	-
Skunk Cabbage D*	312	120	21.9	-	296	106	22.6	-
Skunk Cabbage A*	370	656	10.2	-	220	368	10.5	-
Skunk Cabbage B	439	612	11.5	35.2	260	186	16.0	25.5

* Forest inventory unit would have a lop-and-scatter operational method where no biomass volume is removed.

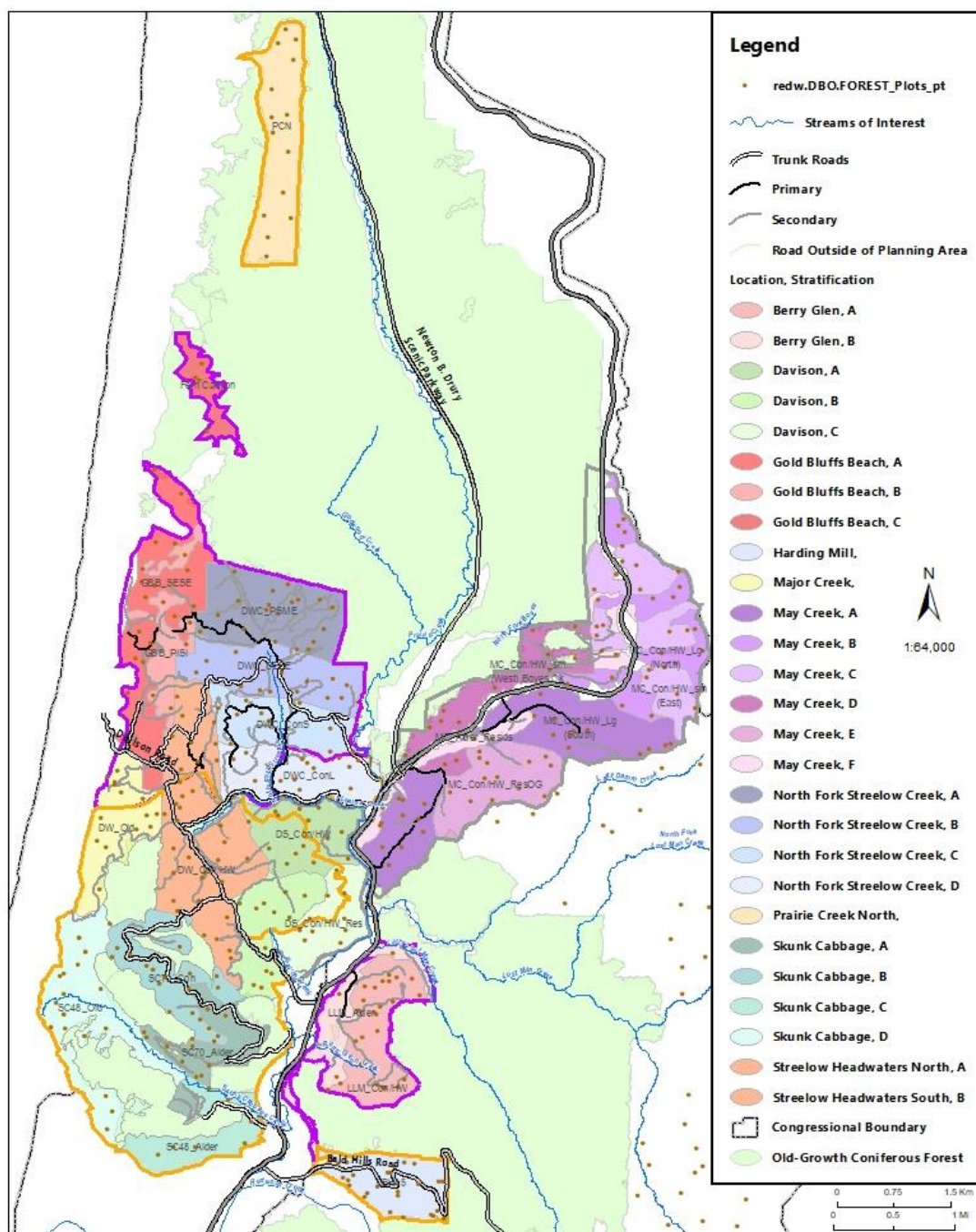


Figure 5. Map of forest inventory units throughout Greater Prairie Creek Ecosystem Restoration Program area.

4. *Operational Method*

Operational method refers to the method by which trees are felled, either with mechanized heavy equipment or manually with chainsaws, and how woody material is treated and/or removed from the treatment area. Two types of operational methods will be used, biomass removal and lop and scatter (Table 4, Figure 6).

A. Biomass Removal

Biomass removal refers to removing trees from units to reduce fuel accumulations and encourage understory development. No wood will be removed from the program area until consideration is given to its usefulness for other restoration projects, such as terrestrial or stream habitat improvement or as coarse woody debris on site. Excess biomass that is not removed from the site would be lopped and scattered on site. Two types of biomass removal methods will be used:

- Ground-based operations refers to the use of ground-based mechanized equipment (e.g., feller-buncher, skidder, harvester/processor) to fell trees and/or skid logs or whole trees from the stump to a landing or roadside area. At the landing, a processor will limb and buck the material into lengths appropriate for hauling. Loaders will be used to load log trucks, which will transport the logs along haul roads out of the park and eventually to a mill or cogeneration power plant. Tree removal using ground-based operations will be restricted to areas with slopes under 40% grade (Figure 6).
- Skyline operations refers to the use of a cable yarding machine, an overhead system of winch-driven cables, to pull logs or whole trees from the stump to a landing or roadside area. All trees will be felled and processed (cut to log length and limbed) using chainsaws prior to skyline yarding. Trees to be removed will be skyline yarded to a landing, skid trail, or road using a cable yarder or yoader. A slack-pulling carriage will be used to skid felled trees to the main cable yarding corridor. Cable yarding corridors are generally not wider than 20 feet. Stumps or second growth trees will be used as tail holds. Guylines for the yarder will be anchored to old-growth stumps or second-growth stumps or trees surrounding the landing. Tree removal from skyline operations would generally be restricted to areas with slopes greater than 40% grade (Figure 6).

B. Lop and Scatter

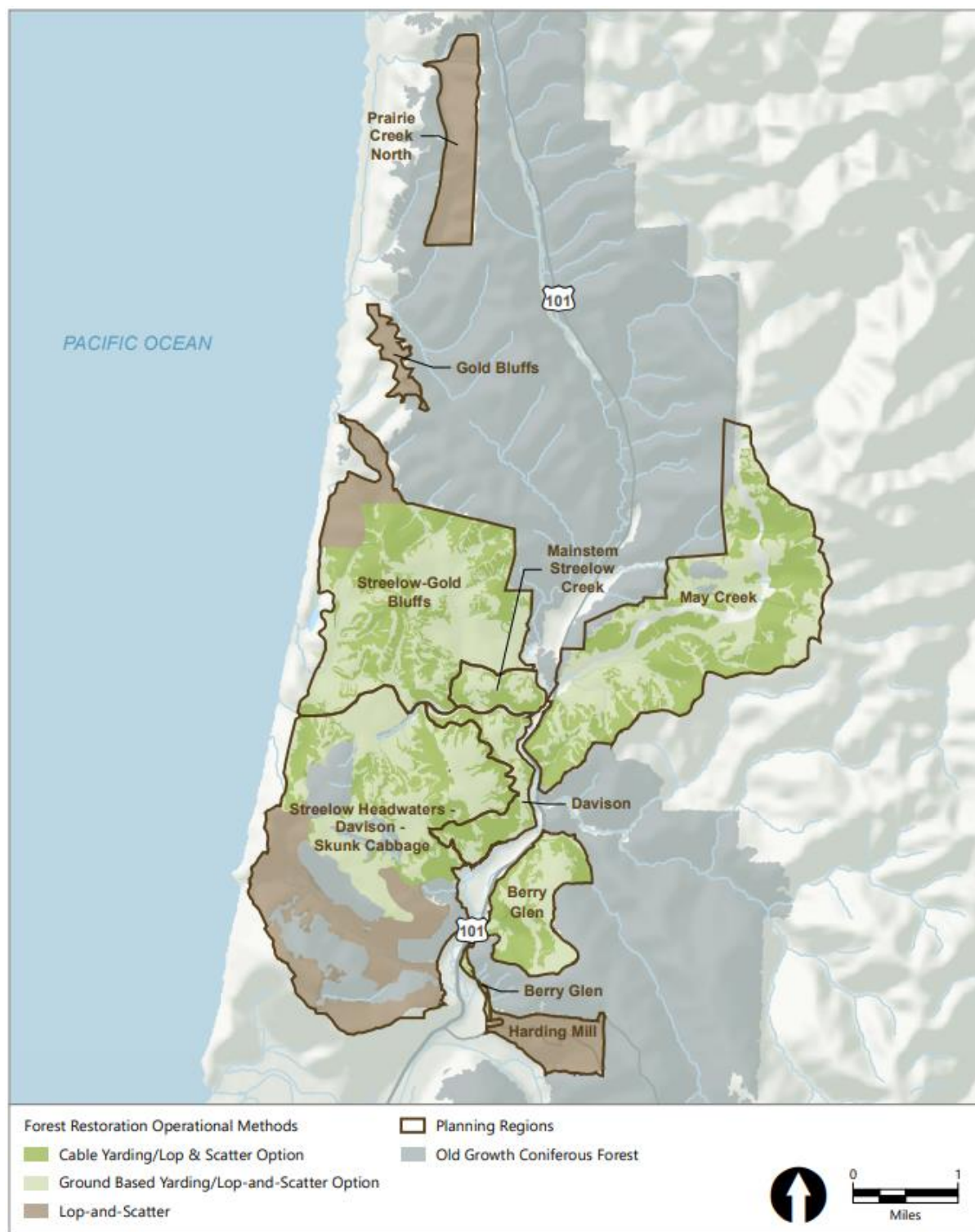
Lop-and-scatter refers to an operational method where felled tree branches are cut off and broadcast throughout the treatment area. The goal is to get the felled tree boles in contact with the ground to speed up natural decomposition. No felled trees will be removed, and heavy equipment use will not occur. All tree felling, de-limbing and bucking will be done by hand crews with chainsaws. Lop-and-scatter areas will occur where the equipment necessary to

remove biomass cannot access the stand because of steep slopes, special management zones, or because the area lacks existing haul roads (Figure 6). Lop-and-scatter is a default option across the entire program area; if it is determined that biomass removal is not feasible in an area, the operational method would switch to lop-and-scatter. If biomass removal operations cannot be implemented where road access is not available, or no contractor bids are submitted, then those areas would be treated with lop-and-scatter operations using the same prescribed silvicultural method described in Section 3, above. All lop-and-scatter work will be performed outside of the marbled murrelet noise restriction period (24 March – 15 September) if work is to occur within 500 feet of suitable marbled murrelet breeding habitat.

Table 4. Proposed Operational Methods (see Figure 5 for locations of forest inventory units).

Forest Inventory Unit	Size (acres)	Ground-Based Operations (acres)	Skyline Operations (acres)	Lop-and-Scatter Operations (acres)
Davison A	283	169	113	-
Davison B	286	135	151	-
Davison C	250	106	145	-
Streelow Headwaters North A	313	204	109	-
Streelow Headwaters South B	470	290	180	-
Major Creek	302	181	121	-
North Fork Streelow Creek D	310	150	161	-
North Fork Streelow Creek C	303	249	54	-
North Fork Streelow Creek A	450	200	250	-
North Fork Streelow Creek B	385	259	126	-
Gold Bluffs Beach A	510	206	304	-
Gold Bluffs Beach B	172	56	116	-
Gold Bluffs Beach C	108	-	-	108
Berry Glen B	209	90	119	-
Berry Glen A	354	215	139	-
Harding Mill	289	-	-	289
May Creek F	155	139	16	-
May Creek B	318	131	187	-

Forest Inventory Unit	Size (acres)	Ground-Based Operations (acres)	Skyline Operations (acres)	Lop-and-Scatter Operations (acres)
May Creek A	621	262	358	-
May Creek C	383	150	233	-
May Creek D	293	180	113	-
May Creek E	321	121	200	-
Prairie Creek North	433	-	-	433
Skunk Cabbage C	234	170	64	-
Skunk Cabbage D	498	301	197	-
Skunk Cabbage A	248	155	93	-
Skunk Cabbage B	310	277	33	-
Total Acres	8,808	4,396	3,582	830



Publish Date: 2018/07/17, 9:36 AM | User: jsfox
 Filepath: \\orcas\gis\Jobs\SaveTheRedwoodsLeague_1808\Maps\InternalScoping\Fig4_ForestRestoration.mxd

Figure 6. Map of ground based yarding, cable yarding, and lop and scatter areas within Greater Prairie Creek Ecosystem Restoration Program area.

5. *Aquatic Restoration*

Aquatic restoration includes placement of large wood in streams, planting trees in riparian corridors and around wetlands, and treatment of the Davison Mitigation Site, a planted alder forest, along mainstem Prairie Creek (Figure 7). Work will occur in all phases of the program. All above ambient noise producing work will be performed outside of the marbled murrelet noise restriction period (24 March – 15 September) if work is to occur within 500 feet to 0.25 miles of suitable marbled murrelet breeding habitat depending on the loudness of the equipment used.

A. Large Wood Placement in Creeks

Large wood will be placed in streams to create complex fish habitat by creating areas of lower velocity during higher flows, providing additional instream cover, creating scouring pools, and recruiting wood.

a. Mainstem Prairie Creek

Large wood placement will occur within the mainstem of Prairie Creek as wood becomes available throughout any program phase. Riparian conifers will also be planted to provide future large wood for natural recruitment to the channel. Large wood placement locations within the channel were identified based on adequate site access and avoiding impacts to large established conifers (Figure 7). Where access allows, approximately 40 - 50 pieces of large wood will be placed in the channel. In addition, several large alders will be removed from the right bank and placed in the wetland pond at the Elk Meadows Picnic area to provide cover for juvenile salmonids using the pond. Himalayan blackberry and other invasive plants will be removed where they are found within reach of the excavator at equipment location sites.

b. Streelow and May Creeks

Large wood placement would also occur programmatically and opportunistically in Streelow and May Creeks as wood becomes available. Large wood project reaches for these Prairie Creek tributaries are described in Table 5 and shown on Figure 7.

Table 5. Proposed Large Wood Loading in Streeflow and May Creeks (locations shown in Figure 7).

Stream	Reach Length Description
May Creek	Extends from Highway 101 upstream to the uppermost fork in the creek
Streeflow Creek	
Mainstem/ South Fork Streeflow	Extends from the mouth upstream to the confluence with Little North Fork Creek. Above Little North Fork Creek, portions of the channel are buried, and surface flow is not continuous.
North Fork Streeflow	Extends from the corners of forest units 7 and 9 upstream to the log stringer bridge. The channel is buried above the log stringer bridge.

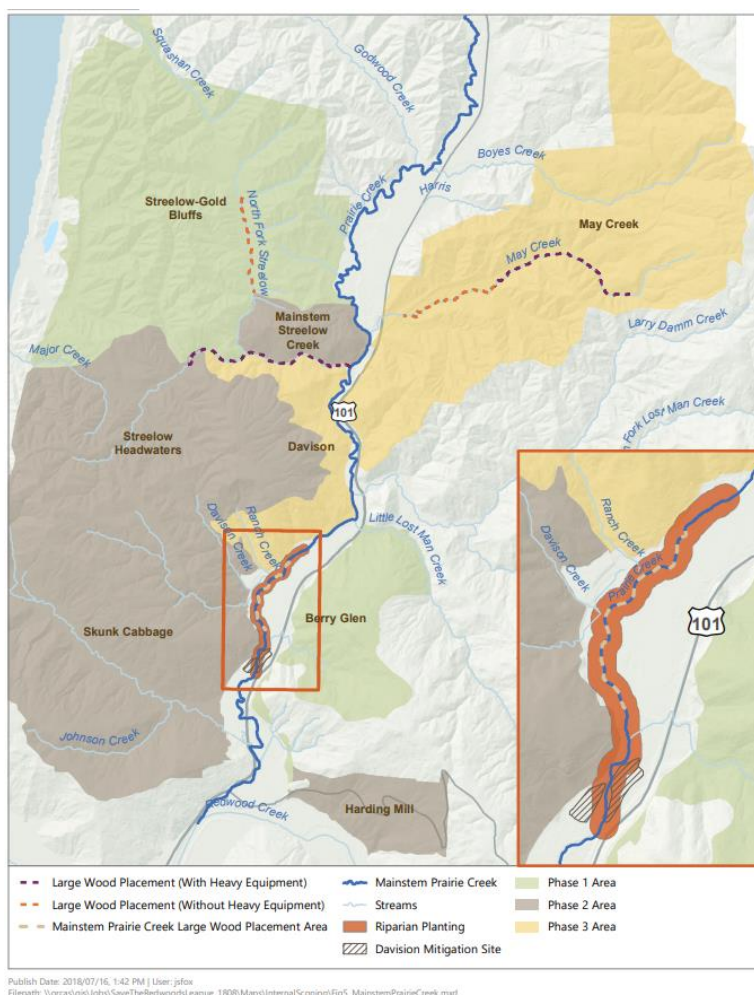


Figure 7. Locations of aquatic restoration activities in the Greater Prairie Creek Ecosystem Restoration Program area.

The upper limits of large wood loading will be 68 pieces per mile of wood greater than 24 inches in diameter and 50 feet in length. This target is based on large wood surveys on Godwood Creek (a reference reach), a tributary to Prairie Creek, located north of the action area in old growth forest in Prairie Creek Redwoods State Park.

The following two techniques will be used to place large wood in tributary streams (Figure 8):

- With heavy equipment: Large wood will be placed in streams using heavy equipment from road locations adjacent to stream channels. Heavy equipment will not cross floodplains or streams and would only use existing roads for equipment access.
- Without heavy equipment: Entry to streams will be on foot and use chainsaws to drop wood into the channel, or large wood may be pulled into the stream from the banks and/or floodplain. A come-a-long winch would be used to move and position large wood in the channels.

Cable and rebar will not be used to anchor large wood due to safety risks and aesthetic concerns. Large wood is expected to be dynamic in the channel and may break loose and deposit naturally at downstream sites.

B. Riparian and Wetland Plantings

Riparian and wetland plantings will occur within the mainstem of Prairie Creek following placement of large wood, which will occur as wood becomes available during any program phase. Planting will use a variable spacing of riparian trees and understory vegetation within 200 feet on both sides of Prairie Creek adjacent to the large wood placement reach (Figure 7). In this same area, appropriate species would also be planted within wetlands dominated by invasive manna grass (*Glyceria* spp.) and/or reed canary grass (*Phalaris arundinacea*). Trees would be planted in areas lacking adequate overstory tree cover. Sitka spruce (*Picea sitchensis*), redwood (*Sequoia sempervirens*), big leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), willow (*Salix* spp.), or other appropriate species would be planted along well-drained soils within 200 feet of both sides of the stream channel. Saplings would be between 5 and 8 feet tall, 1-2 inch diameter, and would be grown from stock appropriate to the site. At wetland planting areas, existing invasive grasses would first be mechanically or manually treated, after which saplings would be planted. The planting areas would be managed to prevent invasive grasses from establishing for at least 5 years. Elk exclusion fencing may be used to protect the young saplings and understory vegetation from elk browsing for several years after planting. If temporary exclusion fencing is used, it will be raised 1-2 feet above the ground to allow for travel of smaller animals and greater flow of water and debris across the Prairie Creek floodplain. The fencing will be removed once adequate vegetation is established.

Davison Mitigation Site Enhancement

The Davison Mitigation Site red alder stand (Figure 7) will be thinned using a similar variable density thinning prescription as described above and native shrubs and trees will be planted as needed. All felled trees will be lopped and scattered with chainsaws within the stand.

6. Logging Road and Log Landing Reconstruction, Maintenance and Removal

Road work will entail three steps: 1) road and log landing reconstruction, 2) multi-season road maintenance (if a specific road is to be utilized for more than one operating season) and, 3) road removal. Roads within the entire program area (i.e. Phase 1, 2, and 3 areas) have been inventoried and categorized based on landscape position, including inner gorge, midslope, and ridge (Figure 8). Inner gorge and midslope roads are the highest priority for removal. Log landings have not been inventoried or mapped. All log landings, however, will be located on existing sites and no new landings will be created. No landings will be larger than 0.25 of an acre. All attempts will be made to locate landings on existing roads to minimize ground disturbance.

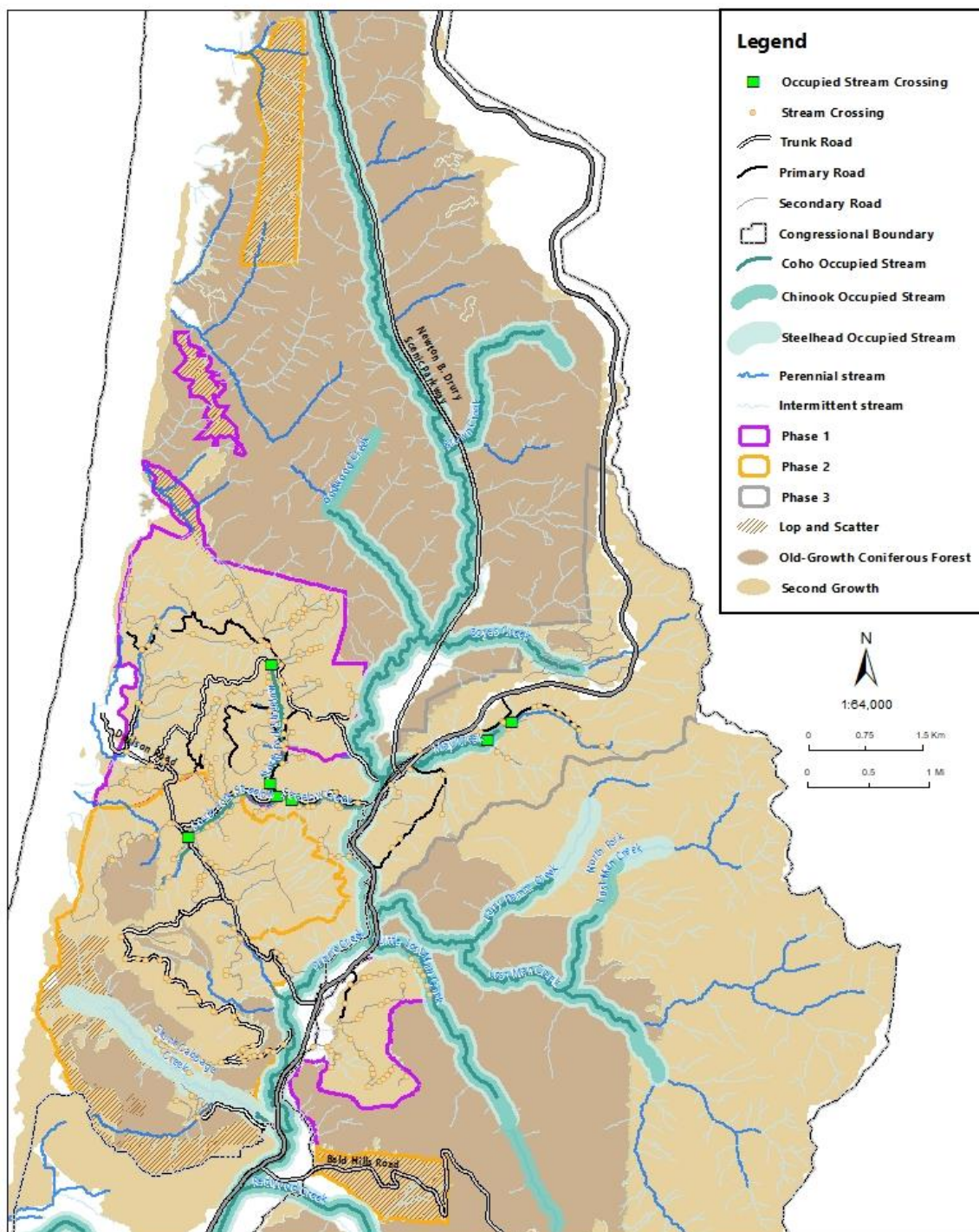


Figure 8. Road and stream crossing locations entire Greater Prairie Creek Ecosystem Restoration Program area.

A. Road and Log Landing Maintenance

Throughout the program area, abandoned and long-unmaintained haul roads, skid trails, and landings that will be utilized will require maintenance to provide access for forest and aquatic restoration activities (Figure 2, 6, and 8). Trees and brush that have grown in on the road surface will be removed with chainsaws, excavators and/or masticators and roads will be graded to provide proper drainage in these areas. The majority of road sections will only be reoccupied and used during one season. Multi-season road maintenance is described in the next section. Reopening old landings will be similar to opening old roads, brush and trees will be removed with chainsaws or excavators and minimal grading and possible second growth stump removal may occur.

Temporary road reconstruction will also include removal of stream crossing structures that are non-functional and replace them with temporary stream crossing structures (either culverts or temporary bridges) for access to forest restoration sites. Approximately 250 legacy stream crossings have been identified on haul roads in the program area on 52 miles of haul roads. Most of these crossings were constructed with fill or wood that interfere with streamflow and fish passage. These crossings have been eroding since their construction in the 1950s and 1960s, leading to severely degraded aquatic habitat conditions. Based on information collected on the inventoried crossings, the average crossing contains 1,500 cubic yards of fill requiring removal (ranging from 200 to 2,500 cubic yards per crossing; approximately 448,460 cubic yards total throughout the program area for roads inventoried to date; Table 6).

Table 6. Inventoried Stream Crossing Sites (see map for crossing locations Figure 8).

Watershed	Inventoried Roads			Road Not Inventoried (miles)	Total Miles
	Number of Crossings	Total Excavation Volume (cubic yards)	Inventoried Road (miles)		
May Creek	50	36,529	2.8	6.1	8.9
Berry Glen	52	77,411	2.3	1.9	4.2
North Fork Streelaw	181	173,539	10.6	6.4	17
Davison	34	23,887	2.2	0.5	2.7
Streelaw Headwaters	69	81,520	4.3	4.0	8.3
Skunk Cabbage	60	55,577	5.3	0.8	6.1
Gold Bluffs Beach	0	--	0	4.8	4.8
Total	446	448,463	27.5	24.5	52.0

Note:

--: not applicable

Old stream crossing structure removal and temporary stream crossing structure installation will be done with equipment like bulldozers and excavators. The equipment will dish the crossing out and the excavator will dig to the old structure and pull it from the stream course. The stream will be pumped around the work area if it is actively flowing during replacement activities. A new temporary stream crossing structure (a plastic pipe culvert or temporary bridge) will then be placed by the excavator along/across the stream course. The equipment will then backfill the removed material and the road bed will be re-graded.

B. Multi-Season Use Road Maintenance and Winterization

Main haul roads (designated in Figure 2 by purple lines) and log landings along main haul roads that will be utilized over multiple years will be winterized to prevent erosion. Winterization includes the following: grading exposed road and landing surfaces to allow water to freely drain across them without concentrating or ponding or rilling; installing rolling dips/drains to drain steeper sections of road; and clearing clogged drains where necessary to convey concentrated water across exposed road and landing surfaces. In addition, some native surface road segments will be covered in crushed rock to limit surface erosion. Weed free crushed rock will be brought into the site by dump trucks and spread with graders.

C. Road Removal

After forest thinning and aquatic restoration activities are complete, road removal will occur. Road removal is described as partial landform restoration and will involve complete removal of all haul roads, crossings and limited removal of the skid roads. Road removal entails removing fill from stream channels, excavating sidecast fill material, and restoring natural hillslope topography and drainage patterns to reduce the potential for sediment to erode and be deposited in streams. Landforms that existed prior to road construction would be recreated as much as is feasible. Stream crossings would be excavated to near original width, depth and slope to expose natural channel armor and uncover buried soils on original stream valley side slopes. Material excavated from the stream channels would be placed in stable locations away from streams. Road reaches between stream-crossings would be treated by excavating road fill from the outboard side of the road. Excavated material would be placed against the cut bank locally or, where the road bench or slopes are potentially unstable, moved to stable locations. All excavated material would be shaped to blend with the surrounding topography, recreating natural landforms and drainage patterns. The locations of proposed treatments are shown in Figure 8.

Work will be implemented with heavy equipment including excavators, bulldozers, loaders and dump trucks.

Wherever feasible, the organic and nutrient rich soil from excavated fill would be placed on the regraded surface to enhance recovery of native vegetation. Trees, shrubs, and other organic material removed from fill slopes during excavation would be stockpiled and spread over the finished surface. This would reduce surface erosion and provide habitat for seedlings, fungi, microorganisms, insects, birds, salamanders and small mammals.

D. Low-threat Roads

Roads with little to no threat of delivering sediment to streams would be minimally treated. Typically, these roads are on ridges or gentle slopes where erosion potentials are minimal or nonexistent. Some of these roads may be maintained for administrative purposes. Roads determined not to be needed would be closed and treated to improve drainage to ensure that they are not contributing sediment to aquatic systems (Figure 8).

7. *Measures to Minimize Impacts to Listed Species*

A. Marbled Murrelet

- Any above-ambient background noise producing work using heavy equipment, trucks, and/or chainsaws occurring within 500 feet to 0.25 miles of suitable marbled murrelet breeding habitat (Figure 2) will be restricted to between two hours after sunrise to two hours before sunset during the marbled murrelet noise restriction period (24 March to 15 September) in order to minimize disturbance. Generally, back-up warning signals on heavy equipment, or different types of equipment operating simultaneously, would result in a 0.25 mile noise disturbance buffer. Chainsaws and other motorized equipment would result in a 500-foot noise disturbance buffer.
- No trees with the potential to provide a nesting opportunity will be removed by program activities.
- Contractors and RNSP staff working in the program area will pack out all food scraps and trash, including fruit cores and peels and other uneaten food items, to ensure that corvids and other murrelet predators are not increasingly attracted to the vicinity of suitable marbled murrelet habitat during and upon completion of project work.
- All lop and scatter tree felling work will occur outside of the marbled murrelet noise restriction period (24 March to 15 September) within 500 feet of suitable marbled murrelet nesting habitat.
- All heavy equipment and trucks operating within the project area will be equipped with “white noise” backup warning signals that project sound over shorter distances than do standard warning signals.
- Forest restoration, road use and road removal will be geographically located to minimize noise disturbance to any given marbled murrelet nesting habitat area to one or as few nesting seasons as is practicable given the limitations of the existing program area road network.

B. Spotted Owl

- Suitable spotted owl nesting and roosting habitat occurs throughout and immediately adjacent to the program area. Spotted owl surveys using methods in the established protocol (USFWS 2011) will be conducted throughout the program and adjacent areas to locate a potential spotted owl activity center and determine if owls are reproductive. If evidence of nesting is observed or reproductive status cannot be determined, consultation

would be reinitiated as necessary to determine appropriate work restrictions.

- All habitat will retain pre-treatment functionality post-treatment.
- A very limited number of trees >30 inches DBH will be felled – only exotic species or trees located directly on a re-occupied road.
- All snags and logs will be retained that don't pose a threat to worker safety to maintain prey habitat.
- Forest canopy will average at least 60% over forest restoration units.
- All tree top and limb slash will be left on site in ground based and cable yarding units to enhance terrestrial prey habitat.
- Trees with broken tops, multiple tops, cavities and lateral branch sprays (potential future nest trees and prey habitat trees) will be preferentially retained.

C. Humboldt Marten

- A very limited number of trees >30 inches DBH will be felled – only exotic species or trees located directly on a re-occupied road.
- All snags and logs will be retained on site to maintain prey habitat that don't pose a threat to worker safety.
- Forest canopy will average at least 60% over forest restoration units.
- All tree top and limb slash will be left on site in ground based and cable yarding units to enhance terrestrial prey habitat and marten cover.
- Trees with broken tops and cavities (potential future den trees and prey habitat trees) will be preferentially retained.

8. Annual Post Project Reporting

Post project annual reporting to the USFWS will include:

- Locations and time of maintenance, use and removal of temporary roads.
- Locations, acres, and timing of forest thinning.
- Acres of suitable marbled murrelet nesting habitat potentially disturbed by above ambient noise produced by program activities.

9. Minor Variance Process

Because of the wide range of proposed activities and the natural variability within and between program areas, some program actions may require minor variations from those previously described in the proposed action. Best management practices will always be implemented. The following variance process will be used when the variance provides equal or greater conservation benefit, and does not result in effects that were not analyzed during consultation. Minor variance requests will be documented as part of the pre-project notification process and include the following information:

1. describe the restoration activity and the design feature that needs variance
2. define the requested variance

3. explain why the variance is necessary
4. provide a rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects

Variances that do not result in an effect to listed species (i.e., following or not following a minimization measure would have no effect positive or negative) will be documented in the annual verification reporting.

V. STATUS AND DISTRIBUTION OF LISTED SPECIES

Please refer to *Threatened, Endangered, Proposed, and Candidate Species in Redwood National and State Parks, Biological Assessment Reference Document* (RNSP 2013) for general in depth species accounts, habitat status backgrounds, and literature summaries. Information specific to the action area is summarized below:

A. Marbled Murrelet (*Brachyramphus marmoratus*)

1. Species Account

During marbled murrelet surveys in 1996 and 1997, conducted by personnel from the US Forest Service PSW research station, Redwood Sciences Laboratory, both “presence” and “occupied behavior” were documented at some of the highest levels ever recorded near the large contiguous blocks of suitable nesting habitat north and east of the program area (USFS unpub. data). Hebert and Golightly (2006) found individual marbled murrelet nests using radio telemetry in the large contiguous block of habitat immediately to the east of the program area as well as in two of the isolated stands of old growth within the program area. Signs of marbled murrelet nesting (egg shell fragments found on the forest floor) have also been recorded in both of the large contiguous blocks of habitat north and east of the program area as well as one of the isolated old growth stands within the program area over the past 10 years (RNSP unpublished data). Marbled murrelet surveys are conducted every breeding season in Boyes (Elk) Prairie and the adjacent old growth forest as part of a yearly training program for regional agencies and companies conducted by private contractors under an existing park commercial use permit. Nesting behavior is recorded every season in relatively large numbers (S. McAlister pers. comm.). Boyes (Elk) Prairie and the surrounding suitable old growth forest is located immediately to the north of the program area. It is assumed that all suitable nesting marbled murrelet habitat within and adjacent to the program area is occupied by murrelets during the breeding season (24 March – 15 September).

2. Habitat Status

Suitable marbled murrelet nesting habitat occurs as large contiguous blocks of old growth forest immediately to the north and east of the program area. Seven isolated stands of old growth are found within the program area (Figure 2). One thousand one hundred and sixteen acres of suitable marbled murrelet nesting habitat is within the program area (the seven isolated old

growth stands) and 3,406 acres are within 0.25 miles of the program area.

A subset of that suitable murrelet nesting habitat is also designated critical habitat along the northern end of the main block of the program area in Prairie Creek Redwoods State Park and also surrounding two isolated second growth stands within the program area within the state park itself (Prairie Creek North and Gold Bluffs Beach C units) (Figure 2). There are 1,995 acres of critical habitat within 0.25 miles of the program area.

B. Spotted Owl (*Strix occidentalis*)

1. Species Account

Four spotted owl activity centers have been found within the program area or action area. All were last occupied between 1992 and 1995. No spotted owls were detected during various inventory surveys on the within a mile of the action area between 1995 and 2014. Only barred owls (*Strix varia*) were detected during any of those surveys within the action area (RNSP 2015). The most recent spotted owl inventory surveys, conducted in 2018, detected no spotted owls in the entire Phase One area. Barred owls, however, were detected on 16 different survey nights in approximately six locations throughout the Phase One area (Stauffer 2018).

2. Habitat Status

The entire program area is suitable spotted owl nesting, roosting and foraging habitat. There are approximately 8,641 acres of >40 year old second growth (defined as suitable nesting and roosting habitat in RNSP) and 1,116 acres of isolated old growth stands within the program area. The second growth forest habitat is of lower quality overall, however, due to high stand density, relatively smaller tree size and structural diversity and low overall canopy height heterogeneity. Suitable nesting structures are assumed to be limited. Crown volume is also limited and canopy cover is high resulting in little light penetration to the forest floor and little to no understory growth (RNP 2016). These conditions produce low prey densities (Zabel et al. 1995). All of the old growth forest in the action area to the north, east and south of the program area and the isolated old growth stands within the program area is high quality suitable nesting, roosting and foraging habitat (Figure 2).

C. Humboldt Marten (*Martes caurina humboldtensis*)

1. Species Account

Humboldt martens have never been detected in the program or action area. Inventory surveys conducted in 2001 – 2002 inside the action area and within two miles of the action area to the east and north of the program area found no sign of martens (Slauson et al. 2003). Martens were detected approximately four miles to the north and east of the action area within Prairie Creek Redwoods State Parks in 2012. Single martens were detected multiple times between 2012 and 2017. Three different martens were detected simultaneously in 2018 in the same area as the single marten detections (CDPR unpub. data).

2. Habitat Status

Humboldt marten habitat consists of stands of old growth, conifer dominated forests with dense shrub layers and high proportions of large snags and logs (Slauson et al. 2007). All of the old growth forest in the action area to the north, east and south of the program area is high quality suitable denning and foraging habitat as are the seven isolated old growth stands within the program area (Figure 2). The forest restoration units may contain some low quality suitable denning habitat where there are sufficient old growth logs, stumps and snags with sufficiently sized cavities. These structures are scattered in low densities throughout the treatment units and may be too sparse to create suitable habitat. Generally, however, almost all of the second growth stands within the program area are not suitable denning habitat due to a lack of sufficiently large snags, logs, or dense shrub layer (RNP 2016).

VI. IMPACTS TO THREATENED AND ENDANGERED SPECIES

A. Marbled Murrelet

1. Indirect Effects

a. Noise Disturbance

This program could affect marbled murrelets due to noise disturbance from chainsaw use, heavy equipment operation, logging truck operation and vehicle and heavy equipment access to work sites during the breeding season. Anthropogenic noise may affect birds in a number of ways that include inducing stress and fright-flight responses, negatively impacting reproductive success, and interfering with the ability to hear predators. Noise above ambient background in or adjacent to suitable habitat also may cause a nesting adult to move off the nest exposing the egg to an increased level of predation and could disrupt chick feeding attempts by the adult, resulting in aborted attempts.

Depending on the type of equipment in use at any given time, program activities could create above-ambient background noise levels within suitable habitat that is within 0.25 miles of the action area. It is possible that different types of equipment would be operating simultaneously, thus, compounding the machinery decibel output. It is assumed that suitable nesting habitat in or near the program area is occupied by marbled murrelets.

Noise disturbance will occur over the entire 10 to 15 years the program is expected last, depending on where equipment is operating in proximity to suitable nesting habitat during any given year. A worse-case-scenario maximum extent noise model was developed to determine how much suitable nesting habitat would be disturbed over a single breeding season, two breeding seasons all the way up to a maximum of six breeding seasons (Table 6 and Figure 9). It is expected that the actual noise disturbance area will be less than modeled due to timing and equipment minimization measures.

Table 7. Acres of suitable marbled murrelet breeding habitat disturbed by above ambient noise over one or multiple breeding seasons from program activities across the entire Greater Prairie Creek Ecosystem Restoration Program area.

Acres Disturbed					
One Season	Two Seasons	Three Seasons	Four Seasons	Five Seasons	Six Seasons
1,185	974	414	126	41	20

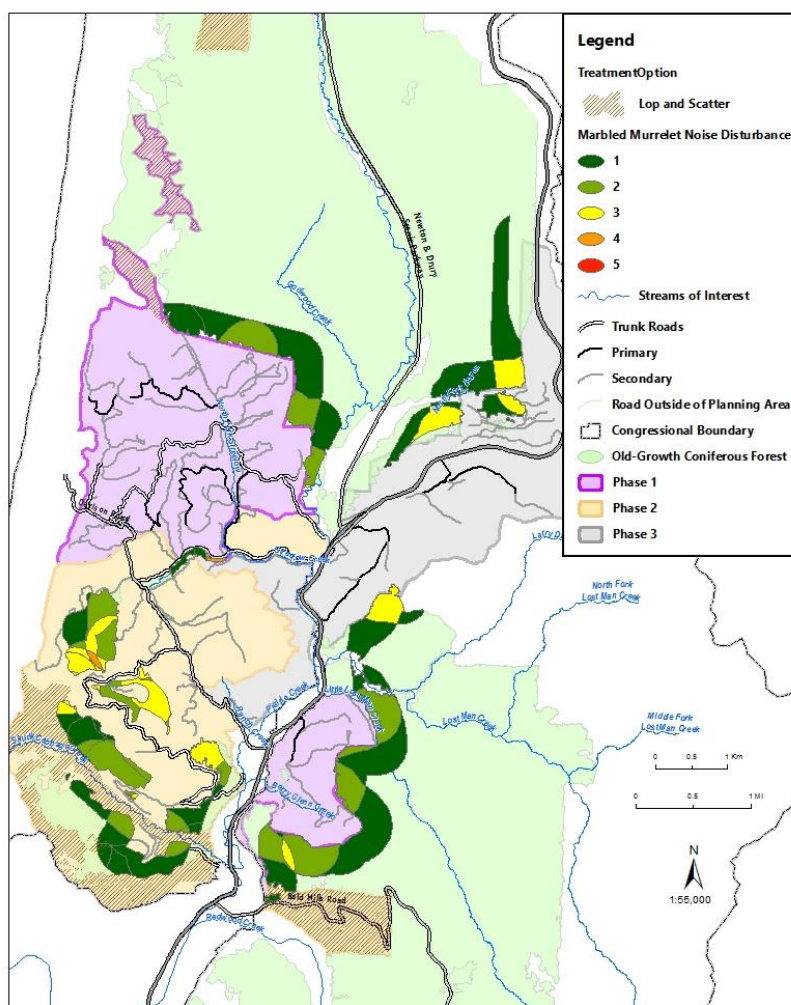


Figure 9. Map of marbled murrelet noise disturbance model within the Greater Prairie Creek Ecosystem Restoration Program area. Numbers in legend and green to red colored polygons correspond to the number of years a given suitable marbled murrelet breeding habitat area will experience noise disturbance above ambient levels.

The total amount of habitat that may be potentially impacted equals approximately 4% of the suitable marbled murrelet nesting habitat within all of RNSP.

Implementing a daily work restriction period, including access to the work sites, between 2 hrs after sunrise to 2 hrs before sunset should minimize disturbance during times of peak murrelet activity (dawn and dusk).

b. Increased Predation

Road removal proposed by this program could indirectly impact nesting marbled murrelets by reducing protective vegetation near potential nest sites that may act as a screen that deters predator access. Program activities could indirectly influence corvid behavior and activity when openings in the landscape are created that cause food-producing shrubs or trees to become established in the vicinity of old growth stands and residual old growth trees. These openings may enhance “edge effects” as described in the corvid/nest predation literature. A number of studies in Oregon and Washington (cited in McShane *et al.* 2004) found Steller’s jays (*Cyanocitta stelleri*) to be most abundant along forest edges bordered by early seral vegetation with berry-producing shrubs. Other studies indicate that the type of edge plays a role in predation rates; rates were lower near feathered edges or natural edges compared to abrupt edges (McShane *et al.* 2004). Nelson and Hamer (1995) found that successful murrelet nests were a mean of 545 ft and a minimum of 180 ft away from a forest edge, defined in their study as “unnatural openings, including...roads and clearcuts”. All nests that failed because of predation were located within 210 ft of an edge.

Various logging road corridors segments will be opened up for use and then removed after use. Re-opening these areas by removing trees from the cut and fill slopes would increase the size of the disturbed area, creating additional edge and area for shrub growth. This vegetation could in turn attract an increased number of Steller’s jays, as well as allow for higher than usual numbers of jays to persist, perhaps for a longer period than otherwise, in the program area and adjacent suitable marbled murrelet nesting habitat. The combined area of the disturbance polygons plus a 50 m (164 ft)-wide buffer, contiguous with the entire edge of the disturbance polygons (referred to in previous park documents as the “zone of increased predation threat”), was used as the area that could potentially attract an increased number of corvids, particularly Steller’s jays, thus increasing the potential for predation on murrelet eggs or chicks. All old growth falling within the 50 m buffer along the proposed road removal corridors were included in the calculation of effects. By this method it was **determined that a total of 115 acres of suitable nesting habitat could potentially be impacted by increased corvid activity post-program.**

2. Loss and Modification of Suitable Habitat

Second growth forest restoration activities immediately adjacent to old growth stands along the edges and within the program area (Figure 2) may temporarily degrade suitable murrelet nesting habitat over the short term but improve nesting habitat quality and quantity over the medium and long term. Thinned stands will retain at least a 60% canopy cover and all dominant trees. Forest inventory data conducted throughout the program area showed that no second growth trees are ½ the site potential in height (1/2 site potential = 180 ft. tall) and that the vast majority of the trees

targeted to be thinned are <120 feet tall (RNP 2016). Very few second growth trees that will be targeted for removal and that are located immediately adjacent to old growth stands extend to the level of suitable nest platforms. It is expected, however, that some negligible amount of nest cover may be degraded. The habitat degradation will be short term. Tree growth rate in thinned stands, including height and canopy spread, is expected to increase post treatment. Increased tree growth will mean that more potentially suitable murrelet nest platforms will be hidden by adjacent tree cover, thus improving habitat quality more quickly than if the second growth stands were left untreated. This increased rate of habitat quality and quantity recovery due to restoration activities is expected to last decades or even centuries. It is difficult to estimate the habitat improvement quantitatively, however, because second growth tree canopy development in relation to the spatial arrangement of suitable murrelet nest platforms in adjacent old growth trees is unknown.

3. Critical Habitat

Marbled murrelet critical habitat borders many of the units on the northern end of the main block of the program area and surround the Gold Bluffs C and Prairie Creek North units in Prairie Creek Redwoods State Park (Figure 2 and Figure 7). Critical habitat primary constituent elements include trees of ½-site potential tree height (approximately 180 feet tall in the program area) occurring within 0.5 mi of large trees with potential nest platforms. A forest inventory was done of every forest restoration unit within the program area (RNP 2016). The average and standard deviation large tree height (trees that could potentially be felled during restoration thinning activities) in every unit is below 180 feet in height. In all units but two, even the tallest trees inventoried are below 180 feet in height. The two units that do have trees taller than 180 feet (Prairie Creek North and a small area in the May Creek units area) (Figure 2) contain a few dozen residual old growth trees. These trees will not be felled. Therefore, primary constituent elements of marbled murrelet critical habitat will not be impacted.

B. Spotted Owl

1. Direct and Indirect Effects

Spotted owl protocol surveys will be conducted throughout the action area for the life of the program. The first season of the current survey effort found no spotted owls in Phase 1 of the program area (Stauffer 2018) and no spotted owls have been detected historically within the action area since 1995 (RNSP 2015). Additionally, past long term monitoring of spotted owls throughout RNSP has showed that barred owls occupied many areas of the parks in relatively high densities and spotted owls may be restricted to one activity center in the far southeastern portion of Redwood National Park, about 15 miles from the action area (RNSP 2015). The chance of a reproductive spotted owl pair and their young occurring within the program area and being affected by restoration activities, therefore, is assumed to be negligible. If there is a reproductive spotted owl pair detected, then the parks will reinitiate consultation with the USFWS.

2. Loss and Modification of Suitable Habitat

The Greater Prairie Creek Ecosystem Restoration Program is likely to cause temporary, minor modification but medium and long term improvement of potentially suitable spotted owl nesting, roosting and foraging habitat throughout the forest restoration units of the program area (Figure 2 and 7). Canopy cover will be temporarily reduced to 60% across forest restoration units. This canopy cover level is still suitable for spotted owl nesting, roosting and foraging. Canopy cover should increase to over 80% in the first 10 to 20 years based on monitoring data collected in similarly treated stands in the Lost Man Creek area of Redwood National Park (RNP unpub. data). The forest restoration units within the program area are currently lower quality habitat due to high stand density and associated tree and stand conditions such as trees lacking structures suitable for nesting, lack of a developed understory, and a deficit of prey habitat structures like log and snags. Post thinning, retained trees will gain size, height, crown volume, canopy spread, and canopy heterogeneity more quickly than if left untreated. The variable density thinning prescription will result in stands with considerably more structural heterogeneity, increasing habitat quality. Prey density is expected to increase as greater light penetration to the forest floor increases shrub component (prey food) quantity and quality. Over the short and medium term, the slash in yarding units or lopped and scattered trees will create abundant terrestrial prey cover habitat as compared to current conditions. Finally, the treated stands will have lower bole densities as compared to pre-treatment and should enhance foraging space for owls.

C. Humboldt Marten

1. Direct and Indirect Effects

To date, only one to three individual martens have been detected at survey stations within RNSP. It is unknown how many total individuals these detections represent. All of the detections have occurred approximately four miles north of the main program action area (exclusive of PC North) within the large old growth forest block of Prairie Creek Redwoods State Park. No detections have occurred in any second growth stands within the parks. The second growth stands to be treated as part of the forest restoration activities and road removal activities occurring in the same locations are unsuitable habitat for martens. These two facts make the probability highly unlikely that a marten will be within the program area and thus affected by restoration activities.

2. Loss and Modification of Suitable Habitat

Restoration activities are likely to cause long term improvement of potentially suitable marten denning and foraging habitat throughout the second growth forest restoration units of the program area (Figure 2 and 7). The forest restoration units within the program area are currently low quality habitat due to high stand density and little to no understory cover. Post thinning, retained trees will gain size, height, crown volume, canopy spread, and canopy heterogeneity more quickly than if left untreated. The variable density thinning prescription will result in stands with considerably more structural heterogeneity as well, increasing habitat quality. Over

the short and medium term, the slash (in yarding units) or lopped and scatter trees will create abundant terrestrial prey habitat as compared to current conditions. A key habitat component for martens, high shrub cover, is expected to increase as greater light penetration to the forest floor increases shrub quantity and quality. This effect will also increase prey density because food for songbirds and small mammals should increase in quantity and quality as well.

D. Cumulative Effects

Cumulative effects are those state and private actions in the action area that may occur in the future that have the potential to impact listed species in the park. State park actions are analyzed in this assessment.

There are only relatively small inholdings (< 5 acres) of private land within or near the action area. No alterations to those lands are expected that could impact listed species. The rest of the action area is surrounded by RNSP lands.

VII. DETERMINATION

Based on the nature and timing of the proposed action, it is the determination of the NPS that the Greater Prairie Creek Ecosystem Restoration Program in Redwood National and State Parks:

may affect, and is likely to adversely affect, the marbled murrelet due to noise disturbance;

may affect, but is not likely to adversely affect, the northern spotted owl due to short term, temporary habitat modification;

may affect, but is not likely to adversely affect, the Humboldt marten due to short term, temporary habitat modification.

VIII. MANAGEMENT RECOMMENDATIONS

There are no management recommendations.

IX. CONTRIBUTORS

Bensen, Keith. General analysis and document compilation. Fish and Wildlife Biologist. Redwood National Park.

Leonard, Lathrop. Maps and GIS analysis, forest stand data. Forester. Northcoast Redwoods District, California Department of Parks and Recreation.

Ozaki, Vicki. Aquatic restoration data. Geologist. Redwood National Park.

Teraoka, Jason. Maps and GIS analysis, forest stand data. Forester. Redwood National Park.

Transou, Amber. General analysis. Supervisory Ecologist. Northcoast Redwoods District, California Department of Parks and Recreation.

Wartella, Judy. Maps and GIS analysis, Geographic Information System Specialist. Redwood National Park.

Youngblood, Neal. Maps, GIS analysis, road removal data. Geologist, Redwood National Park.

X. LITERATURE CITED

Hebert, P.N. and R.T. Golightly. 2006. Movements, nesting, and response to anthropogenic disturbance of Marbled Murrelets (*Brachramphus marmoratus*) in Redwood National and State Parks. Unpublished report, Department of Wildlife, Humboldt State University, Arcata, California and California Department of Fish and Game Report 2006-2, Sacramento, California.

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpub. Rept. EDAW, Inc. Seattle, WA. Prepared for the U.S. Fish and Wildlife Service, Region1, Portland, OR.

Nelson, S.K. and T.E. Hamer. 1995. Nest Success and the Effects of Predation on Marbled Murrelets. In: Ecology and Conservation of the Marbled Murrelet. C. Ralph, G. Hunt, M. Raphael, J. Piatt. Gen. Tech. Rep. PSW-GTR-152. Albany, CA. pp. 89-98.

[NPS] National Park Service. 2008. A Biological Assessment of Impacts to Terrestrial Threatened and Endangered Species from the South Fork Lost Man Creek Second Growth Forest Management Plan in Redwood National Park. Unpub. report. Redwood National and State Parks. Orick, CA. 58 pp.

[NPS] National Park Service. 2012. A Biological Assessment of Impacts to Terrestrial Threatened and Endangered Species from the Middle Fork Lost Man Creek Second Growth Forest Management Plan in Redwood National Park. Unpub. report. Redwood National and State Parks. Orick, CA. 64 pp.

[RNP] Redwood National Park. 2016. Lower Prairie Creek Forest Inventory – 2016 Report. Unpub. report on file at South Operations Center, Redwood National and State Park, Orick, CA. 129 pp.

[Redwood National and State Parks] Redwood National and State Parks. 2015. Northern Spotted Owl Surveys in Redwood National and State Parks 2013 -2014. Unpub. report on file at South Operations Center, Redwood National and State Park, Orick, CA. 15 pp.

Slauson, K.M. and W.J. Zielinski. 2007. The relationship between the understory shrub component of coastal forests and the conservation of forest carnivores. Gen. Tech. Rep. PSW-GTR-194. Berkeley, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: 241-243.

Slauson, K.M., W.J. Zielinski, G.W. Holm. 2003. Distribution and Habitat Associations of Humboldt marten (*Martes Americana humboldtensis*) and Pacific fisher (*Martes pennant pacifica*) in Redwood National and State Parks. Unpub. report on file at South Operations Center, Redwood National and State Park, Orick, CA. 29 pp.

Stauffer, J.R. 2018. Northern Spotted Owl Survey Report, 2018, Greater Prairie Creek Restoration Project, Redwood National and State Parks. Unpub. report on file at South Operations Center, Redwood National and State Park, Orick, CA. 13 pp.

[USFWS] US Fish and Wildlife Service. 2011. Protocol for surveying proposed management activities that may impact northern spotted owls. February 2, 2011; 42 + iii pp.

Zabel, C.J., K. McKelvey and J.P. Ward. 1995. Influence of primary prey on home range size and habitat-use patterns of northern spotted owls (*Strix occidentalis caurina*). Canadian Journal of Zoology. 73(3): 433-439. <https://doi.org/10.1139/10.11/z95-049>.

Personal Communications

McAlister, Sean. Biologist. Mad River Biologists.