6.6 Wildlife and Wildlife Habitat

6.6.1 Affected Environment and Environmental Setting

Regional Setting

Placing redwood and associated codominant tree species such as Douglas-fir into a regional context helps in the identification of conservation opportunities and priorities at considerably larger scales than has been done historically. Several efforts to identify ecological regions and capture the distributional limits of these forest types have occurred; the actual boundaries being driven by the varying objectives of the efforts.

The World Wildlife Fund (WWF) (Ricketts et al. 1999) sought to compare conservation assessments for 116 ecoregions in the United States and Canada and placed redwood and associates into the Northern California Coastal Forests Ecoregion (http://www.worldwildlife.org/wildworld/profiles/terrestrial_na.html). This ecoregion designation ranked high in comparison with others in the U.S. and Canada as a result of its high biomass, forest structural complexity and unique ecological qualities. The northern boundary was determined by the northernmost extent of coast redwoods. There is also approximate congruence with Bailey's Northern California Coast Section (263A), which is broader towards the north and does not include the Redwood areas south of San Francisco Bay. The ecoregion generally corresponds to Küchler's vegetation classes, Redwood Forest, Mixed Evergreen Forest with Rhododendron, and Coastal Prairie and Coastal Scrub.

The redwood region also has been described by Noss (2000) based primarily on the distribution of the redwood species, for a paper on redwood biology and ecology. He notes that the issues related to the conservation of redwood are complex and differ significantly across the ecoregion. Socioeconomic factors and local attitudes concerning redwood conservation and management are likewise different across the northern, central and southern portions of the redwood distribution in California.

Similarly, the USFS identified the Northern California Coast Ecological Subregion as an area located along coastal California of approximately 4,600 mi^2 (11,900 km^2) that ranges in elevation from sea level to 3,000 ft (0-912 m) (Figure VII. 6.6.1). (http://www.fs.fed.us/r5/projects/ecoregions/). The ecological components of the subregion are largely influenced by persistently moist, maritime climate conditions that are maintained by Pacific storms in the winter and coastal fogs in the summer. Cool temperatures and wet conditions characterize the winter and much of the spring and fall, and cool, sunny conditions with intermittent fog characterize the summer months.

The JDSF EIR considers these or other regional scale landscapes depending on the issue or resource examined and the availability of data for analysis.

Regional Extent of Wildlife Habitats

The regional extent of wildlife habitats for JDSF relative to the approximately 7-million-acre Klamath/North Coast Bioregion (Figure VII.6.6.1) and Mendocino County was determined by overlaying the Multi-source Land Cover Data (FRAPVEG) and Management Landscape GIS coverages developed for the 2003 FRAP Assessment with current ownership, and the JDSF 2004 vegetation layer (Tables VII.6.6.1 and VI.6.6.2; Figures VII.6.6.1.1, VII.6.6.1.2, and VII.6.6.1.3). All of the analyses involving vegetation found on the JDSF were done using the JDSF vegetation layer, whereas vegetation outside JDSF is derived from the FRAPVEG multi-source vegetation coverage. The FRAPVEG coverage uses the California Wildlife Habitat Relationship (CWHR) habitat classification system as a standard (Mayer and Laudenslayer 1988). The JDSF vegetation layer also uses a CWHR classification scheme; however there are difficulties associated with making a direct mapping comparison between the two. For example, differing mapping /classification methodologies and the scale differences between the two vegetation layers can be problematic. These include errors inherent in mixed-scale analysis, that lead to difficulties with the identification of inclusions of less common vegetation types into larger mapped areas of more common types. In addition, thematic inclusions of type/size combinations into more generalized multi-typed classes due to differences in mapping methodologies also can confound direct comparisons. Both of these kinds of errors can lead to (a) a relative over representation of spatially rare types on JDSF due to the finer scale mapping effort conducted or (b) a relative under representation of spatially rare types outside of JDSF due to the coarse scale of mapping effort conducted. [1]

Regional Biological Diversity in Predominant Forest Types

Species richness (the number of species present in an area) in contrast to species diversity (number of species and their relative abundance) provides one basic description of biological diversity. Species richness is typically greatest in those areas where a mosaic of stages of forest development is found since edge effects are high and species with a preference for a particular forest stage coincide. The richness metric must be interpreted with caution however since species preferring forest interior conditions may be negatively affected by patch size in the mosaic and higher numbers of species of concern are typically found in late stages of forest development.

Species richness is affected by changes in forest type, tree size and density. This relationship is illustrated for the redwood forest type (Figure VII.6.6.2) but is also very similar to that for Douglas-fir and Montane Hardwood Conifer forest types. Species richness is typically highest in the sparse and open levels of canopy closure (10-39%) in all size classes.

[1] The mapping methodologies for FRAPVEG are detailed in the FRAPVEG documentation (http://frap.cdf.ca.gov/projects/frap_veg/methods/Methods_Development_Habitat_Data_02_2.pdf

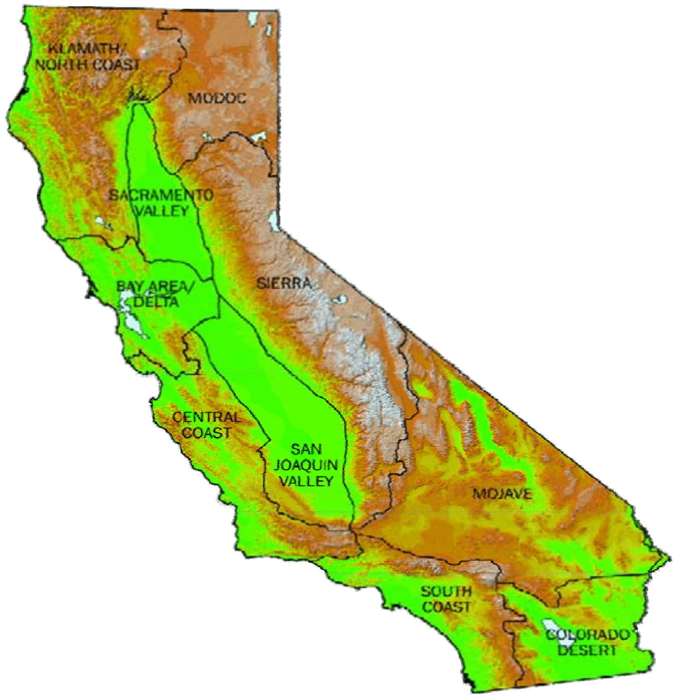


Figure VII.6.6.1. Location of Klamath/North Coast Bioregion.

Table VII.6.6.1. Percent CWHR type, size and density for types found on JDSF and relative to the Klamath/North Coast Bioregion.

CWHR Type	CWHR Size	CWHR Density	Percent of Regional Acres in JDSF	Acres in JDSF	Percent of Region	Acres in Region
AGS			0	48	16%	1,103,955
BAR			0	9	2%	121,570
CPC	U	U	77.6	13	<1%	17
CPC	1				<1%	19
CPC	2	D	18	120	<1%	668
CPC	2	M	0.7	30	<1%	4,060
CPC	2	P	0.7	49	<1%	6,655
CPC	2	S	14.2	37	<1%	259
CPC	3	_			<1%	7
CPC	3	D	0.3	51	<1%	15,565
CPC	3	M	0.1	25	<1%	19,901
CPC	3	P	0.7	72	<1%	9,682
CPC	3	S	23	185	<1%	807
CPC	4	D	5.7	302	<1%	5,315
CPC	4	M	1.1	103	<1%	9,161
CPC	4	P	3	187	<1%	6,292
CPC	4	S	28.9	43	<1%	149
CPC	5	D			<1%	6,859
CPC	5	M			<1%	15,422
CPC	5	P			<1%	7,712
CPC	5	S			<1%	189
CPC	6	D	100	59	<1%	59

Table VII.6.6.1. Percent CWHR type, size and density for types found on JDSF and relative to the Klamath/North Coast Bioregion.

CWHR Type	CWHR Size	CWHR Density	Percent of Regional Acres in JDSF	Acres in JDSF	Percent of Region	Acres in Region
DFR	U	_			<1%	5
DFR	U	D			<1%	8,267
DFR	U	M			<1%	2,365
DFR	U	P			<1%	1,278
DFR	U	S			<1%	262
DFR	1	_			<1%	166
DFR	1	D			<1%	9,271
DFR	1	M			<1%	4,371
DFR	1	P			<1%	2,338
DFR	1	S			<1%	124
DFR	2	_			<1%	32
DFR	2	D	0	26	1%	55,062
DFR	2	M	0.1	28	<1%	25,551
DFR	2	P			<1%	11,223
DFR	2	S	0.1	9	<1%	7,128
DFR	3	D	0	14	4%	309,285
DFR	3	M			1%	65,208
DFR	3	P	0	2	<1%	24,343
DFR	3	S			<1%	21,742
DFR	4	D	1.4	8979	9%	649,128
DFR	4	M	1.4	1338	1%	97,421
DFR	4	P	4	1271	<1%	31,758
DFR	4	S	0.1	11	<1%	17,171
DFR	5	_			<1%	17
DFR	5	D			14%	979,477
DFR	5	M	0.5	351	1%	75,380
DFR	5	P	0.3	86	<1%	31,816
DFR	5	S	0.1	40	<1%	28,718
DFR	6	D	0.5	1841	6%	389,350
FEW			0.4	9	<1%	2,263
MCH	U	U	100	77	<1%	77
MCH	2	S			<1%	16,229
MCH	3	D			1%	74,499
MCH	4	D			10%	693,859
MHC	U	U			<1%	3,487
MHC	1	D	100	33	<1%	33
MHC	2	D	0.1	18	<1%	18,167
MHC	2	M			<1%	5,266
MHC	2	P			<1%	9,012
MHC	2	S			<1%	2
MHC	3	D	0	3	2%	157,283
MHC	3	M			<1%	29,315
MHC	3	P	0	5	<1%	33,213
MHC	3	S			<1%	12
MHC	4	D	0.4	1167	4%	301,535
MHC	4	M	0.5	109	<1%	21,647
MHC	4	P	1.2	181	<1%	14,744
MHC	4	S	53.3	11	<1%	21
MHC	5	D			<1%	8,391
MHC	5	M			<1%	7,344

Table VII.6.6.1. Percent CWHR type, size and density for types found on JDSF and relative to the Klamath/North Coast Bioregion.

CWHR Type	CWHR Size	CWHR Density	Percent of Regional Acres in JDSF	Acres in JDSF	Percent of Region	Acres in Region
MHC	5	P			<1%	15,557
MHC	5	S	100	43	<1%	43
MHC	6	D	0.2	317	3%	191,171
MRI	U	U			<1%	119
MRI	2	D			<1%	1,050
MRI	2	M			<1%	1,273
MRI	2	P			<1%	7,365
MRI	2	S			<1%	1,571
MRI	3	D			<1%	29,568
MRI	3	M			<1%	6,563
MRI	3	P			<1%	6,598
MRI	3	S			<1%	8,705
MRI	4	D			<1%	12,360
MRI	4	M			<1%	5,987
MRI	4	P			<1%	5,367
MRI	4	S			<1%	5,867
MRI	5	D			<1%	64
MRI	5	M			<1%	2
MRI	5	P			<1%	5
MRI	5	S			<1%	5
MRI	6	D	100	9	<1%	9
RDW	U	U			<1%	869
RDW	1	M	100	25	<1%	42
RDW	2	D	1.6	679	1%	42,863
RDW	2	M	4.3	695	<1%	16,036
RDW	2	P	1.9	72	<1%	3,835
RDW	2	S	0.2	7	<1%	4,162
RDW	3	D	0.2	322	2%	137,886
RDW	3	M	3.6	599	<1%	16,563
RDW	3	P	1.6	92	<1%	5,796
RDW	3	S	1.2	108	<1%	9,178
RDW	4	D	6.6	11349	2%	171,703
RDW	4	M	18.2	2909	<1%	16,014
RDW	4	P	5.3	325	<1%	6,114
RDW	4	S	3.1	224	<1%	7,292
RDW	5	D			5%	338,488
RDW	5	M	3.7	1265	<1%	33,885
RDW	5	P	2.6	385	<1%	14,711
RDW	5	S	2.1	416	<1%	19,879
RDW	6	D	7.9	11833	2%	149,046
URB		_	0	35	2%	123,631

Table VII.6.6.1.1. CWHR vegetation codes.

CWHR Code	Description
AGS	Annual Grass
BAR	Barren
CPC	Closed Cone Pine - Cypress
DFR	Douglas-fir
FEW	Freshwater Emergent Wetland
MCH	Mixed Chaparral
MHC	Montane Hardwood Conifer
MRI	Montane Riparian
RDW	Redwood
URB	Urban

Table VII.6.6.1.2. CWHR density.

CWHR Density	% Canopy Closure Range
S—Sparse Cover	10 to 24.9 percent
P—Open Cover	25 to 39.9 percent
M—Moderate Cover	40 to 59.9 percent
D—Dense Cover	>60 percent
U—Unknown	

Table VII.6.6.1.3. CWHR size codes.

CWHR Size	Size Class	Diameter at Breast Height (DBH)
1	Seedling	Less Than 1 inch
2	Sapling	1 to 6 inches
3	Pole	6 to 11 inches
4	Small Tree	11 to 24 inches
5	Medium/Large Tree	Greater Than 24 inches
6	Multi-Layered	Size 5 Over Size 4 Or 3; Total Tree Crown Closure Greater Than 60 percent
U	Unknown	

Table VII.6.6.2. Percent CWHR type, size and density for types found on JDSF relative to Mendocino County.

CWHR type	CWHR size	CWHR density	Percent of County Acres in JDSF	Acres in JDSF	Percent of County	Acres in County
AGS			0	48	18.9	284,479
BAR			0.1	9	0.8	11,914
CPC	U	U	90.9	13	0.0	130
CPC	2	D	35.9	120	0.0	335
CPC	2	M	1.1	30	0.2	2,773
CPC	2	P	0.9	49	0.4	5,345
CPC	2	S	21.6	37	0.0	170
CPC	3	D	5.5	51	0.1	930
CPC	3	M	0.9	25	0.2	2,656
CPC	3	P	4.6	72	0.1	1,559
CPC	3	S	68.2	185	0.0	272
CPC	4	D	39.2	302	0.1	772
CPC	4	M	8.2	103	0.1	1,243
CPC	4	P	27.5	187	0.0	679
CPC	4	S	89.7	43	0.0	48
CPC	5	D			0.2	3,140
CPC	5	M			0.4	6,225
CPC	5	P			0.3	4,164
CPC	5	S			0.0	62
CPC	6	D	100	59	0.0	59
DFR	U	U			0.0	326
DFR	1				0.0	373
DFR	2	D	0.2	26	0.8	11,643
DFR	2	M	0.6	28	0.3	4,736
DFR	2	P			0.1	907
DFR	2	S	0.4	9	0.2	2,646
DFR	3	D	0	14	4.1	62,509
DFR	3	M			0.6	9,778
DFR	3	P	0.1	2	0.2	3,076
DFR	3	S			0.3	4,482
DFR	4	D	10.1	8979	5.9	89,037
DFR	4	M	16.7	1338	0.5	8,002
DFR	4	P	33.1	1271	0.3	3,840
DFR	4	S	0.3	11	0.2	3,160
DFR	5	D			4.9	73,936
DFR	5	M	2.2	351	1.0	15,613
DFR	5	P	1.4	86	0.4	6,319
DFR	5	S	0.4	40	0.6	9,283
DFR	6	D	2	1841	6.2	93,412

Table VII.6.6.2. Percent CWHR type, size and density for types found on JDSF relative to Mendocino County.

CWHR type	CWHR size	CWHR density	Percent of County Acres in JDSF	Acres in JDSF	Percent of County	Acres in County
FEW	U	U	1.6	9	0.0	585
MCH	U	U	100	77	0.0	77
MCH	2	S			0.0	110
MCH	3	D			1.2	17,965
MCH	4	D			4.4	65,597
MHC	U	U			0.0	35
MHC	1		100	33	0.0	33
MHC	2	D	0.2	18	0.6	9,296
MHC	2	M			0.0	141
MHC	2	P			0.2	2,508
MHC	3	D	0	3	0.8	12,221
MHC	3	M			0.0	531
MHC	3	P	0.1	5	0.2	3,295
MHC	4	D	7	1167	1.1	16,569
MHC	4	M	20.3	109	0.0	536
MHC	4	P	6.3	181	0.2	2,857
MHC	4	S	100	11	0.0	11
MHC	5	D			0.0	703
MHC	5	M			0.0	302
MHC	5	P			0.4	6,074
MHC	5	S	100	43	0.0	43
MHC	6	D	2.2	317	1.0	14,327
MRI	U	U			0.0	23
MRI	2	D			0.0	167
MRI	2	M			0.0	232
MRI	2	P			0.0	642
MRI	2	S			0.0	506
MRI	3	D			0.1	1,709
MRI	3	M			0.1	1,066
MRI	3	P			0.1	983
MRI	3	S			0.1	1,486
MRI	4	D			0.1	1,190
MRI	4	M			0.1	851
MRI	4	P			0.0	492
MRI	4	S			0.1	889
MRI	5	D			0.0	2
MRI	5	M			0.0	2
MRI	5	S			0.0	5
MRI	6	D	100	9	0.0	9
RDW	U	U			0.0	536

Table VII.6.6.2. Percent CWHR type, size and density for types found on JDSF relative to Mendocino County.

CWHR type	CWHR size	CWHR density	Percent of County Acres in JDSF	Acres in JDSF	Percent of County	Acres in County
RDW	1		100	25	0.0	42
RDW	2	D	1.8	679	2.4	36,892
RDW	2	M	5.3	695	0.9	13,057
RDW	2	P	4.7	72	0.1	1,526
RDW	2	S	0.2	7	0.2	3,487
RDW	3	D	0.4	322	5.2	79,096
RDW	3	M	6.6	599	0.6	9,065
RDW	3	P	3.2	92	0.2	2,843
RDW	3	S	2.9	108	0.2	3,706
RDW	4	D	13	11349	5.8	87,603
RDW	4	M	35.3	2909	0.5	8,231
RDW	4	P	16.3	325	0.1	1,995
RDW	4	S	8.7	224	0.2	2,588
RDW	5	D			11.4	172,304
RDW	5	M	5.6	1265	1.5	22,674
RDW	5	P	4.8	385	0.5	8,067
RDW	5	S	3.2	416	0.8	12,801
RDW	6	D	9.3	11833	8.5	127,782
URB			0.2	35	1.3	19,526

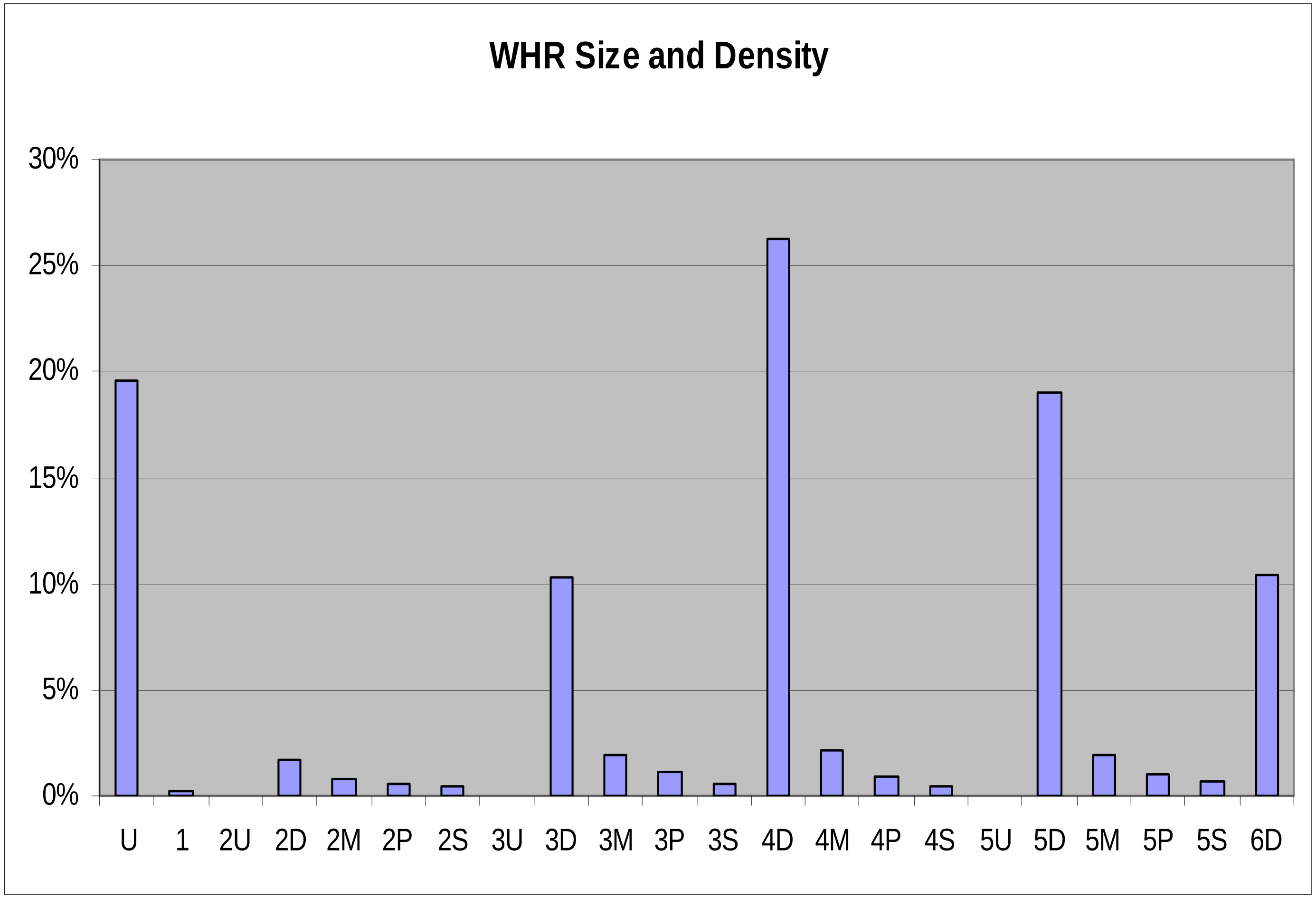
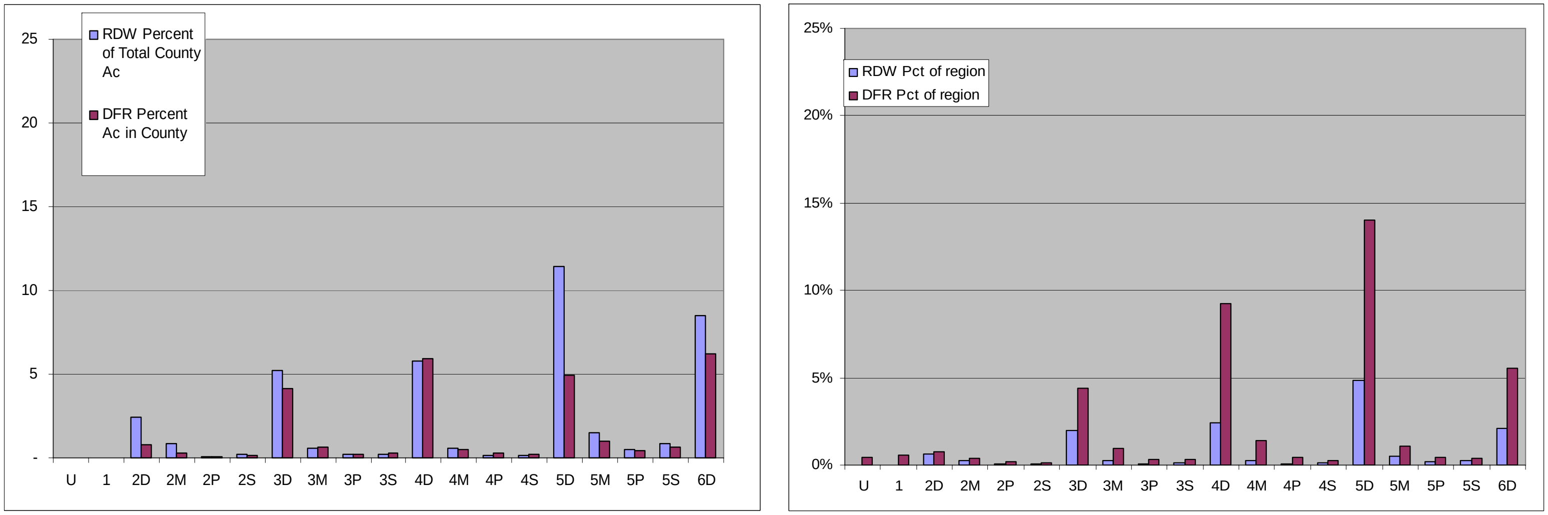
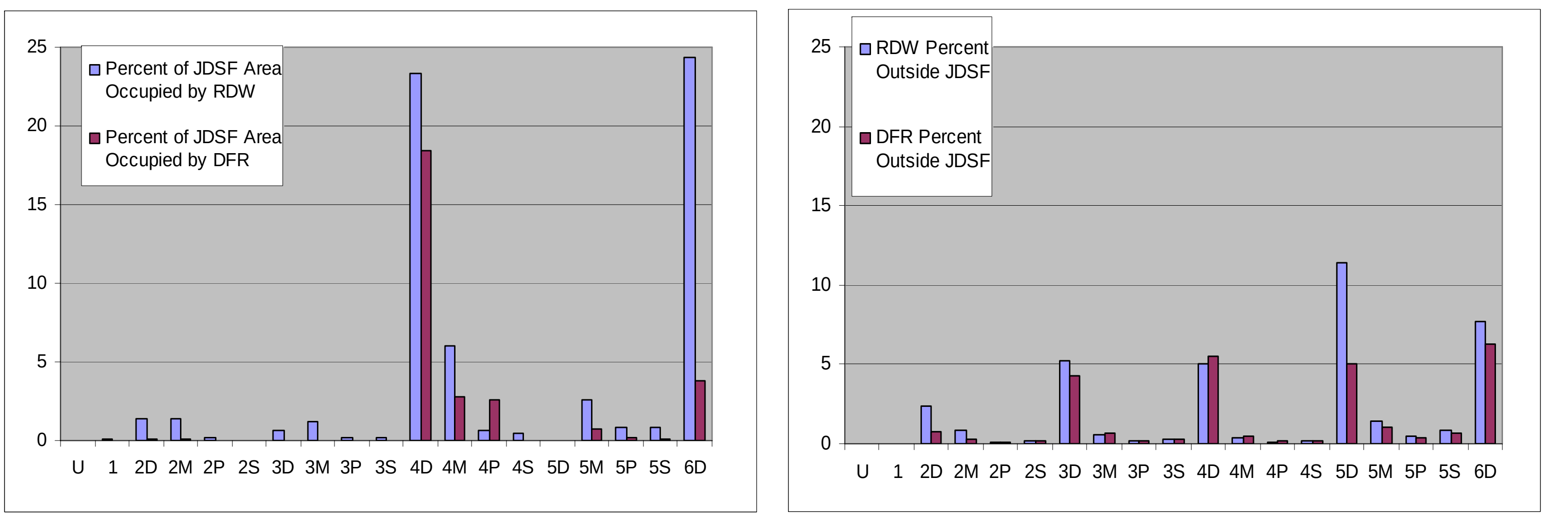


Figure VII.6.6.1.1. Distribution of CWHR Size and Density Classes across the North Coast Region. Note: The code “U” denotes a missing WHR label for either Size or Density or both.



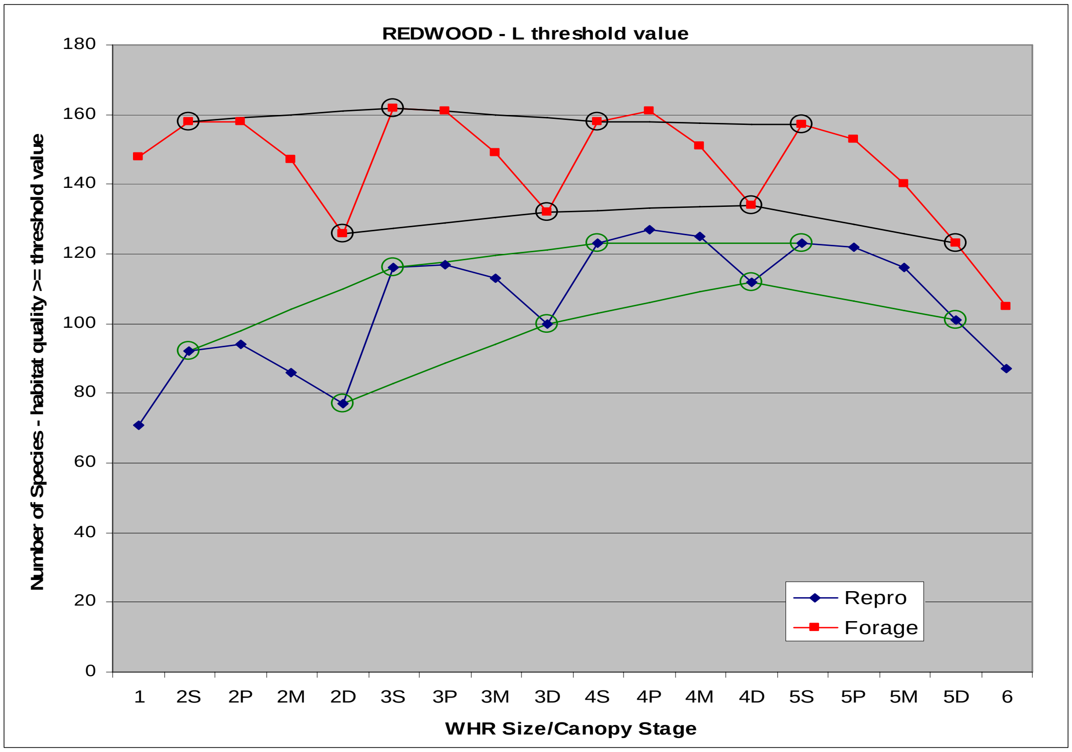
(a) (b)

Figure VII.6.6.1.2. Distribution of Redwood and Douglas-fir size and density classes across (a) Mendocino County and (b) North Coast region.



(a) (b)

Figure VII.6.6.1.3. Distribution of CWHR Size and Density Classes (a) inside JDSF and (b) cumulative effects assessment area outside JDSF for Redwood and Douglas-fir.



L threshold is habitat that is marginal or better (rated Medium or High) for species occurrence and relatively low population densities at low frequencies or better (rated Medium or High). Relative species richness between (S)parse and (D)ense canopy closure for Reproduction and Foraging also shown where variable is tree DBH.

Figure VII.6.6.2. Species Richness for Redwood Reproductive and Forage Habitat by CWHR Size and Canopy Classes.

Regional Species Composition

Wildlife in the Northern California Coast Ecological Subregion is relatively diverse, although few species are endemic (occurring nowhere else) to the region. A query of the California Wildlife Habitat Relationships System (version 8) for the Northern California Coast Ecoregion and for predominant forest types (Redwood, Douglas-fir, Montane Hardwood, Montane Hardwood-Conifer, and Montane Riparian) yielded a total of 288 species (170 birds, 21 reptiles, 19 amphibians, and 78 mammals) whose range includes a portion of this ecoregion. The majority of terrestrial vertebrates known to be associated with the redwood forests (nearly 95 percent) are also found in Douglas-fir forests.

Amphibian species diversity is relatively high in the Northern California Coast Ecological Subregion due in large part to generally cool and moist environmental conditions. With the exception of the lungless salamanders of the family Plethodontidae, aquatic habitats are used for reproduction by all species. As a result, streams, perennial and ephemeral wetlands, headwaters, and riparian zones receive a high level of use. Amphibian representation in redwood forests is greatest in the family *Plethodontidae*. The biomass represented by species in this family is very high and may surpass that of other forest types in the Pacific Northwest (Cooperrider et al. 2000). Species in this terrestrial amphibian family are also frequently associated with those forest microsites and habitat elements typically encountered in late seral forest conditions (large logs, dense canopies, and damp substrates).

In contrast to the amphibian fauna, reptiles are less well represented in the ecoregion, having lower overall diversity and relative abundance. Reptile abundance and diversity is related to those forest conditions or edges that allow sunlight to penetrate the canopy. Reptile requirements for higher ambient and hence body temperatures for life functions serves to limit possible distribution of these species. Forest openings, early stages of forest development and edge habitats with open canopy conditions are generally favored.

A large number of bird species are native to and utilize terrestrial forest types and associated habitat inclusions (riparian areas, meadows etc) in this ecoregion. Cooperrider et al. (2000) notes however, that bird species richness decreases markedly as one moves from hardwood or mixed conifer species stands to pure redwood stands. Only six (6) bird species are known to nest primarily in redwood dominated forest conditions in various parts of the ecoregion: Ruffed Grouse, Vaux’s Swift, Allen's Hummingbird, Chestnut-backed Chickadee, Rufous Hummingbird, and the Varied Thrush (Small 1974 fide Cooperrider et al. 2000). Many bird species breeding or wintering in this region are considered Neotropical migrants. Neotropical migrants are migratory bird species that nest in the United States and Canada but migrate south to the tropical regions of Mexico, Central and South America, and the Caribbean for the non-breeding season (generally south of the Tropic of Cancer). Hayes (1995) has suggested a more refined definition in which the former describes a Nearctic migrant reserving the term Neotropical migrant for species breeding in South America that migrate northward during the non-breeding season. Both of these migratory patterns are exhibited by birds found in the ecoregion. Other year round residents seek suitable habitat conditions with seasonal elevational changes.

Of the 78 mammals potentially occurring in the predominant forest types of the ecoregion, 33 are rodents, 16 are carnivores, and 14 are bats. As a group, bats typically exhibit a preference for specific habitat element conditions like tree hollows (an important roost site for some species), caves, and exfoliating tree bark. Remnant stands of late seral and old-growth redwood had greater levels of tree hollow use than larger areas in unfragmented old-growth stands (Zielinski and Gellman 1999). Stand level characteristics of importance to forest carnivores (marten and Pacific fisher) include canopy closure, snag and log frequency, and relative proportion of hardwoods and conifers in the stand as an influence on prey density and availability.

A relatively rich assemblage of invertebrate species is also found in redwood dominated forest types (Cooperrider et al. 2000). These invertebrates are the foundation for a number of ecological processes such as decomposition, pollination, and the cycling of nutrients. The ecological interactions of 8,000 plus species of arthropods in temperate forest communities is clearly complex, exhibiting varying degrees of sensitivity to changes in temperature and moisture conditions and in the variety of habitats available in a forested environment. In addition, invertebrate patterns of habitat specialization, low dispersal ability, and limited distribution that are exhibited by a large percentage of the canopy, forest floor, and aquatic fauna are features that are frequently associated with forest conditions that have remained relatively stable for long periods of time. Several primitive and relict insect species, such as the silverfish (*Tricholepidion gertschi*), a relict ant (*Amblyopone oregonense*), a moth (*Paraphymatopus californicus*) resembling an ancestor of moths and butterflies, and a wood feeding roach (*Cryptocercus punctulatus*) a link between roaches and termites, are examples of a distinctive invertebrate fauna (Cooperrider et al. 2000).

Habitat Meta-Elements
The presence of certain habitat elements or forest structural conditions is also a determinant of species presence. The relationship described in Figure VII.6.6.3 for the redwood forest type is similar to those of other predominant forest types in the region.

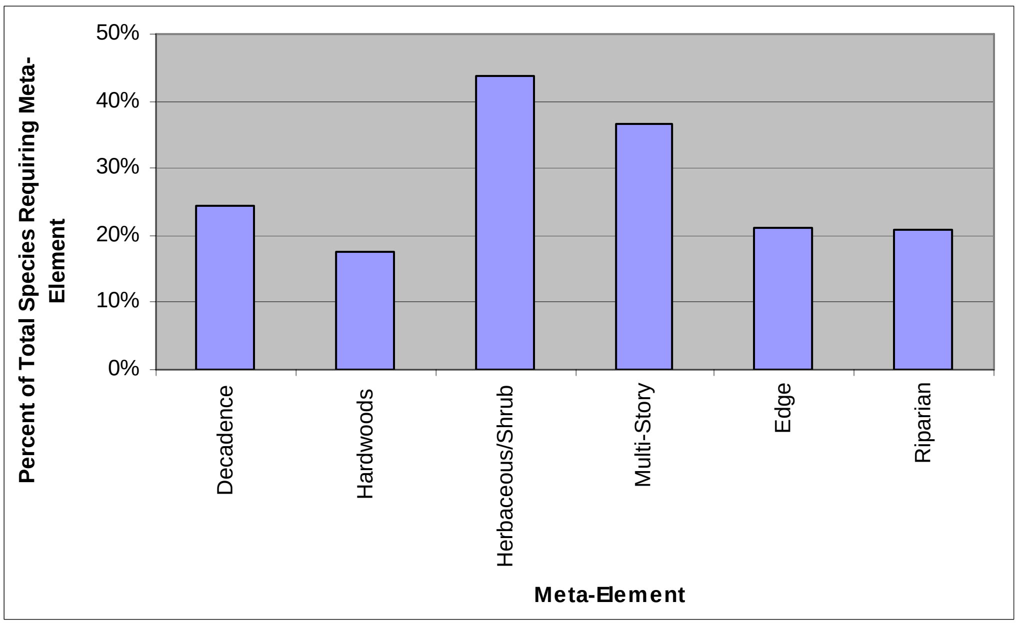


Figure VII.6.6.3. Habitat Meta-Elements for Redwood Forest Type.

Slightly less than half of the species finding low, moderate or high habitat suitability in this forest type show a preference for the “herbaceous/shrub” meta element. Nearly 25% exhibit a preference for the “decadence” meta-element (presence of snags and downed wood) and approximately 37% for multi-storied forest conditions.

Regional Distribution of Snags and Downed Wood

Snags are standing dead trees, and downed wood (or LWD) is fallen dead trees, or parts thereof (logs). Snags and LWD are recognized as critical habitat elements for a wide array of forest-dwelling wildlife species. Snags and decaying live trees can provide cavity nests, chimney roosts, platform nests, perches, food caches, foraging substrates, and nests or roosts beneath peeling bark. Large woody debris provides a similar food and cover resource for a variety of species. According to the California Wildlife Habitat

Relationships System, over 90 vertebrate species that occur in Mendocino County prefer or require snags to fulfill a portion of their life history needs (2 amphibians, 54 birds, and 36 mammals).

For purposes of this regional analysis of snag and LWD occurrence, snags are defined as dead trees greater than 11" dbh and 12' or greater in height. These sizes are based on minimum dimensions that afford potential value to most vertebrate wildlife species (Thomas et al. 1979). In general, larger snags provide better habitat than smaller ones because they last longer (before they decay and fall), provide better thermal cover, and accommodate a more diverse spectrum of wildlife species.

Target densities for snags in a variety of managed forests have been proposed by a number of authors using a variety of methods. Zarnowitz and Manuwal (1985) recommended 3.6 snags per acre for cavity-nesting birds in western hemlock Douglas-fir forests on the Olympic Peninsula of Washington. Mannan et al. (1980) recommended 4.3 snags per acre for breeding birds in Douglas-fir forests in western Oregon. Hunter (1990) suggested two to four large snags per acre as an average target for an array of habitat conditions across North America. In the Sierra Nevada of California, Raphael and White (1984) found that the abundance of cavity-nesting birds increased with snag density to a maximum at three snags per acre. Due to the longer life expectancy and high resistances to bugs, disease, and decay, redwood take much longer to develop into snags than other species such as Douglas-fir, white fir, grand fir, and hardwoods.

Laudenslayer (pers. comm. 1/28/05) has examined the influence of site and spatial scale on snag demographics. Fixed snag density standards applied across large landscapes may not be appropriate since they do not take into account the wide range of environmental variables influencing snag demographics. As such, management for snags ought to be applied at local (10s to 100s of hectares and decades) rather than landscape scales. Snag recruitment and loss are small-scale events that are a product of forest structure interacting with a wide range of causes of tree mortality (site quality, weather, insects and disease, etc). In addition, snag recruitment processes identified under one disturbance regime are unlikely to be applicable under an altered regime (e.g. change in fire frequency). Ultimately, the number of standing snags may not be as important as ensuring recruitment and a supply of snags of appropriate size through time, as determined by local processes. Managing for a sustainable population of green trees (future snags) is likely to be more critical to forest function. Those environmental factors responsible for snag recruitment are then free to operate at the landscape scale.

Regional estimates of snag and down log densities by forest type and ownership class were developed using Forest Inventory and Analysis (FIA) plot data for three predominant forest types in Mendocino County (Tables VII.6.6.3 and VII.6.6.4).

Evaluation of these structural characteristics provide an important measure of the ability of forests to maintain desired levels of biological diversity and helps define quality of habitat with diminished biological components. Timber management activities on private and public forestlands have altered the structural characteristics of several forest types. Without specific mitigation to create or preserve snags and down logs, intensive wood product management will make it difficult for resource managers to provide the adequate numbers, size, and decay classes of snags required for the long-term persistence of dependent wildlife species.

Table VII.6.6.3. Down log (>11" DBH) densities by forest type and ownership in Mendocino County.

CWHR Forest Type	Factor	Owner				
		National Forest	Other Public	Private Industrial	Private Nonindustrial	Grand Total
Douglas-fir	Acres	16,223	0	55,239	50,881	122,342
	Number of plots	6	0	9	7	22
	Average logs per acre - ALL	13	0	28	37	30
	Average >30" logs per acre	2	0	3	4	3
Montane Hardwood Conifer	Acres	27,610	11,398	159,675	138,407	337,090
	Plots	8	1	22	22	53
	Average logs per acre - ALL	17	35	34	22	28
	Average >30" logs per acre	6	5	5	2	4
Redwood	Acres - sum	0	81,961	284,450	105,389	471,800
	Number of plots	0	9	38	16	63
	Average logs per acre - ALL	0	30	45	29	39
	Average >30" logs per acre	0	4	4	1	3
Total Acres		43,832	93,359	499,364	294,678	931,232
Total plots		14	10	69	45	138
Total Average logs per acre		15	31	39	27	34
Total Average >30" logs per acre		5	4	4	2	3

Table VII.6.6.4. Snag (>11" DBH) densities by forest type and ownership in Mendocino County.

CWHR Forest Type	Factor	Owner				
		National Forest	Other Public	Private Industrial	Private Nonindustrial	Grand Total
Douglas-fir	Acres - sum	16,223	0	55,239	50,881	122,342
	Number of plots	6	0	9	7	22
	Average snags per acre	6	0	6	2	4
	Average >30" snags per acre	0	0	0	0	0
Montane Hardwood Conifer	Acres - sum	27,610	11,398	159,675	138,407	337,090
	Number of plots	8	1	22	22	53
	Average snags per acre	4	10	2	4	3
	Average >30" snags per acre	1	2	0	0	0
Redwood	Acres - sum	0	81,961	284,450	105,389	471,800
	Number of plots	0	9	38	16	63
	Average snags per acre	0	1	2	2	2
	Average >30" snags per acre	0	0	0	1	0
Total Acres - sum		43,832	93,359	499,364	294,678	931,232
Total Number of plots		14	10	69	45	138
Total Average snags per acre		5	2	2	3	3
Total Average >30" snags per acre		1	1	0	0	0

Regionally Significant Forest Conditions

Late-Successional/Old-Growth Forest Habitat

The majestic redwood and Douglas-fir forests of coastal California have impressed chroniclers since their first visits to the region in the 1700s. Since the late 1800s, they have also driven the acquisition of forests for more than 40 parks and reserves from Monterey to Del Norte counties. In addition, late-successional/old-growth forests also have characteristics unique among the various forest seral stages for a range of plant and wildlife species. Certain plants, insects, and other small fauna are closely associated with the unique ecological conditions that develop over time within these forest conditions. Also of regional relevance are the associated habitat elements that are of high value to some wildlife species. Some species are believed to be dependent on the structural or biological characteristics of such forests for one or more of their life cycle needs. As an example, Marbled Murrelets typically require large old-growth trees for nesting and cover, but are totally dependent on ocean conditions for food. For other species, late-successional/old-growth forest may be considered higher-quality habitat than younger forests that are also utilized. The implications of habitat selection and availability on the long-term population viability of these species are an area for additional research. Some species such as the Northern Spotted Owl that occur at relatively high densities within late successional, old-growth, and stands with similar structural characteristics also nest successfully in other stand conditions where access to necessary forage and cover needs are met. The availability of late-successional/old-growth forest habitat is a concern because of its value as wildlife habitat for certain species and the substantial reduction in this forest seral stage that has occurred throughout Pacific Northwest over the last 150 years.

Old-growth forests are distinguished from other forest seral stages in several respects. In most cases, trees form a single crown canopy layer as they grow through their juvenile and early-seral stages. They generally maintain this single canopy layer until competition, weather, insects, or disease cause mortality, resulting in openings in the canopy. Over time, seedlings become established and grow in these openings. This results in multiple canopy layers that include many large trees, some with broken tops and decaying wood, many large snags, and heavy accumulations of large logs on the forest floor. This process can begin in stands as young as 40 years in some areas, but take well over 100 years in others (Green 1985).

Definitions of what constitutes old-growth vary. Some authors use tree diameter to define it as 50 percent or more of the conifer canopy in trees over 24 inches dbh; others use over 20 inches dbh, or over 41 inches dbh. Some use age and define it as a certain percent of trees being over 100 years or being mature (Green 1985). The multi-storied, true old-growth stage develops over the next 100 to 200 years, as multiple canopies with large snags, and many large fallen trees become completely formed (USFS and BLM 1994).

Stand size and degree of fragmentation influence the value of late-successional and other stages of forest development to wildlife species. Fragmented forests composed of many small stands have a high ratio of forest edge to interior forest conditions. A number of forest structure and environmental changes occur at the edges of forests that may reduce habitat value for some wildlife species while increasing the value for others. At forest edges, wind disturbance increases, temperature and humidity are more variable, and canopy cover and vegetation type can substantially differ from that of the interior forest. Predation and parasitism on forest-nesting birds can also be greater along a forest edge relative to more interior forest areas. On the other hand, some prey species, such as the dusky-footed wood rat, occur in greater densities in brushy stands and early-successional habitats (Sakai and Noon 1993) and are known to occur in early successional stands on JDSF (Fitts 1991). Woodrats are an important prey source for Northern Spotted Owls, a late-successional nesting bird (Thomas et al. 1990, Zabel et al. 1995). In general, a mosaic of late, mid, and early-successional forested habitats will provide habitat for these and a wide range of other wildlife species.

Patches of both old-growth redwood and Douglas-fir forests are found in coastal northern California. The climatic and soil conditions in this area produce stands of very large, long-lived trees. The majority of the remaining old-growth redwood in California (about 90,000 acres) is in state and federal parks (Green 1985).

Old-growth forests and late successional forest as defined by California's Forest Practice Rules (FPR) are not well represented by the CWHR classification system since the latter is designed to classify habitat rather than vegetation condition. According to the FPR, "late successional forest" stands mean stands of dominant and predominant trees that meet the criteria of CWHR 5M, 5D, or 6 with an open, moderate, or dense canopy closure classification, often with multiple canopy layers, and are at least 20 acres in size. Functional characteristics of late successional forests include large decadent trees, snags, and large down logs." Although stands classified as CWHR 5M and 5D have large trees and high canopy closures, characteristics of late successional forest habitat may be lacking; a condition not generally determined with remotely sensed mapping efforts. Individual stands of CWHR 6 contain multi-storied structure, but may lack decadence (i.e., snags and downed wood) required for the stand to function as late-successional forest habitat or be classified as late-successional under the FPRs. As such, late successional or old growth extent expressed as acreage of CWHR stands 5M, 5D, and 6 represent the maximum availability of late successional forest habitat on JDSF. More detailed information on the structure and composition of individual timber stands classified as 5M, 5D, or 6 could reveal that some of these stands do not have the characteristics necessary to function as late-successional forest habitat. Old-growth stands are a subset of those classified as CWHR 5M, 5D, or 6. Designation of a stand as old-growth or late successional also requires an evaluation of individual characteristics, such as the stand's age, structural characteristics, and harvest history.

Hardwoods

Hardwood stands and hardwood inclusions in predominantly coniferous stands provide important reproductive, cover, and foraging habitat for a variety of wildlife species. Oak leaves and twigs supplement the dietary requirements of deer for protein and phosphorous in spring and fall. In Mendocino County, oak browse is the most common food item contributing almost 60% of the yearly diet.

The presence of a hardwood component is particularly important for wildlife in conifer-dominated forests as it provides habitat diversity, food, and cover. Although few or no wildlife species depend completely on mixed coniferous forests, this plant community supports a high diversity of amphibians, reptiles, birds, and mammals (Mayer and Laudenslayer, 1988). The acorn crops of oaks and chinquapin, as well as the berries of the madrone, provide an important food resource for many bird and mammal species (Hagar, 1960; Keator, 1994; Pavlik et al., 1991; Diller, 1996).

Most of the hardwoods on JDSF occur as components of coniferous forests rather than in hardwood-dominated stands. This mixed coniferous forest type is common throughout Mendocino County, as well as in other portions of northern and southern California (Barbour and Major, 1977; Holland and Keil, 1995). On JDSF, hardwoods tend to dominate on south-facing slopes, in areas where soils are shallow, and on or near ridgetops (Cafferata and Yee, 1991). On JDSF, hardwoods include madrone, black oak, canyon live oak, tanoak, California bay, chinquapin, red alder, bigleaf maple, and eucalyptus (a non-native species). Alder, maple, and willow are generally restricted to riparian forest.

Riparian Forest

Riparian forests are a special habitat type represented by transitional areas between aquatic and upland zones, encompassing sharp environmental gradients, unique ecological processes, and diverse communities (Naiman et al. 1993). In coniferous forests, the diverse vegetation structure and composition of riparian zones provide a mosaic of habitats and edges in a small area, making them a source of habitat diversity (Thomas 1979). Riparian zones also provide important resources to both obligate riparian and upland species. Plant species diversity is typically higher in riparian zones than in upland vegetated zones, and the diversity of wildlife species using these zones is related to this habitat and structural diversity.

As discussed in more detail in the Aquatic Resource Section, stream shading and riparian canopy closure can influence water temperatures and microclimate conditions. These parameters can strongly affect habitat quality for some species.

Wetlands

Wetlands support specialized plant communities, which in turn provide foraging and breeding habitat for a variety of invertebrates, amphibians, reptiles, birds, and mammals. Wetland areas on JDSF are small in extent, but of high interest and value. They include two (known) *Sphagnum* bogs, a few isolated ponds, stream margins and several springs and seeps.

Sphagnum bogs are rare in California and develop in low-lying areas fed by mineral-poor seeps and springs that are invaded by various moss species, including those of the genus *Sphagnum*. Over time, the accumulation of peat formed from plant remains alters the hydrology of the bog, isolating it from input of groundwater. The increased dependence on direct input of rainwater, together with the organic acids released by decaying *Sphagnum*, lowers the pH of the bog. The low pH, saturated organic soil and very low nutrient availability create conditions favorable to a highly specialized group of plants, including a number of carnivorous species (Schoenherr 1992 and Holland and Keil 1995). Because bogs are nutrient-poor, they are particularly vulnerable to watershed changes that cause an influx of organic matter or mineral-rich water (Guntenspergen and Stearns 1985) and to alteration of drainage patterns.

Other Unique/Special Habitats and Features

Other special habitat conditions required by some species include specific geologic features such as cliffs, caves, or talus; or specific non-forest habitats such as meadows, vertical banks, or sandy beaches. A particular species' life requirements may be met solely by the broad habitat type, or it may require many specific elements that are independent of the dominant vegetation. The absence of a particular key element can eliminate the species from otherwise suitable habitat.

No caves are known to occur on JDSF. The ownership does contain a few rock outcrops, although they are not steep or high enough to provide habitat for cliff-associated species such as Peregrine Falcons. JDSF also lacks talus that some amphibian species (e.g., Del Norte salamanders) find suitable. Deposits of rock and soil occur in association with debris slides, but the large amount of soil filling interstitial spaces in these deposits generally limits their habitat value for talus-associated species.

Other unusual habitat types that also occur include northern coastal salt marsh, coastal brackish marsh, coastal and valley freshwater marsh, and grand fir forest.

The Bob Woods Meadow is in a natural forest opening or glade, which is a type of grassland typical of the Northern California Coastal Ecological Subregion. Forest openings or glades are usually at slightly higher elevations than coastal prairie grasslands, but are located closer to the coast than bald hill prairies (Barbour and Major 1977). Glades and forest openings typically occur where the soil is alkaline and high in clay content, which in combination may prevent tree establishment.

Habitat Utilization Guilds in the Northern California Coast Ecological Subregion

Guilds are a grouping of wildlife species that exploit the same class of environmental resources in a similar way (Root 1967). For example, pileated woodpeckers, mountain chickadees and screech owls could be considered part of a cavity nesting bird guild. The application of the guild approach to environmental impact assessment has been somewhat controversial. One obvious benefit is that an understanding of the habitat requirements of broad guilds of animals reduces the complexity faced when one attempts to assess the overall effects of habitat changes to each of the hundreds of species that may use a given area (Furnas 2004). Severinghaus (1981) reasoned that, “once the impact on one species in a guild is determined, the impact on any species in the guild is known.” This logic led to the use of indicator species for assessing and monitoring impacts to multiple animals within a guild (e.g., Spotted Owl and old growth forest associated wildlife). However, the use of guilds and indicator species in impact assessment has been criticized as overly simplistic and inappropriately applied (Simberloff and Dayan 1991, Mannan et.al.1983). Species within any identified guild may have very different abilities to utilize other, possibly sub-optimal, habitats. The predicted response of a whole guild could be an overestimate or an underestimate for some members of the guild. Others have acknowledged these issues, but suggested that careful and qualified use of guilds and indicators could play an important role in impact assessment (Landres 1983, Laudenslayer 1991). Similarly, Roberge and Angelstam (2004) concluded that multi-species approaches that consider the occurrence of a range of habitat types and landscape attributes offer promising conservation avenues compared to approaches that can not effectively integrate massive amounts of species specific data.

The California Wildlife Habitat Relationships (CWHR) system rates habitat quality for the reproductive, cover and foraging requirements of hundreds of species of terrestrial wildlife in California forest communities. The Habitat Utilization Guilds computer program (developed by Brett Furnas of the California Department of Fish and Game and Robert Laacke, an independent consultant formerly of the USDA Forest Service

Pacific Southwest Research Station) was used to assign these animals to guilds based on how habitat quality varies with changes in tree size and canopy cover according to the CWHR species models (Figure VII.6.6.4). For example, a particular species may be placed in a guild category called "Down with Cover," because the CWHR model for this species predicts that habitat quality decreases as canopy cover increases. Although many species do not exhibit an identifiable pattern, increase in tree size or reduction in canopy closure are favorable conditions for breeding, feeding or cover requirements.

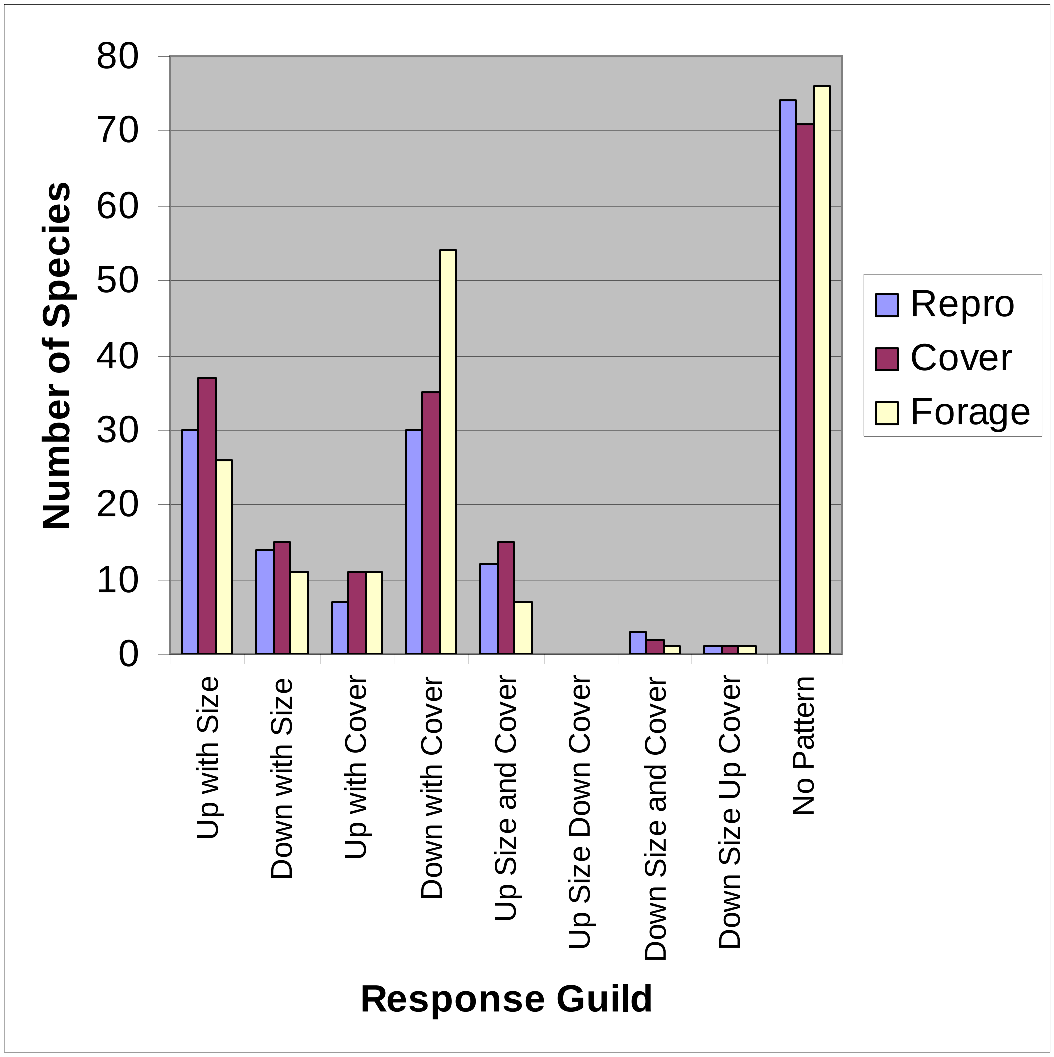


Figure VII.6.6.4. Redwood multi-species patterns when animals are assigned to guilds based on how habitat suitability responds to changes in tree size and cover per the CWHR 8.0 models.

Contemporary Regional Change in Vegetation Cover and Cause

The current landscape in the region is clearly different from the pre-settlement condition. Typically, redwood dominated stands formed a mosaic with other forest types such as montane hardwood, montane hardwood-conifer, and closed cone-pine cypress. Fire was the principal disturbance mechanism altering the juxtaposition and extent of habitats. The current landscape condition has a lower abundance of older stands, smaller habitat patch size, lower spatial and temporal variability in stand age-class distribution, and lower frequency of natural fire starts that result in stand or landscape altering events. Little research however has been done on the effects of habitat fragmentation in the redwood-dominated areas of the Northern California Coast Region (Cooperrider et al. 2000).

Change in Vegetation Cover and Cause

The California Land Cover Mapping and Monitoring Program (LCMMP) uses Landsat Thematic Mapper (TM) satellite imagery to map vegetation and derive land cover change (losses and gains) within five-year periods. The results of this statewide monitoring program provide a regional scale snapshot of contemporary change in vegetation condition and agents causing those changes. The North Coast project (http://frap.cdf.ca.gov/projects/land_cover/monitoring/pdfs/nccdp_report_final.pdf) area is larger than the Northern California Coast Ecological Subregion described above and covers all or most of Alameda, Del Norte, Humboldt, Lake, Marin, Mendocino, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Sonoma and Trinity counties, and covers portions of twelve other counties. It also completely encompasses the Mendocino and Six Rivers National Forests, partially covers the Shasta-Trinity National Forest and covers a small portion of the Siskiyou National Forest (Figure VII.6.6.5). Changes in vegetation cover were assigned to categorical increase and decrease classes while the causes of cover changes were determined by GIS analysis, resource professionals, aerial photography and ancillary data layers.

Change in Vegetation Cover

Of the 16.5 million acres in the project area, about 2.4 million acres are barren, agriculture, water, or urban. The remaining 14.1 million acres are composed of the conifer, hardwood, grass/forb and shrub/chaparral lifeforms, each covering about 6.1, 3.8, 2.4 and 1.7 million acres, respectively. Approximately 97.8% of the vegetation in the project area did not exhibit a detectable change between 1994 and 1998.

Decreases in vegetation cover occur on approximately 1.4% (~197,500 acres) of the analyzed 14.1 million acres in the project area and increases in vegetation cover total about 0.8% (~109,500 acres). Most of this change occurs in the conifer lifeform. The hardwood and conifer lifeforms show a larger area affected by a decrease in vegetation while the shrub/chaparral and grass/forb lifeforms show a larger area affected by an increase in vegetation.

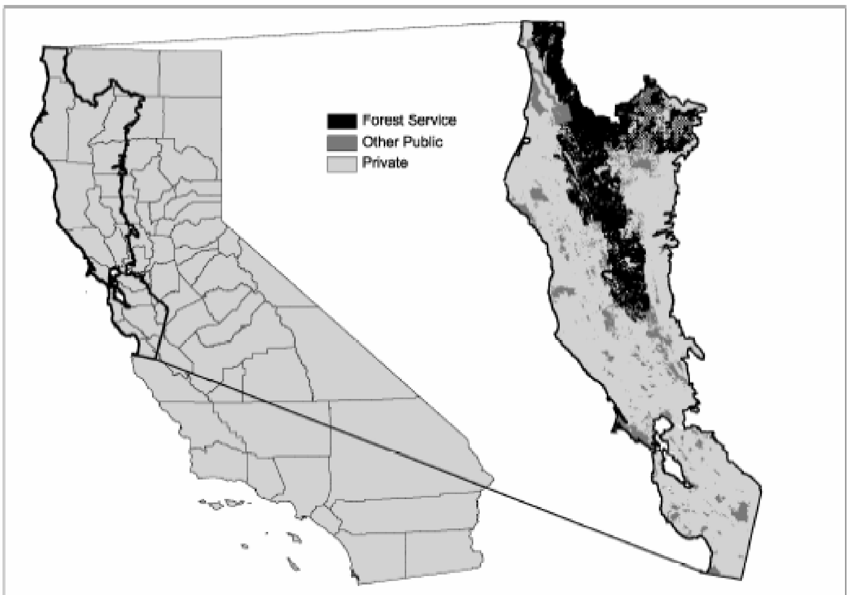


Figure VII.6.6.5. California Land Cover Mapping and Monitoring Program, North Coast Project Area.

Cause of Vegetation Cover Change

All Vegetation Life Forms

Results show that 97.8% of the land area in the assessed 14.1 million acres does not have a detectable vegetation change between 1994 and 1998. Harvest, regrowth and fire are the largest identified causes of change, verified on about 72,000, 68,000 and 53,000 acres, respectively. Privately owned lands show a decrease in vegetation on almost 134,000 acres, which equates to 1.5% of privately owned lands (about 73,000 acres or 0.6% show an increase).

All Vegetation by County

Humboldt County shows a vegetation cover decrease on over 47,000 acres (2.2%) and an increase in cover on over 46,000 acres (2.1%). Lake County displays the largest decrease in vegetation cover caused by fire with over 47,000 acres affected (6.3%). Mendocino County exhibits a decrease on over 42,000 acres (2.0%) and an increase on approximately 12,000 acres (0.5%).

All Vegetation by National Forest

The Mendocino National Forest (NF) has the largest area of decrease caused by fire, with over 36,000 acres affected (4.1%). Almost 17,000 acres (9%) on the Shasta-Trinity NF exhibit a vegetation increase, with over 13,000 of those acres verified to be regrowth.

Hardwoods
The largest hardwood canopy cover decrease and increase occurs in the Montane Hardwood type (31,888 acres; 1.3% decrease and 8,752 acres; 0.4% increase respectively).

Hardwoods by County
Lake County exhibits the greatest decrease in hardwood canopy cover due to fire (15,734 acres; 8.1%). Del Norte County shows a hardwood canopy cover increase on 2,810 acres (2.6%), mostly caused by regrowth. Sonoma County has the largest area of canopy cover decrease as a result of development (189 acres).

Hardwoods By National Forest
The Mendocino NF shows a decrease on 10,213 acres (6.8% of its area) mostly caused by fire (4 acres; 0% show an increase).

Conifers
The redwood type exhibits the largest area of canopy cover decrease, affecting 54,466 acres (5.1%), with over 34,000 of those acres verified to be harvest. The redwood type also shows an increase on 20,365 acres (1.9%), about half of which is verified regrowth. The closed cone pine-cypress type exhibits a decrease on 11,553 acres (11.0%), which is mostly the result of fire and an increase on 81 acres (0.1%). Private lands show a conifer canopy cover decrease on 100,934 acres (3.6%) and show an increase on 34,743 acres (1.2%). Harvest and regrowth, respectively, are the primary verified causal agents for conifer change on private lands.

Conifers by County
Humboldt County displays a canopy cover decrease on 40,486 acres (3.0%) and an increase on 30,047 acres (2.2%). Harvest and regrowth are the primary causes of conifer change. Mendocino County shows a decrease in conifer canopy cover on 35,718 acres (3.5%), with harvest as the most frequent cause (25,746 acres). A total of 3,404 acres of conifer lands exhibited an increase in canopy cover in Mendocino County. Lake County shows a decrease in conifer canopy cover on 30,700 acres (14.4% of its area), with fire as the primary cause.

Conifers by National Forest
The Mendocino NF shows a decrease in conifer canopy cover on 26,121 acres (5.4%), most of which is due to fire (1,135 acres; 0.2% show an increase). The Six Rivers NF exhibits an increase in canopy cover on 10,547 acres (1.4%), most of which is verified to be regrowth (3,331 acres; 0.4% show a decrease).

Shrub/Chaparral
Coastal scrub shows a cover increase on 9,108 acres (12.3%) and montane chaparral shows a cover increase on 9,051 acres (3.0%). The primary cause for each type is regrowth. Private land shows an increase in shrub/chaparral cover on 14,755 acres, or 1.7%, over 10,000 acres of which is regrowth (3,026 acres; 0.4% show an increase).

Shrub/Chaparral by County

Mendocino County exhibits a shrub/chaparral cover increase on 6,459 acres (4.2%) and a cover decrease on 343 acres (0.2%). Humboldt County shows an increase in shrub/chaparral cover on 4,058 acres (9.3%) and a cover decrease on 125 (0.3%). The shrub/chaparral cover on private land increases on 14,755 acres, or 1.7% and decrease on 3,026 acres, or 0.4%.

Shrub/Chaparral by National Forest

The Shasta-Trinity NF displays a shrub/chaparral cover increase on 3,846 acres (3.0%) and a cover decrease on 997 acres (1%).

GIS Approaches to Identifying Potential Focal Areas for a Regional Conservation Strategy

Strittholt et al. (1999) identified conservation focal areas within the distribution of the redwood ecosystem and the Northern California Coastal Forests Ecoregion (http://www.consbio.org/cbi/applied_research/redwoods/redwoods_pdf.htm). The purpose of their project was to create a GIS-based model that identified specific focal areas throughout the historic range of coast redwoods in California. Focal areas were defined as zones that offer the best conservation opportunities for long-term protection and maintenance of the redwood ecosystem based on the current condition of a range of criteria.

Nine criteria were analyzed in each of three subregions to rank 6th order subwatersheds in terms of current overall conservation value. The nine equally weighted criteria included: (1) location of largest late-successional patches, (2) concentration of late-successional patches, (3) road density, (4) location of imperiled species, (5) forest neighborhood age, (6) forest fragmentation (as measured by mean nearest neighbor, mean core area per patch, interspersion and juxtaposition, and area weighted mean shape index), (7) potential connectivity to existing protected areas, (8) road/stream intersections, and (9) forested riparian zones. A tenth criterion addressing management potential was not modeled but qualitatively included to evaluate institutional barriers to management. Each of the nine criteria was developed separately with individual results assigned ordinal scores numbering 1-5. These ordinal results were then added together to produce a final composite score and summarized by one hectare cells and by subwatershed basin (Figure VII.6.6.5A). Criterion 1 (Location of Largest Late

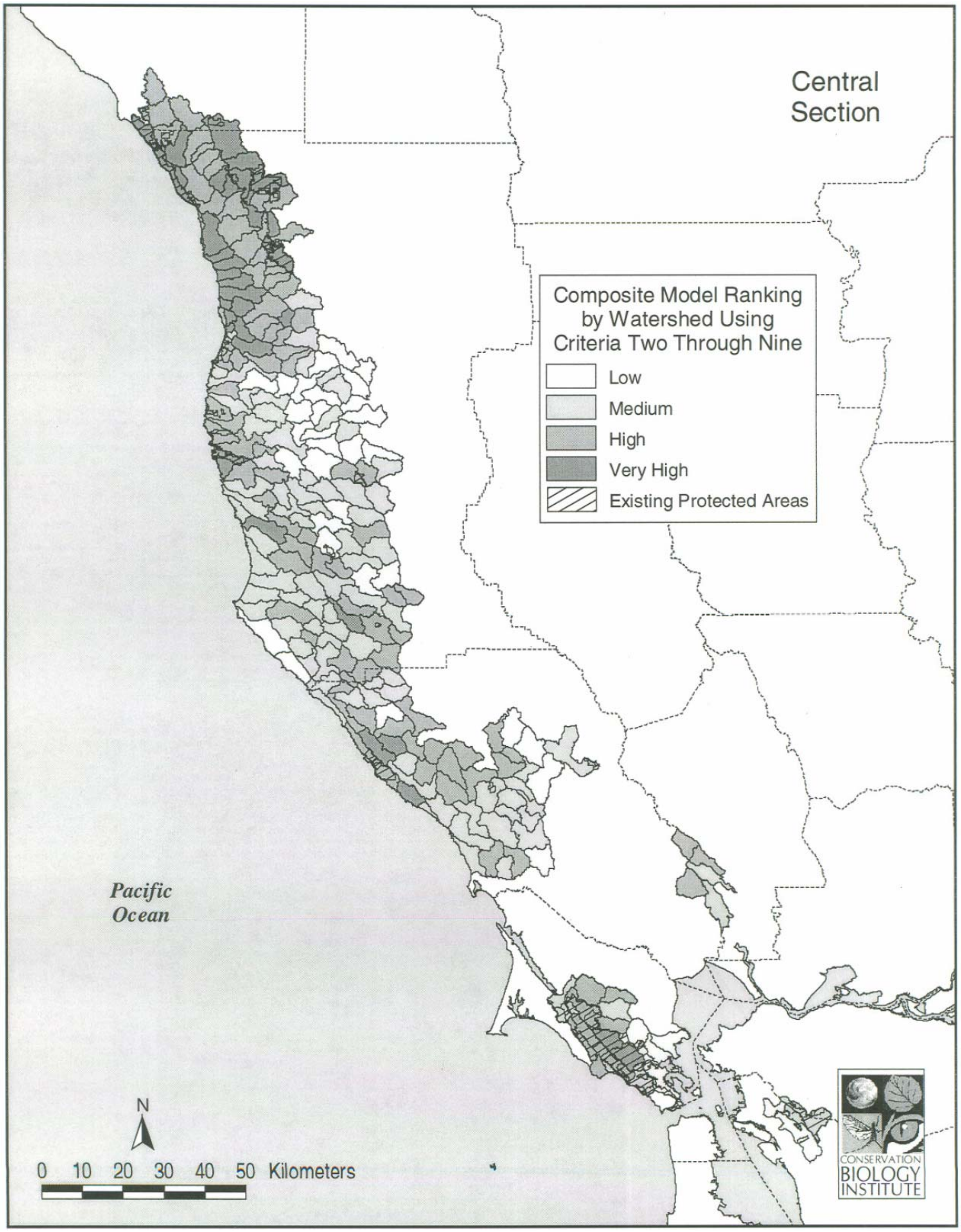


Figure VII.6.6.5A. Spatial arrangement and ranking of focal areas (Criterion 2-9) for the Central Subregion Including JDSF and other Ownerships Making up the Assessment Area Possessing Highest Conservation Value Scores. From Strittholt et al. 1999.

Successional Patches) was dropped from the analysis given the relatively low amount of existing late seral habitat in a protected status and consequent inability to differentiate across focal areas.

The landscape scale methodology reported by Strittholt et al. (1999) was not designed to provide specific conservation and management measures for each focal area but rather to provide a general and relative picture of focal area conservation value across the California range of coast redwood when selected conservation criteria are weighted equally. Future improvements in data availability and quality are expected to also improve application of the methodology and identification of areas of region wide importance.

Relationships between Landscape Habitat Metrics and Northern Spotted Owl Activity Center Data across Different Habitat Mosaics

The amount and configuration of mature and late seral forests surrounding owl nest sites is thought to be an important factor in determining the viability of populations of Northern Spotted Owls. A commonly held view is that owls show a strong preference toward sites that are dominated by large patches of late seral forest. The association between owl habitat use and the presence of late seral conditions has been well documented (Lehmkuhl and Raphael, 1993). However, most forested areas on the North Coast of California contain much younger forests and exhibit a much wider range of habitat types. While older forests tend to have more complex structural characteristics to some degree those same structural attributes may also be present in younger forests depending on the silvicultural practices employed. In addition, more recent studies suggest that climatic conditions are important determinants of survival rates (Franklin 2000).

Metrics describing the pattern of fragmentation have been widely used in forested landscapes (Ripple 1991a, Crow and Gustafson 1997, McGarigal 1995). These metrics provide useful descriptions of landscape pattern and intensity of land use, but may not clearly explain how the spatial configuration of habitat affects the viability of a population. Interpretation of landscape metrics can also be misleading. For example, Franklin (2000) found that for Northern Spotted Owls, in his Northern California study area, an increasing amount of forest edge could be detrimental by decreasing the amount of interior habitat, increasing predation rates, and reducing the survival rate. However, forest edge may also produce beneficial results, by increasing the amount of prey and ultimately the reproductive output of adults (Franklin, 2000). Forest management is thus presented with the challenge to determine the appropriate mix of stand conditions that, when considered with prevailing disturbance regimes, can still support a viable population.

CDF evaluated the pattern of habitat surrounding owl nests on private, public managed and public reserve lands. This was done to determine whether notable differences in landscape pattern could be clearly identified among different land management groups using a common set of landscape metrics. The study area covers over 8 million acres of forest land in Northern California (Figure VII.6.6.6). The region boundary is defined by the Northern California Coastal and Coast Range Ecological Units (Goudey, 1994).

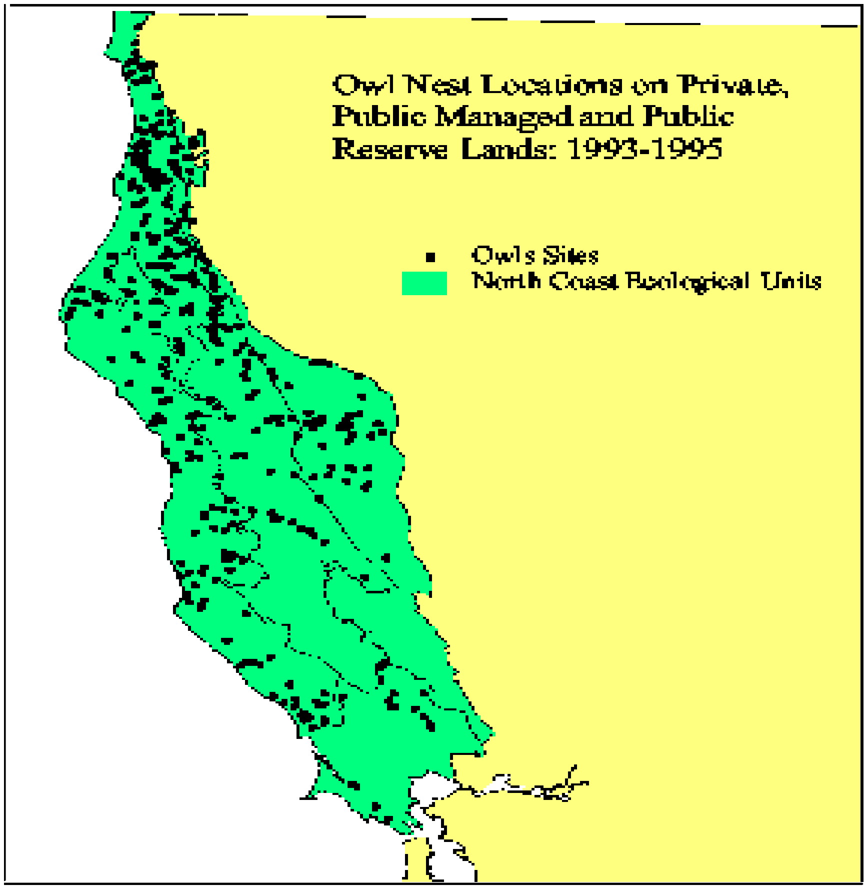


Figure VII.6.6.6. Extent of Study Area and the Distribution of Owl Sites within the North Coast Ecological Units.

Interpretation of Owl Habitat

Northern Spotted Owl habitat was assessed using a digital vegetation map that was derived from 1994 Landsat TM imagery. The vegetation data includes attributes for vegetation type, canopy cover and density. Previous owl studies in Northern California have shown that vegetation data derived from satellite imagery can be used to represent forest seral stages that are relevant to owl nesting and prey habitat (Hunter et al., 1995). For this study the vegetation data was interpreted to represent the following habitat classes: High capability Owl, Low to moderate capability Owl habitat, Woodrat Habitat, Shrub/Grass, and Non-Forest (Table VII.6.6.5). Since the habitat classes integrate floristic and structural characteristics the accuracy of each attribute needs to be considered. The vegetation map had an overall accuracy of approximately 80% (Beardsley and Schwind, 2000). An evaluation of the error matrix indicated that most errors involved mislabeling of vegetation classes that had the same lifeform. However, errors in structural attributes were associated with classes that were most similar. For example, size class 4 being confused with size class 5. By aggregating the detailed vegetation map into broader habitat classes the influence of error due to misclassification was reduced. This procedure produced a habitat map that was used to assess habitat availability across entire ecological units and surrounding individual owl activity sites.

TABLE VII 6.6.5. Interpretation of habitat classes.

Class Name	Description	Size (QMD)	Canopy Cover (Pct.)
High Capability Owl Habitat	Conifer	>= 24"	>=70%
	Hardwood	>= 30"	>=70%
Low to Moderate Capability Habitat	Conifer	>= 24"	< 70%
	Conifer	< 24"	
	Hardwood	>= 30"	< 70%
	Hardwood	< 30"	
Woodrat Habitat	Conifer	< 24"	10% - 50%
	Hardwood	< 30"	10% - 50%
Grass and Shrub			
Non-Forest	Urban, Barren and Water		

Note: QMD = Quadratic Mean Diameter

A total of 347 Owl sites were examined on Private, Public Managed and Public Reserved lands. Information on the location and reproductive status of Northern Spotted Owls is maintained in a database by the California Department of Fish and Game (Gould, 2000). To insure that the habitat surrounding owl observations represented individual territories, only sites that were identified as "Pair" or "Nest" were used in the analysis. To determine the extent to which landscape metrics are descriptive of habitat use, metrics surrounding owl sites were compared to 55 randomly selected non-owl sites. The random points were weighted by ecological unit area. Existing owl sites, 0.5 mi in radius, were excluded from consideration in the selection of random sites. To coincide with the date of the vegetation map only owl nest sites from 1993 - 1995 were used.

Generating Landscape Metrics

Previous studies have analyzed the effect of circle size on estimating habitat use from owl sites (Hunter and Gutierrez, 1995, Lehmkuhl and Raphael, 1993). Based on the results of these studies we used circles with an 800-meter radius to characterize the habitat surrounding owl nest sites. Landscape metrics were calculated using the program Patch Analyst (Elkie et al., 1999). All of these metrics were originally implemented by McGarigal (1995) in FRAGSTATS. Each owl circle was treated as a single observation. The landscape metrics were generated using the habitat patches for each circle and recorded in a tabular database containing over 400 records.

The habitat data for owl circles was partitioned into three land management groups: private, public managed and public reserve (Figure VII.6.6.7).

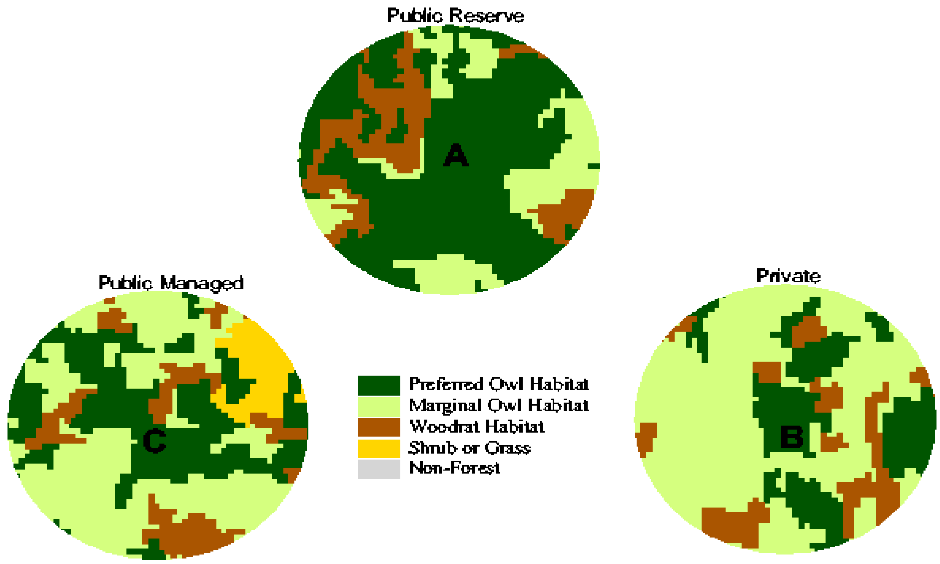


Figure VII.6.6.7. Habitat data for owl circles was partitioned into three land management groups: private, public managed and public reserve.

Seven of the twelve landscape metrics showed differences (P-value < 0.01) across the three land management groups (Table VII.6.6.6). All area metrics had recognizable differences (P-value < 0.01) among land management groups. Public reserve sites had the highest percentage of high capability owl habitat. All owl sites contained significantly more high capability owl habitat than the amount found on random sites. Owl sites on private lands contained the least amount of high capability owl habitat and consequently, private owl sites contained a greater amount of low to moderate capability habitat.

There was no clear distinction in the amount of woodrat habitat among private, public managed or public reserve. Although, the amount of woodrat habitat was significantly lower on random sites. Patch density and patch size were used to infer the degree of fragmentation. More patches of smaller size indicate a higher degree of fragmentation. Public reserve sites contained fewer patches that were larger in size than those on private or public managed lands. The amount of edge, created by different habitat types, was characterized by edge density and mean patch edge. Edge density was highest on private owl sites. Edge density on public reserve and random sites were both significantly lower than on private and public managed sites. None of the shape metrics were useful in distinguishing between land management groups. The diversity index measured the number of different habitat types. This metric was highest on private and public managed lands.

Table VII 6.6.6. Results of Anova tests using landscape metrics on private, public managed and public reserve lands.

Landscape Metrics	Private	Public Managed	Public Reserve	Random	F-Value	P-Value
Pct. High capability Owl	35.0a	43.7b	49.4b	30.3c	14.14	0.0001
Pct. Low –to moderate capability	43.2a	35.4b	34.4b	28.5c	14.82	0.0001
Pct. Woodrat	12.5a	12.9a	12.3a	7.8b	4.02	0.0078
Total # of Patches	26.8a	26.3a	23.2b	24.4ab	3.10	0.0267
Median Patch Size	3.4a	9.9 a	25.8 b	5.1a	7.51	0.0001
Edge Density	72.4 a	71.5 a	65.2 b	61.8 b	4.03	0.0077
Mean Patch Edge	2093.5 b	2584.4 ab	2887.5 a	1973.8 b	3.15	0.0249
Mean Shape Index	1.71a	1.69a	1.63a	1.51b	5.20	0.0016
Mean Patch Fractal Dimension	1.10	0.35	1.11	0.99	1.23	0.2969
Mean Perimeter to Area Ratio	1689	3425	4421	3678	1.35	0.2585
Shannon Diversity Index	1.18ab	1.20a	1.04c	1.11b	7.93	0.0001
Shannon Eveness Index	0.87	0.87	0.87	0.85	0.66	0.5782

Note: means with same letters within individual rows did not differ using Duncan's multiple means test at alpha = 0.05. Results are only reported for means where the ANOVA test was significant at the 5% level.

Landscape metrics from randomly chosen sites were included in the analysis to determine whether habitat pattern and configuration was uniquely different surrounding owl sites. Random sites were significantly different (i.e. at Alpha = 0.05) than all three of the land management groups for the following metrics: Percent low to moderate capability habitat, percent woodrat habitat, mean shape index, total number of patches and Shannon diversity index. Random sites contained the least amount of high capability owl habitat. Random sites contained patch sizes that were similar to private, but much smaller than public reserve sites. Although patch sizes were small, edge density was lowest on randomly selected sites.

Analysis of the amount and pattern of vegetation conditions surrounding owl sites confirms that owls rely on mature older forests, but also demonstrates that owls utilize a much broader range of habitats (Figure VII.6.6.8a). These results support earlier studies that have found greater amounts of mature forest surrounding owl nests than sites chosen at random (Hunter and Gutierrez, 1995). This finding indicates that owl habitat use is preferential towards mature and late seral forest conditions for nesting, but the variability suggests that owls also make use of low to moderate capability habitat (Carey, 1995). The amount of mature forest was highest on public reserve lands. Habitat patches on reserve lands were found to be larger than those on private lands, and were lower in the diversity of habitat classes surrounding a single site. This can be contrasted with the habitat conditions on private lands. Private lands contained more low to moderate capability habitat that had smaller patch sizes and a higher edge density. This is indicative of a highly fragmented landscape, the result of intensive land management. The public managed lands shared characteristics of both private and public reserve lands. Public managed lands were closer to reserve lands in the amount of high capability owl habitat available. However, the patch size tended to be much smaller and the diversity of habitat classes were higher.

Differences exist in the habitat configuration and the resulting landscape pattern on private, public reserve and public managed lands. Other factors must also be considered to explain the distribution of owls across the landscape. Further work is needed that relates fecundity and survival rates to different habitat configurations. Recent studies have suggested that climate plays a significant role in explaining variability in population numbers (Franklin, 2000).

Analysis of landscape metrics, Figure VII 6.6.7 above, lead to the following conclusions:

- Owl sites on public reserve lands had larger patches with more high capability owl habitat.
- Private lands contained less high capability owl habitat in smaller patch sizes, and contained a greater amount of low to moderate capability habitat.
- Public Managed lands share characteristics of both public and private lands.

Figure VII 6.6.8a shows the amount of high capability owl habitat (i.e. mature forest) was highest on Public Reserve lands. However, the scatterplot of the data shows that the amount of high capability owl habitat varied greatly and suggests a fairly broad range of habitat use.

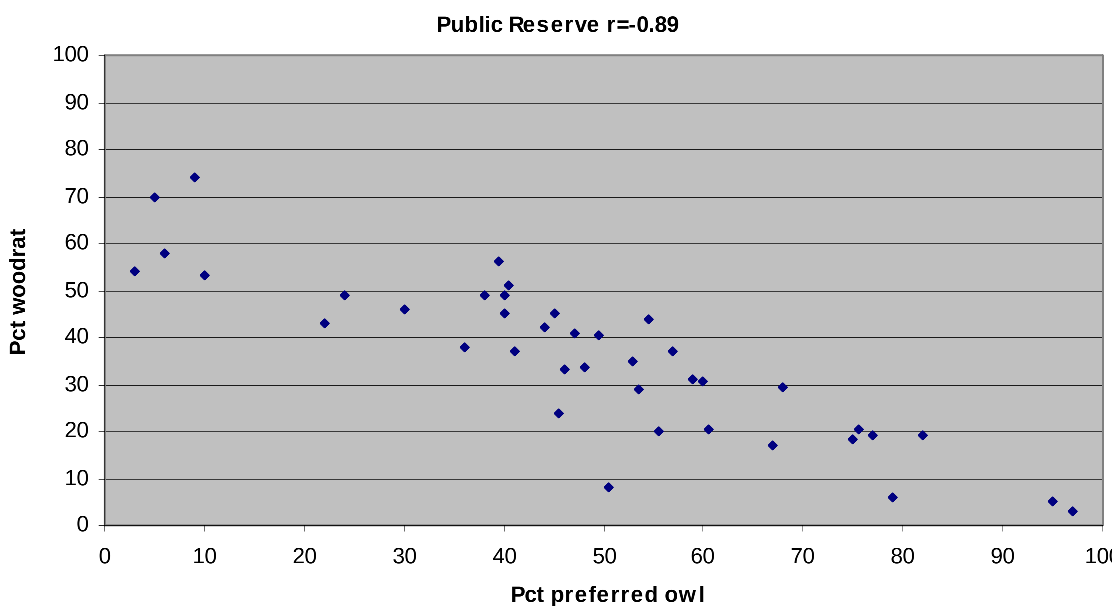


Figure VII 6.6.8a. Amount of high capability Northern Spotted Owl habitat.

Natural History of Species of Concern

This section reviews the natural history of species of concern within JDSF and the large area around it. It addresses Federal, State and/or Board of Forestry and Fire protection listed wildlife species and their regional and local distributions. Table VII.6.6.7 provides a listing of the relevant species, their regulatory status, habitat associations, availability of habitat on JDSF, and known occurrence in the project area.

Table VII 6.6.7. Threatened, endangered, and sensitive terrestrial Invertebrate, amphibian, reptile, mammal, and bird species potentially occurring on JDSF.

Species	Regulatory Status	Habitat Associations	Habitat(s) Available on JDSF	Project Area Occurrence
INVERTEBRATES				
Lotis blue butterfly *Lycaeides argyrognomon lotis*	Federal-E State-none	*Sphagnum* bog/wet meadow	Possible	Known previously to occur west of JDSF.
Behren's silverspot butterfly *Speyeria zerene behrensii*	Federal-E State-none	Coastal dunes, meadows, open coniferous forest	Unlikely	Known previously to occur west of JDSF.
Pomo bronze shoulderband snail *Helminthoglypta arrosa pomoensis*	Federal-none State-none	Dense redwood forest	Likely	Found on lands adjacent to JDSF.
AMPHIBIANS and REPTILES				
Southern Torrent salamander *Rhyacotriton variegatus*	Federal-none State-CSC	Seeps, springs, and streams in conifer forest	Yes	Known to occur on JDSF.
Western Tailed frog *Ascaphus truei occidentalis*	Federal-none State-CSC	Streams in conifer forest	Yes	Known to occur on JDSF.
Northern red-legged frog *Rana aurora aurora*	Federal-none State-CSC	Ponds and streams and adjacent forested and open habitats	Yes	Known to occur on JDSF.
Foothill yellow-legged frog *Rana Boylii*	Federal-none State-CSC	Streams	Yes	Known to occur on JDSF.
Northwestern pond turtle	Federal-none	Slow-moving waters with	Yes	Known to occur on JDSF.

Table VII 6.6.7. Threatened, endangered, and sensitive terrestrial Invertebrate, amphibian, reptile, mammal, and bird species potentially occurring on JDSF.

Species	Regulatory Status	Habitat Associations	Habitat(s) Available on JDSF	Project Area Occurrence
Clemmys marmorata marmorata	State-CSC	adjacent open habitats or forest		
MAMMALS				
Fringed myotis *Myotis thysanodes*	Federal-none State-none	Roosts in mines, caves, trees, and buildings; feeds along forest edges and over forest canopy	Likely	No reported occurrences on or adjacent to JDSF.
Long-legged myotis *Myotis volans*	Federal-none State-none	Roosts in hollow trees, crevices, mines, and buildings; feeds in open habitats	Possible	No reported occurrences on or adjacent to JDSF.
Pacific (Townsend's) big-eared bat *Corynorhinus (Plecotus) townsendii townsendii*	Federal-none State-CSC	Roosts in mines, caves, and buildings; feeds along habitat edges	Possible	No reported occurrences on or adjacent to JDSF.
Pallid Bat *Antrozous pallidus*	Federal-none State-CSC	Roosts in trees, caves, crevices, and buildings; feeds in a variety of open habitats	Likely	No reported occurrences on or adjacent to JDSF.
Sonoma red tree vole *Arborimus pomo*	Federal-none State-CSC	Mid to late-seral Douglas-fir and mixed conifer forest	Yes	Known to occur on JDSF.
Pacific Fisher *Martes pennanti pacifica*	Federal-FC State-CSC	Late seral conifer and mixed conifer forest	Possible	No reported occurrences on or adjacent to JDSF.
Humboldt marten *Martes americana humboldtensis*	Federal-none State-CSC	Late seral conifer forest	Unlikely	No reported occurrences on or adjacent to JDSF.
BIRDS				
Bald Eagle *Haliaeetus leucocephalus*	Federal-T State-E CA Board of Forestry-S	Late seral conifer forest near open water	Yes	No records for this species in JDSF; species has been occasionally observed in nearby watersheds to north

Table VII 6.6.7. Threatened, endangered, and sensitive terrestrial Invertebrate, amphibian, reptile, mammal, and bird species potentially occurring on JDSF.

Species	Regulatory Status	Habitat Associations	Habitat(s) Available on JDSF	Project Area Occurrence
				and south of JDSF during migration periods.
American Peregrine Falcon *Falco peregrinum anatum*	Federal-none State-E CA Board of Forestry-S	Cliffs and canyons used for nesting; often feeds near water	Unlikely	Known to occur in adjacent areas east of JDSF.
Marbled Murrelet *Brachyramphus marmoratus*	Federal-T State-E CA Board of Forestry- S	Late seral conifer forest and marine waters	Yes	Known to occur in adjacent areas west of JDSF.
Northern Spotted Owl *Strix occidentalis caurina*	Federal-T CA Board of Forestry-S	Late and mid-seral stage conifer forest	Yes	Known to occur on JDSF.
Bank Swallow Riparia riparia	Federal-none State-T	Nests in vertical banks along streams	Unlikely	No reported occurrences on or adjacent to JDSF.
Western Snowy Plover *Charadrius alexandrinus*	Federal-T State-	Dry, sandy coastal beaches and dunes; large gravel bars on large low-gradient rivers	Unlikely	No reported occurrences on or adjacent to JDSF.
Great Blue Heron *Ardea herodias*	Federal-none State-A CA Board of Forestry-S	Feeds and usually nests near open water; roosts and nests in trees and snags	Yes	Observed occasionally on JDSF and known to occur on lands adjacent to JDSF.
Great Egret *Casmerodius albus*	Federal-none State-A CA Board of Forestry-S	Feeds and usually nests near open water; roosts and nests in trees and snags	Yes	Known to occur on lands adjacent to JDSF.
Double-crested Cormorant *Phalacrocorax auritus*	Federal-none State-CSC	Coastal areas, bays, estuaries, freshwater lakes, ponds and rivers. Nests and roosts in trees, snags, and rock ledges	Possible	Known to occur on lands adjacent to JDSF.

Table VII 6.6.7. Threatened, endangered, and sensitive terrestrial Invertebrate, amphibian, reptile, mammal, and bird species potentially occurring on JDSF.

Species	Regulatory Status	Habitat Associations	Habitat(s) Available on JDSF	Project Area Occurrence
Long-billed Curlew *Numenius americanus*	Federal-none State-CSC	Estuaries, grasslands, croplands	Unlikely	No reported occurrences on or adjacent to JDSF.
Northern Harrier *Circus cyaneus*	Federal-none State-CSC	Open habitats including grasslands, scrublands, and wetlands	Likely	No known occurrences on or adjacent to JDSF.
Sharp-shinned Hawk *Accipiter striatus*	Federal-none State-CSC	Early to mid seral forest and riparian zones	Yes	Known to occur on JDSF.
Cooper's Hawk *Accipiter cooperii*	Federal-none State-CSC	Coniferous and mixed forests, riparian areas	Yes	Known to occur on JDSF.
Merlin *Falco columbarius*	Federal-none State-CSC	Frequents coastlines, open grassland, woodlands, lakes, wetlands, edges and early successional forest stages.	Possible	No reported occurrences on or adjacent to JDSF.
Osprey *Pandion haliaetus*	Federal-none State-CSC CA Board of Forestry-S	Large trees near open, fish-bearing waters	Yes	Known to occur on JDSF.
Northern Goshawk *Accipiter gentilis*	Federal-none State-CSC CA Board of Forestry-S	Coniferous forest	Yes	Not known to nest but possible sightings on JDSF.
Golden Eagle *Aquila chrysaetos*	Federal-none State-CSC CA Board of Forestry-S	Open woodland	Possible	No reported occurrences on or adjacent to JDSF.
Vaux's Swift *Chaetura vauxi*	Federal-none State-CSC	Conifer forest with large snags	Yes	Known to occur on JDSF.
Purple Martin *Progne subis*	Federal-none State-CSC	Forest and woodland with cavity trees and riparian zones	Yes	Known to occur on JDSF and on adjacent lands west and north of JDSF.

Table VII 6.6.7. Threatened, endangered, and sensitive terrestrial Invertebrate, amphibian, reptile, mammal, and bird species potentially occurring on JDSF.

Species	Regulatory Status	Habitat Associations	Habitat(s) Available on JDSF	Project Area Occurrence
Western Burrowing Owl *Athene cunicularia*	Federal-none State-CSC	Grasslands and shrublands	Unlikely	No reported occurrences on or adjacent to JDSF.
Short-eared Owl *Asio flammeus*	Federal-none State-CSC	Marshlands, grasslands, and forest clearings	Unlikely	Known to occur in urban areas adjacent to JDSF.
Tricolored Blackbird *Agelaius tricolor*	Federal-none State-CSC	Nests in freshwater marsh and occasionally in brush	Yes	No reported occurrences on JDSF; found on lands adjacent to JDSF.
Loggerhead Shrike *Lanius ludovicianus*	Federal-none State-CSC	Grassland, open woodland, and shrubland	Unlikely	No reported occurrences on or adjacent to JDSF.
Yellow Warbler *Dendroica petechia brewsteri*	Federal-none State-CSC	Riparian woodland	Yes	Known to occur on JDSF.
Yellow-breasted Chat *Icteria virens*	Federal-none State-CSC	Riparian thickets and early-seral forest	Possible	Known to occur on lands adjacent to JDSF.
Western Yellow-billed Cuckoo *Coccyzus americanus occidentalis*	Federal Candidate. State endangered	Valley foothill and desert riparian, river bottoms	Unlikely	No reported occurrences on or adjacent to JDSF.

Lotis Blue Butterfly (*Lycaeides argyrognomon lotis*)

Federal: Endangered
State: None
BOF: None

Little is known about the lotis blue butterfly. Since 1930, it has only been recorded at one site, described as a sphagnum bog, under the Elk-Fort Bragg 60 kV transmission line operated and maintained by PG&E (deBecker et al. 1991). However, Embree (personal communication, 2002) notes that a specimen was also collected in the 1950s or 1960s from a locale near Highway 20 about 1.9 mi. (3 km) east of Fort Bragg, but the exact location and habitat is unknown. Subsequent surveys in the 1970s and 1980s documented the lotis blue butterfly at the PG&E site, where it was last sighted in the early 1980s (R. Arnold pers, comm. 2002).

Intensive surveys completed along the PG& E right-of-way in 1990 failed to locate the butterfly in any life stages (deBecker et al. 1991).

Surveys at the PG&E site in the 1970s and 1980s documented a decline in the lotis blue butterfly population (de Becker et al. 1991). Although it has certainly been extirpated from the PG&E site, small populations could still be present elsewhere (R. Arnold, personal communication, 2002). Several potential habitat areas for the species were surveyed in the early 2000's but the species was not located. Because the species is associated with moist, early-seral stages, it could be rediscovered if appropriate habitat were maintained or created within its range. The potential also exists for the species to occur or be discovered on JDSF (R. Arnold, personal communication, 2001).

Known habitat of the lotis blue butterfly is characterized by early successional wet meadows, mucky ditches, and *Sphagnum* bogs where the vegetation has been disturbed to allow the growth of the presumed principal host species, coast hosackia (*Lotus formosissimus*) (R. Arnold, personal communication, 2002). Appropriate foraging habitat is probably not limited to wetlands, and can likely be found in small, open, sunny patches in the Forest as well (R. Arnold, personal communication, 2002).

A combination of human activities and natural climatic events may have led to the decline or extinction of this species. Specifically, habitat formerly occupied by coast hosackia is probably being replaced by other vegetation types through natural plant succession (Arnold et al., 1983). Fire suppression also may reduce the extent of early successional vegetation, as well as the number of small natural forest openings that may have once supported populations of the lotis blue butterfly.

No lotis blue butterflies have been documented on JDSF. However, observations during the 1950s or 1960s may have been on JDSF. The *Sphagnum* bog or early successional wetlands could provide suitable habitat for the host species of this butterfly. The presence of this habitat and the possibility of extant populations suggest that lotis blue butterflies could occur on JDSF in the future.

Southern Torrent Salamander (*Rhyacotriton variegatus)*

Federal Species of Concern
State: Species of Special Concern
BOF: None

The southern Torrent salamander occurs in suitable habitat in the coast ranges below about 4,820 feet (1,470 m) (Welsh and Lind 1996) from northwestern Oregon southward to Point Arena in Mendocino County (Jennings and Hayes 1994, Blaustein et al. 1995, Welsh and Lind 1996). Diller and Wallace (1996) found 1,475 southern Torrent salamanders from 220 different streams on private timberlands located in western Del Norte and Humboldt counties, California.

Little information is available on the current population status or trends of the southern Torrent salamander. Jennings and Hayes (1994) consider the species to be at risk because of its narrow hydric and thermal requirements. Populations may be threatened by removal of riparian forest cover, changes in seep hydrology, and increased deposition of fine sediments in streams (Corn and Bury 1989; Jennings and Hayes 1994; Diller and Wallace 1996).

Breeding habitat for the southern Torrent salamander is generally considered to be forested permanent seeps, streams, and waterfalls with rocky substrates and cold water temperatures (Nussbaum et al. 1983). Foraging occurs in moist areas in or near streams and seeps (Corn and Bury 1991, Corkran and Thoms 1996, Welsh and Lind 1996). Welsh and Lind (1996) found that percent seep habitat was the single best variable for predicting abundance of southern Torrent salamanders in their northwestern California study area. Diller and Wallace (1996) found that a greater percentage of streams flowing through consolidated geologic materials contained southern Torrent salamanders than those flowing through younger, unconsolidated materials.

Significantly greater numbers of southern Torrent salamanders have been found in older (greater than 200 years old) Douglas-fir forest stands than in younger stands (Welsh and Lind 1988, 1991; Welsh 1990; Welsh et al. 1992, Corn and Bury 1991). More recent data shows that younger managed forests are also known to provide habitat for this species (Diller and Wallace 1996, Welsh and Lind 1996). Although Diller and Wallace (1994) and Corn and Bury (1989) found southern Torrent salamanders in some managed forests, they do not believe that this species favors a landscape dominated by young forests. Where the salamanders persist on a managed redwood landscape, streams generally flowed through consolidated geologic materials on primarily northerly facing aspects (Diller and Wallace 1996).

Optimum substrate size and proportions to maintain adequate interstitial space used for cover and oviposition by this species consist of at least 68 percent gravel, boulder and bedrock, and less than 50 percent cobble with gravel, with a low percent sand component (Diller and Wallace 1996, Welsh and Lind 1996). High-gradient stream reaches provide suitable habitat because they are transport areas where finer sediments do not accumulate, and gravel and cobble do not become embedded (Diller and Wallace 1996). The coastal populations may not be as sensitive to loss of forest cover as interior populations because of cooler temperatures (Diller and Wallace 1996).

Southern Torrent salamanders have been recorded on JDSF lands (Kitchen 1992, CNDDB 2004). They have also been found at several locations on adjacent private timberlands (G-P 1997).

Tailed Frog (*Ascaphus truei*)

Federal: Species of Concern
State: Species of Special Concern
BOF: None

Tailed frogs are found in suitable habitat from sea level to near timberline throughout the coastal mountains from British Columbia south to northwestern

California, and in the Rocky Mountains of Idaho, Montana, and British Columbia (Stebbins 1985).

Little information is available on the status and population trends of tailed frogs. Tailed frogs are considered sensitive to canopy disturbance and increased sedimentation associated with timber harvesting and forest management operations, modification of historical flooding regimes, and grazing (Corn and Bury 1989, Welsh 1990, Jennings and Hayes 1994). However, according to Jennings and Hayes (1994), the coastal population persists in most of the drainages where it is known to have occurred historically. This may be due to the cooler temperatures found in coastal forests (Jennings and Hayes 1994). As an example, Diller and Wallace (1999) found tailed frogs in 54 (75%) of 72 randomly selected streams in managed redwood forests in Humboldt and Del Norte counties, California.

Tailed frogs occur in or near cold mountain streams and coastal creeks with large rocks and/or woody debris. They have been associated with many different forest types, including Douglas-fir, redwood, Sitka spruce, ponderosa pine, and western hemlock (Jennings and Hayes 1994). Breeding and developmental habitat for the tailed frog generally consists of permanent cool streams with cobble/boulder substrate and woody debris (Welsh et al. 1993). Adults forage mainly on land along streambanks, but will also forage underwater (Zeiner et al. 1988). In-stream rocks and woody debris provide shelter for this species (Zeiner et al. 1988).

Tailed frogs have been recorded on JDSF (CNDDB 2004). On the nearby private timberlands, a number of tailed frogs have been recorded (CNDDB 2004, G-P 1997).

Northern Red-legged Frog (*Rana aurora aurora*)

Federal: Species of Concern
State: Species of Special Concern
BOF: None

The species *Rana aurora* consists of two subspecies: the northern red-legged frog (*R. aurora aurora*) and the California red-legged frog (*R. aurora draytoni*). The northern red-legged frog ranges from Vancouver Island, British Columbia, Canada, south along the Pacific coast west of the Cascade ranges to northern Del Norte County, California (USFWS 1996a). Red-legged frogs found in areas from Humboldt to Marin Counties exhibit intergrading characteristics between the northern and California (*R. aurora draytoni*) subspecies (Krempels 1986 in USFWS 1996a, Jennings and Hayes 1994). According to USFWS (1996a), the ESA does not protect red-legged frogs found in Humboldt, Trinity, or Mendocino counties. Red-legged frogs present on JDSF belong to the northern subspecies. The known elevation range of the northern subspecies and associated intermediate populations extends from near sea level to 3,830 ft. (1,160 m) (Jennings and Hayes 1994).

Declines in northern red-legged frogs have been reported in British Columbia, Washington, and Oregon (Jennings and Hayes 1994). Sufficient information has not yet been collected in California to assess overall population trends (Jennings and Hayes 1994). Little information is available concerning the causes for the observed decline of this subspecies, but exotic predators and exotic predatory fish introductions, urban and coastal development, and grazing have been implicated as contributing factors (Jennings and Hayes 1994).

Red-legged frogs breed in water 0.5 to 2 m deep (occasionally deeper), in cool, usually well shaded ponds or lake edges, beaver ponds or slow streams, in winter to early spring (Corkran and Thoms 1996). Springs, marshes, and reservoirs may also be used for breeding (Nussbaum et al. 1983; Blaustein et al. 1995). Within these habitats, the red-legged frog usually frequents temporary and permanent pools that are bordered by dense grasses or shrubs (Jennings and Hayes 1994). Although not restricted to old-growth forests, red-legged frogs are frequently found in this habitat (Bury and Corn 1988). In southern Washington, Aubry and Hall (1991) found that red-legged frogs were most abundant in mature stands and least abundant in young stands. Red-legged frogs are frequently observed in managed coastal forested habitats of western Humboldt and Del Norte counties (D. Embree, pers. obser.). The presence of red-legged frogs in older forest stands may be correlated more with downed woody debris and ponds than stand age (Aubry and Hall 1991). Red-legged frogs can also be found considerable distances from breeding habitats on rainy nights (Zeiner et al. 1988).

Northern red-legged frogs have been documented on JDSF (CNDDB 2004, Kitchen 1992). Northern red-legged frogs have also been reported on adjacent private timberlands adjacent to JDSF (CNDDB 2004, G-P 1997).

Foothill Yellow-Legged Frog (*Rana boylii*)

Federal: Species of Concern
State: Species of Special Concern
BOF: None

The foothill yellow-legged frog is found in southwestern Oregon, California, and Baja California. In California, this species can be found in the Sierra Nevada foothills to approximately 6,000 ft (1830m) elevation, and in the Coast ranges from the Oregon border south to the San Gabriel River in southern California (Stebbins 1985).

The foothill yellow-legged frog has become absent from many locations where it was historically present, principally in the Sierra Nevada foothills and southern portions of its range (Jennings and Hayes 1994). However, it is still abundant in many drainages in northwestern California and appears to be distributed throughout its historic range in this region (Jennings and Hayes 1994). Breeding, larval, and developmental habitat for the foothill yellow-legged frog consists of shallow, low-velocity, small- to moderate-sized streams with cobble and boulder substrate, particularly near gravel bars and vegetated streambanks (Kupferberg 1996). Where similar flow conditions exist, larger streams also can provide suitable habitat. As an example, yellow-legged frogs of various life cycle stages were observed, generally associated with cobble substrates, in and along the Trinity, Eel, Mad, and Van

Duzen rivers, Humboldt County, California (NRM 1997, 1998). Oviposition generally occurs between March and early June, with maturity reached after about two years (Jennings and Hayes 1994). Foraging usually occurs within or near streams (Zeiner et al. 1988, Kupferberg 1996). This species is associated with streams in a variety of habitats, including meadows, shrub, various aged forests, and water margins with cobble. It is tolerant of warm water conditions (up to 27 °C [81°F]) (Zeiner et al. 1988, Welsh and Lind 1991, Jennings and Hayes 1994) and is frequently observed basking in full sunlight along coastal rivers in Humboldt County (D. Embree, pers. obser.).

The foothill yellow-legged frog is closely associated with streams and rivers (Stebbins 1985, Corkran and Thoms 1996) and has been documented on JDSF lands and adjacent ownerships (CNDDB 2004, G-P 1997, M. Jameson pers. comm.). Field surveys on adjacent private timberlands suggest that foothill yellow-legged frogs are locally common (G-P 1997).

Northwestern Pond Turtle (*Clemmys marmorata marmorata*)

Federal: Species of Concern
State: Species of Special Concern
BOF: None

The western pond turtle (*C. marmorata*), of which the northwestern pond turtle is a subspecies, is the only freshwater turtle native to California. It can be found in suitable aquatic habitats from southern British Columbia south to northern Baja California (Ernst et al. 1994), from sea level to 6,000 ft (1,830 m) (Zeiner et al. 1988). The northwestern subspecies *(C. m. marmorata)* can be found from British Columbia south to Marin County, California (Stebbins 1985).

Jennings and Hayes (1994) consider the northwestern pond turtle to be threatened in California. Although the northwestern pond turtle appears to still occur in most areas where it was reported historically, some populations show little or no recruitment (Jennings and Hayes 1994). Aquatic altering activities, such as agriculture, urbanization, flood control, water diversion projects, dams, mining, timber harvest, grazing, and exotics are believed to have contributed to population declines (Jennings and Hayes 1994, Reese et al. 1998). However, this species is found in altered aquatic habitats such as canals, reservoirs, and stock ponds (USFWS 1993).

Population estimates for the northwestern subspecies are not available, but some estimates are available for certain areas. For example, in northern California, Reese (1996) estimates a population total of 1,318 pond turtles in their 16 Trinity River study reaches.

Northwestern pond turtles are an aquatic species that requires basking sites for thermal regulation and upland areas for reproduction. In general, aquatic habitats include marshes, sloughs, ponds, reservoirs, and slow moving portions of creeks and rivers (USFWS 1993, Nussbaum et al. 1983, Zeiner et al. 1988, and others).

They require basking sites such as partially submerged logs, rocks, mats of floating vegetation, or exposed mud (Jennings and Hayes 1994, Zeiner et al. 1988).

Nesting usually occurs in sunny areas along the water margin or in southern exposed upland habitats. Ernst (1994) indicates that most nests are located along the water margin of streams or ponds, but may be located up to 100 m above and distant from the water. Nest sites require full sunlight such as open grassy or southern exposures (Ernst et al. 1994, Rathbun et al. 1992). Upland nesting habitats include dry meadows as well as young seral stages of most forest types, including hardwoods, mixed hardwoods, and conifer forests (Rathbun et al. 1992).

Throughout their range, western pond turtles nest from late April through August (Ernst et al. 1994); the peak in Oregon is thought to be June to mid-July (Blaustein et al. 1995). "Female turtles leave the water in late May to July to find nesting sites (Nussbaum et al. 1983)." Young generally emerge from the nest in spring (Holland 1985), but may emerge in late summer or fall (Ernst et al. 1994). Pond turtles hibernate in bottom mud of streams or ponds, or on land up to about 1,600 feet from water (Ernst and Barbour 1972).

Pond turtles are omnivores (Ernst et al. 1983). They forage on aquatic vegetation and a variety of invertebrates, small vertebrates including frogs, and carrion (Nussbaum et al. 1983).

Northwestern pond turtles have been recorded on JDSF (Town 2000a), and on adjacent private lands (G-P 1997). Town's (2000a) observations came during her 1998-1999 study and consisted of one adult in North Fork Caspar Creek, and two juveniles, one in Hare Creek and the other in the North Fork Big River.

Northern Goshawk (*Accipiter gentilis*)

Federal: Species of Concern
State: Species of Special Concern
BOF: Sensitive

Northern Goshawks breed in the North Coast Ranges, throughout the Sierra Nevada, Klamath, Cascade, and Warner mountains, and possibly in the San Jacinto, San Bernardino, and White Mountains (Zeiner et al. 1990a). In the coastal redwood forest zone, Northern Goshawks are present at relatively low densities (G-P 1997). Harris (1996) considers the Goshawk a rare resident breeder in northwestern California. Bloom et al. (1986) indicates that Goshawks have likely always been rare in Coastal California.

Bloom et al. (1986) estimated there to be 1,300 nesting territories in California, of which approximately 61% are active each year. In California, Goshawk population declines are believed to be related to the loss and fragmentation of mature and old growth conifer forests from timber harvesting (Bloom et al. 1986). However, the USFWS (1998a) found no evidence to suggest that Goshawks are dependent upon large, unbroken tracts of old-growth and mature forest. The USFWS "found that while the Goshawk typically does use mature forest or larger trees for nesting habitat, it appears to be a forest habitat generalist in terms of the types and ages of forests it will use to meet its life history requirements." Reynolds (1992) also describes the Goshawk as a "forest habitat generalist that uses a variety of forest types, forest ages, structural conditions, and successional stages." Goshawks can use small patches of mature habitat to meet their nesting requirements within a mosaic of habitats of different age classes; a key factor appears to be availability of prey. Forest management practices, such as the use of controlled fire and selective thinning, also may make habitats more suitable to Goshawks by opening up dense understory vegetation, creating snags, down logs, woody debris, and other conditions conducive to Goshawks and their prey (Reynolds et al. 1992).

More recently, Greenwald et al. (2005) conducted a review of Northern Goshawk home range habitat selection studies. Most studies (9 of 12) showed that Goshawks selected forest stands with higher levels of canopy closure, larger tree size, and greater numbers of large trees when compared to stands selected at random. Goshawks generally avoided open areas and early-seral conditions occurring naturally or as a result of management activities. In addition, Goshawks did not select stands due to prey abundance but rather in response to forest structure conducive to foraging method and prey availability. Management recommendations "focusing on increasing prey abundance at the expense of forest structure within occupied home ranges are not likely to improve goshawk occupancy rates" (Greenwald et al. 2005 p. 126).

Northern Goshawks initiate breeding by mid-June in northern California (Zeiner et al. 1990a). Nest construction can begin as early as two months before egg laying (Johnsgard 1990). Nests are constructed and many pairs will have two to four alternate nest areas within their home range (Reynolds 1992). One nest may be used in sequential years, but often the pair switches to an alternate nest. The young fledge within 45 days and begin to hunt within 50 days. Only one brood per season is produced. After fledgling, the family group stays together and remains in the general vicinity of the nesting territory. This post-fledging area tends to be larger than the nesting territory (Reynolds 1992). The diet of Goshawks consists mostly of birds (from robin to grouse in size), though small mammals such as ground and tree squirrels are also taken (Zeiner et al. 1990a, Reynolds 1992).

In the northwest, Northern Goshawks nest in mature and old-growth stands of coniferous forest composed of large trees with high canopy closure. The nest is typically situated in the largest tree of the stand (Squires and Reynolds 1997). Although Goshawks include both natural and human-made small forest openings in their territories (Squires and Reynolds 1997), it is unclear whether this is because large tracts of closed canopy forest are limited in the present day landscape. Reynolds et al. (1982) similarly report that Goshawks in Oregon frequently nest near breaks in the canopy created by logging trails or downed trees. Snags and dead-topped trees are often used for hunting perches (Zeiner et al. 1990a).

Based on 10 nest sites in northwestern California, Hall (1984) characterized typical nest sites as associated with a mature Douglas-fir stand within a young Douglas-fir forest containing a hardwood component. In Oregon, Goshawks nested in live trees with a mean dbh of 11 inches (27.4 cm) (Reynolds et al. 1982). In California, Richter and Callas (1998) found Goshawks nesting in a variety of large trees (range 11-84 inch dbh), including white fir (38%) and Douglas-fir (32%), and less often in red fir, Jeffery pine, ponderosa pine, sugar pine, incense cedar, and black oak. In the coastal redwood belt, specific habitat parameters for Goshawk nesting have not been determined (G-P 1997). In northwestern California, forest stands used for nesting ranged from 4 to 74 acres (mean = 25 acres) and from 1.0 to 32 acres (mean = 6.7 acres) (Hall 1984, Squires and Ruggiero 1996).

Throughout its range, the Northern Goshawk forages in diverse habitat, which can vary from open sagebrush to dense forests (Squires and Reynolds 1997). However, in California mature and old-growth forest with dbh greater than 20 inches (52 cm) and canopy closure greater 40 percent was used for foraging, and open habitats such as meadows and seedling or sapling stands were avoided (Squires and Reynolds 1997).

The Northern Goshawk is a rare resident and nesting species in northwestern California (Harris 1996). Mendocino County is at the southern edge of the north coastal portion of the Goshawk's nesting range (Zeiner et al. 1990a). The CNDDB (2004) lists five records for Mendocino County: 1) Plaskett Ridge (1981), 2) Cahto Peak, 3) Ornbaum Valley (1994), 4) Leggett (1997), and 5) Bluenose Ridge (1998). Northern Goshawks have also been recorded on private lands adjacent to JDSF (G-P 1997).

Although no nests have been located, there have been at least two possible sightings of Northern Goshawks on JDSF (B. Valentine pers. comm.). Observations occurred in March 1992 in the 14 Gulch area and the other in April 1994 in the NF Big River near Road 70. However, no Goshawks have been detected during the course of surveys (Valentine et al. 1995, CDFG 1996, 1997, Jameson 1999, and others). In 2001, NCASI surveyed the forest for raptors and no Goshawks were detected (Marc Jameson, comments dated 3/21/02).

Cooper's Hawk (*Accipiter cooperi*)

Federal: None
State: Species of Special Concern
BOF: None

In general, Cooper's Hawks breed from southern Canada to northern Mexico and winters in most of North America to Central America. In California, they occur in suitable habitats throughout the state (Johnsgard 1990, Zeiner et al. 1990a, Small 1994). In the Northern Coast Range it is considered an uncommon resident (Harris 1996). Small (1994) considers nesting in woodlands and interior valleys from Humboldt County south to be spotty. However, populations increase throughout the state in winter (Small 1994).

Cooper's Hawks primarily nest at higher elevations in the northern one-third of the state (Small 1994). Reynolds (1983) found Cooper's Hawks from sea level to near timberline in Oregon. According to Rosenfield and Bielefe (1993), Cooper's Hawks breed in a variety of habitats including extensive forests; woodlots of deciduous, coniferous, and mixed pine hardwoods; pine plantations, and urban environments. According to Burridge (1995), Cooper's Hawks prefer mixed forest habitats (Bay, cottonwood, pine, oaks) near creeks. Boal and Mannan found 60 different nest trees in 33 territories in their urban environment study area located in Tucson, Arizona. In California, most common breeding habitats include dense stands of live oak, riparian deciduous or other forest habitats near water (Zeiner et al. 1990a). In Oregon, Reynolds (1983) found most Cooper's Hawks nest sites on gentle to moderate slopes (0-30%) with northern aspects and located near water (Reynolds 1983). In steeper environments they were typically found on north-facing benches. Where they are found in large forested environments, they are usually found near forest edges, along roads or clearings, or at other openings such as stream or lake edges (Johnsgard 1990).

Reynolds (1983) found Cooper's Hawk nests in Oregon primarily in 30 to 70 year old evenaged forested stands. Zeiner et al. (1990a) indicates that Cooper's Hawks usually nest in second-growth conifer stands or in deciduous riparian areas, usually near streams. In Boal and Mannan's (1998) urban study, they found most Cooper's Hawks nest sites in front and back yards of private residence or in high-use recreational areas. Although Cooper's Hawks usually reuse the same forest stand for more than one year, they typically build a new nest within 100 m of the old one (Reynolds 1983). Cooper's Hawks' nests in northeastern Oregon were in trees with an average dbh of approximately 17 inches (43.7 cm) and nest height averaged about 39 feet (12.1 m) (Moore and Henny 1983). Reynolds (1983) found that Cooper's Hawks in his Oregon study area usually appeared at their nest site in late March. The northeastern Oregon population studied by Moore and Henny (1983) found incubation to begin in April with brooding in May.

Cooper's Hawks feed on a variety of small animals, including birds, mammals, reptiles, and amphibians (Zeiner et al. 1990a). They forage along edges and in broken woodlands (Zeiner et al. 1990a).

Cooper's Hawks nest in a variety of wooded environments. Cooper's Hawks have been recorded on JDSF (CDFG 1996) and a nest site was located by Forest staff in 1996. They also are known to occur in the vicinity (G-P 1997).

Golden Eagle (*Aquila chrysaetos*)

Federal: None
State: Species of Special Concern and Fully Protected
BOF: Sensitive

Golden Eagles occur throughout California except in the Central Valley (Zeiner et al. 1990a). However, they are considered rare along the immediate coast, in the southern deserts, in interior portions of the Central Valley, along the lower Colorado River, and around the Salton Sea (Small 1994).

Nesting by Golden Eagles typically occurs on cliffs or large trees in rugged open areas such as canyons and escarpments (Zeiner et al. 1990a). Foraging occurs in open terrain such as grasslands, deserts, sage-juniper flats, and savannas, early successional stages of forest and shrub habitats, desert edges, farms, or ranches (Small 1974, Zeiner et al. 1990a). Golden Eagles hunt over large open areas and feed on a variety of lagomorphs, other mammals, birds, reptiles, and occasionally carrion (Zeiner et al. 1990a).

Although no cliffs occur on JDSF, Golden Eagles could nest in older conifer and mixed conifer stands.

In northwestern California, Golden Eagles are a rare to uncommon resident nesting species (Harris 1996). Although Golden Eagles are known to nest in interior Mendocino County (G-P 1997), they have not been reported within the JDSF, although potential habitat may be available outside the ownership. Individual Golden Eagles have been observed occasionally on nearby private timberlands, although no nests have been found (G-P 1997).

Bald Eagle (*Haliaeetus leucocephalus*)

Federal: Threatened; Bald Eagle Protection Act
State: Endangered
BOF: Sensitive

The status, distribution, and ecology of the Bald Eagle is described in the *Final rule to reclassify the Bald Eagle from endangered to threatened* (USFWS 1995); and the *Pacific Bald Eagle Recovery Plan* (USFWS 1986). The following summarizes the status, distribution, and ecology of the Bald Eagle as relevant to this analysis.

Bald Eagles are widely distributed in North America, breeding in most of central and southern Canada south to the Great Lakes along the Atlantic and Gulf Coasts, and west along the Pacific Coast from Alaska to Baja California. Breeding populations of the Bald Eagle were formerly distributed throughout northern California and from Oregon south to Mexico. However, the majority of Bald Eagle nesting territories in California is currently concentrated in the northern part of the state in Butte, Lassen, Lake, Trinity, Modoc, Plumas, Siskiyou, and Shasta Counties (Zeiner et al. 1990a). Bald Eagles winter throughout most of California, with large concentrations in the Klamath Basin (Zeiner et al. 1990a).

The primary reason for listing the Bald Eagle was the adverse effect of DDT on the reproductive success of nesting eagles. With the ban on DDT and implementation of the Pacific Bald Eagle Recovery Plan, numbers of Bald Eagles have increased. The USFWS is currently considering delisting the eagle. However, Bald Eagles are still locally impacted by loss of roosting, nesting, and foraging habitat owing to development; shooting; secondary lead poisoning; environmental contaminants; electrocution; and disturbance of nesting, roosting, and foraging by human intrusion or activity (USFWS 1986).

The Bald Eagle population levels have increased in response to improved conditions in the environment. Surveys of the lower 48 states documented a total of 417 pairs in 1963. Within about 20 years, Bald Eagles increased to 1,757 pairs in

1984 (USFWS 1995). Ten years later in 1994, a total of 4,452 pairs were observed in the lower 48 states (USFWS 1995). According CDFG (2001), Bald Eagle populations were increasing as of 1997.

Bald Eagles are typically associated with aquatic systems (e.g., rivers, large lakes, reservoirs, major rivers, and some coastal habitats. Fish comprise most of the eagle's diet, although waterfowl, jackrabbits, and carrion can be important locally and/or seasonally (USFWS 1986). To support reproductive pairs, aquatic habitats must have an adequate food base with sufficient nearby perch and nest sites. In winter, roost sites are chosen in areas close to water and with many perch trees (USFWS 1995).

Bald Eagles nest in large, old-growth, or dominant live trees with open branchwork, especially ponderosa pine, usually in stands with less than 40% canopy closure (Zeiner et al. 1990a). Nests are typically located within two miles of bodies of water (USFWS 1986). Pairs use the same territories each year and typically reuse the same nests. The critical period of the breeding season (from the formation of pair bonds through the young fledging) extends from January 1 to August 31 (Small 1994). Snags are important for providing perch sites or access to nests (USFWS 1986).

Wintering habitat and communal roosts are characterized as perch trees near water and with a view of the surrounding area (USFWS 1986). A variety of tree species are used as wintering habitat. Isolation from disturbance is an important feature of wintering habitat, and protection from inclement weather may also be an important factor in its selection. Communal roosts differ from winter perch sites. Communal roosts are typically located near rich food sources and in uneven-aged forest stands containing an old-growth component. Forest stands used as communal roosts also provide protection from inclement weather.

The CNDDB (2004) lists five Bald Eagle nest sites in Humboldt County, none in Marin County, and one recently discovered in Mendocino County within the Ornbaum valley 7.5' Quadrangle. The Georgia-Pacific SYP (G-P 1997) reports that no Bald Eagles currently nest in Mendocino County and that "historical information on nesting suggests that Bald Eagles have never been common in the coastal redwood zone." Harris (1996) considers the Bald Eagle to be a rare to uncommon resident and locally rare breeder in northwestern California. Breeding Bald Eagles in northern California are typically associated with large fish bearing reservoirs and rivers, such as Shasta Lake and the Klamath River.

There are no records of Bald Eagles on the JDSF. However, Bald Eagles have been sighted a few times on private timberlands near JDSF (G-P 1997). Prior to 1940, two nests were reported along the Big River, and several other nests were seen along Ten Mile River (Detrich 1985 in G-P 1997).

Osprey (*Pandion haliaetus*)

Federal: None
State: Species of Special Concern
BOF: Sensitive

Osprey breed in suitable habitats from Alaska to northern California and western United States and throughout south-central Canada to and along the Atlantic coast to Florida. In California, they formerly bred along the coast from the Oregon border south to San Diego County, in the northeastern plateau region, most of the Central Valley, on lakes in the Coast Range, and at a few sites in the central Sierra Nevada. Currently, principal breeding locations include Eagle Lake, Lake Almanor, the Sacramento River in Tehama County, Siskiyou and Del Norte Counties, and south to Marin County (Small 1994). In fall and winter, most Ospreys migrate from extreme northern California to southern California, Mexico, or South America (Small 1994).

Osprey populations declined in California as a result of pesticide contamination, the removal of nesting trees, degradation of river and lake environmental quality, boating and other disturbances on nesting lakes, and shooting (Henny et al. 1978). Small (1994) estimates 400 breeding pairs in California. Osprey populations in Oregon increased from 1976 to 1993 after the ban on DDT (Henny and Kaiser 1996).

Osprey are generally associated with large fish-bearing waters, such as lakes, rivers, bays, estuaries, and surf zones (Zeiner et al. 1990a). Osprey require open, clear waters for foraging where they feed primarily on fish, although they may also take a few mammals, reptiles, birds, amphibians, and invertebrates (1990a).

Birds arrive on the nesting grounds in mid-March to early April, and breeding occurs in March through September. Nests are constructed in large dead-topped trees, snags, cliffs, or man-made structures (Zeiner et al. 1990a), usually within 440-yd (400 m) of fish-producing waters (Lederer 1976). Tall open-branched trees are required near the nest tree for landing by adults before approaching the nest and for practice flights by the young (1990a).

Ospreys are a common summer resident and nesting species in northwestern California (Harris 1996). Nesting Ospreys have been recorded on JDSF near Caspar Creek (CDFG 1997) and are regularly observed on nearby private timberlands (G-P 1997).

American Peregrine Falcon (*Falco peregrinus anatum*)

Federal: None (delisted 1999)
State: Endangered
BOF: Sensitive

A detailed account of the taxonomy, ecology, and reproductive characteristics of the American Peregrine Falcon may be found in the following documents: *The Pacific Coast American Peregrine Falcon Recovery Plan* (USFWS 1982) and

Proposed Rule to Remove the Peregrine Falcon in North America from the List of Endangered and Threatened Wildlife: Proposed Rule (USFWS 1998b).

The American Peregrine Falcon occurs throughout much of North America from the subartic boreal forests of Alaska and Canada south to Mexico. This subspecies nests from central Alaska, central Yukon Territory, and northern Alberta and Saskatchewan, east to the Maritimes and south (excluding coastal areas north of the Columbia River in Washington and British Columbia) throughout western Canada and the United States to Baja, California, Sonora, and the highlands of central Mexico.

The American Peregrine Falcon was delisted by the federal government on August 25, 1999. The primary reason for the original listing of the Peregrine Falcon was a significant reduction in numbers and distribution due to reproductive failure, caused primarily by eggshell thinning as a result of accumulations of DDT in its tissues. With the ban on DDT and implementation of the recovery plan, Peregrine Falcon numbers have increased. In some portions of California, the lingering effects of DDT have caused reproductive rates to remain low. Some predation from great horned owls (*Bubo virginiatus*), other raptors, and mammalian predators has been noted, and several diseases and parasites are known to occur in peregrine populations; however, no information exists as to the level of significance of these potential mortality factors. Additional threats as reported in the Pacific population recovery plan (USFWS 1982) include collisions with electrical transmissions lines, electrocution, shooting, and the capture of nestlings for falconry. In some California locations, these factors were responsible for a significant portion of the total known mortality.

Currently, populations of American Peregrine Falcons have increased to a minimum of 1,388 pairs in Alaska, Canada, and the western United States, and a minimum of 205 pairs are found in the eastern and midwestern United States. The American Peregrine Falcon has met or exceeded recovery goals for number of breeding pairs in each of the five recovery areas within its range. Currently, approximately 239 breeding pairs of Peregrine Falcons are known to occur within the Pacific coast region (California, Oregon, Washington, and Nevada). This exceeds the recovery goal of 185 breeding pairs within this area (established in the Pacific Coast Recovery Plan (USFWS 1982) for delisting the species.

The Peregrine Falcon is found in a wide variety of habitats, including arctic tundra, mountain ranges, open forests, and grasslands. In California, this species generally breeds near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, or mounds and occasionally in tree or snag cavity or old raptor nest (Zeiner et al. 1990a). Nest ledges often include a recessed platform that provides protection from inclement weather.

In northwestern California, the Peregrine Falcon is an uncommon migrant and winter visitor, and a rare, local nesting species and summer resident (Harris 1996). Nesting habitat is primarily cliffs, although large trees are occasionally used (Zeiner et al. 1990a). Foraging habitat consists of open areas such as grasslands, wetlands, and open forest habitats, such as recent clear cuts. No cliffs occur on JDSF. However, falcons nesting on adjacent properties could forage on JDSF. Habitats on JDSF potentially used by Peregrine Falcons for foraging include meadows, early-seral stages of conifer and hardwood-conifer forest stands, pygmy forest, and closed-cone pine-cypress and areas associated with water.

Marbled Murrelet (*Brachyramphus marmoratus*)

Federal: Threatened
State: Endangered
BOF: Sensitive

Accounts of the taxonomy, ecology, and reproductive characteristics of the Marbled Murrelet are found in the following publications: Endangered and threatened wildlife and plants; determination of threatened status for the Marbled Murrelet, final rule (USFWS 1992b); Ecology and Conservation of the Marbled Murrelet (Ralph et al. 1994); the Final Designation of Critical Habitat for the Marbled Murrelet (USFWS 1996b); Final Recovery Plan for the Marbled Murrelet in Washington, Oregon, and California Populations (Recovery Plan) (USFWS 1997); the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl (FSEIS) (USFS and BLM 1994); the Status of the Marbled Murrelet in North America: with Special Emphasis on Populations in California, Oregon, and Washington (Marshall 1988), and in Nelson (1997). The USFWS recently had prepared an Evaluation report for the 5-year status review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004). This status review summarizes, evaluates, and interprets biological, ecological, and population information and provides an evaluation of current threats to the species.

Biology and Ecology
Marbled Murrelets are diving seabirds that feed on a wide variety of small fish and invertebrates in near-shore marine waters (generally within one mile of the shore) (USFWS 1996b). They are generally opportunistic feeders and can exhibit major changes in prey consumption in response to changes in the marine environment. Nesting birds carry one prey item to the nest at a time to feed their young (Hamer and Nelson 1995a).

Marbled Murrelets produce one egg per nest (Hamer and Nelson 1995b). Replacement of a lost egg following early breeding failure has been documented for small numbers of murrelets in northern California (Hebert et al. 2003 fide McShane et al. 2004). Nests are not built, but rather the egg is placed in a small depression or cup in moss or other debris on the limb (Nelson 1997). In California, egg-laying and incubation span a long period, beginning March 24 and ending August 25, with the nestling period beginning April 23 and ending September 9 (Hamer and Nelson 1995b). In California's Redwood National and State Parks, Hebert et al. (2003) noted nest site initiation from April 22 to July 5 and fledging dates of June 17 to August 30 in 2001. In 2002, nesting was estimated to have begun on May 6 until July 21 (a re-nesting attempt). Fledging ranged from June 29 to September 15. Marbled Murrelets, like many Alcids, display a high level of fidelity to nest locations returning to the same tree or stand each year (Nelson 1997).

Distribution

The Marbled Murrelet ranges from the Aleutian Archipelago and the eastern Bering Sea in Alaska to Monterey Bay in California (Ralph et al., 1994). The distribution of Marbled Murrelet populations has been significantly reduced as habitat has been removed and populations have declined. Current breeding populations are discontinuous and generally concentrated at sea in areas adjacent to remaining late-successional coniferous forests near the coast (Nelson, 1997a). At-sea observations of murrelets are rare between the Olympic Peninsula in Washington and Tillamook County in Oregon, a gap of approximately 100 miles. Off the California coast, Marbled Murrelets are concentrated in two areas at sea that correspond to the three largest remaining blocks of older, coastal forest. These forest blocks are separated by areas of little or no habitat, which correspond to locations at sea where few Marbled Murrelets are found. A 300-mile gap occurs in the southern portion of the Marbled Murrelet’s breeding range, between Humboldt and Del Norte Counties in the north and San Mateo and Santa Cruz Counties in the south. Marbled Murrelets likely occurred in this gap prior to extensive logging of redwood forests (USFWS, 1997c). Moderate numbers of murrelets have been observed along the coast of Mendocino, Sonoma, or Marin counties (Paton and Ralph 1988, 1990).

Local Distribution

Recent radar surveys have documented the occurrence of birds considered to be murrelets, flying inland at several locations (Ten Mile, Big, and Navarro rivers) along the Mendocino coast (S. Martinelli CDFG pers. comm. July 6, 2004). Meekins (2003) used radar to determine the presence, absence, and relative abundance of murrelets on private forestland within portions of the Ten Mile watershed and its tributaries, Usal Creek watershed, and South Fork Eel Watershed, all north of JDSF. All contiguous old-growth forest was logged from the Ten Mile River and Usal Creek watersheds and tributaries by the 1970s. Remaining forests within the watersheds are of early to mid seral stages and less 90 years of age. Remnant old-growth trees (>200 yrs) exist individually or in small clumps <0.2 ha on the landscape along stream courses or in areas that were difficult to access with historic logging methods (Meekins 2003). Suspected murrelet radar targets (identified principally by flight speed) were highest within the main stem of the Ten Mile River and at the confluence of the Middle and North Forks of the Ten Mile River (5 each) but were also noted for Chadbourne Gulch, Usal Creek, and North Fork Ten Mile-East Skimmerhorn Ridge (1-2 each). Murrelets may be using these watersheds as a flight corridor to access old-growth stands on state lands adjacent to the Hawthorne Timberlands ownership (Meekins 2002; Meekins 2003).

Marbled Murrelets have been detected at numerous inland locations either with radar or as known occupied sites in Recovery Zone 5. This Recovery Zone (also termed the Mendocino Recovery Zone) extends from the southern boundary of Humboldt County, California, to the mouth of San Francisco Bay. It includes waters within 1.2 miles of the Pacific Ocean shoreline and extends inland a distance of up to 25 miles from the Pacific Ocean shoreline. Detections include Russian Gulch State Park (adjacent to JDSF), Alder Creek, Admiral Standley Park, Big River, Greenwood Creek, Gualala River, Garcia River, Albion River, Hardy Creek, Usal Creek, Navarro River, Ten Mile River, Wheatfield Creek, Haupt Creek, and Willow Creek (Hamer Environmental 1999; Meekins and Hamer 2000; Hamer and Zawacki 2002; J. Hunter USFWS pers. comm. August 15, 2002). Although health of the lower Alder Creek population is unknown, it represents the most consistent and largest number of murrelet sightings in the Recovery Zone. Lower Alder Creek on Medocino Redwood Company (MRC) lands has a high residual component of redwood and Douglas-fir not seen elsewhere on the MRC ownership. Disease and storm damage of the Douglas-fir and other conifers in this area has resulted in a large number of potentially suitable nesting platforms that combined with relatively short distance to the coast contribute to population persistence (Mendocino Redwood Company 2001).

Marine sightings off the Mendocino County coast and results of radio-tracking movements of individuals in populations to the north (Humboldt County) and south (Santa Cruz County) indicate that murrelets are likely nesting in Mendocino County and in the vicinity of JDSF (K. Nelson pers. comm. March 11, 2004). Aerial surveys and incidental sightings indicate that murrelets are present off-shore in the vicinity of JDSF during the breeding season. A total of 4 adult and 1 juvenile murrelets were noted off shore of MacKerricher State Park in 2004 (USFWS pers comm.). The presence of murrelets offshore near JDSF, coupled with incidental inland sightings, suggest that a small population of murrelets may be nesting in the area.

The distribution of Marbled Murrelets in and near JDSF was determined by reviewing Cota and Papke (1994), Ralph et al. (1994), Georgia-Pacific SYP (G-P 1997), Camp Three THP (Jameson 1999), Town (2001), M. Jameson, (pers. comm. 2002), other wildlife reports, biologist and forester interviews, and comments received on earlier review drafts of this EIR. According to Jameson (1999), surveys for Marbled Murrelets have been conducted on JDSF without confirmed detection since 1992. Town (2001) indicates that J. Stein had two possible detections in the vicinity of Digger Creek. These two possible detections were rechecked but were not confirmed

There have been several inland detections near JDSF. Early detections were in Russian Gulch State Park in 1976 (Paton and Ralph 1988), and apparently 1 km (0.6 mi.) east of the town of Mendocino in 1988 (F. Sharpe, personal communication, fide Paton and Ralph (1988). Town (2001) indicates that murrelets are known to occur within Russian Gulch State Park. Russian Gulch continues to be an area of frequent murrelet activity and is considered occupied as nesting habitat given flight patterns and behavioral observations of murrelets (S. Martinelli, CDFG, pers. comm., July 6, 2004). State Parks staff has recorded murrelets in Russian Gulch in 2004 at the same survey stations surveyed in past years. Murrelets were detected on private forestlands at Horsetail Gulch when non-protocol surveys were conducted in 2004 (S. Martinelli, CDFG, pers. comm., February 14, 2005).

Limited surveys conducted elsewhere on the former Georgia-Pacific lands (now Campbell Hawthorn) suggest that murrelets travel across their ownership in some areas to get to nest sites. One pair of murrelets was observed flying across former Georgia-Pacific lands near the Wages Creek/Rider Gulch confluence, and other murrelets were detected on lands directly adjacent to this ownership in the Admiral Standley State Recreation Area.

Survey Results

Additional inland surveys have been conducted on areas outside of JDSF. The surveys with positive detections and other incidental detections are shown in Table VII 6.6.8. A partial list of survey efforts outside of JDSF but within 10 miles of the analysis area is included in Table VII 6.6.9. At sea survey results are listed in Table VII 6.6.10. A summary of survey results within JDSF is found in Table VII 6.6.11.

Complete survey results for 2005 were not available. However, a Marbled Murrelet was detected by Mad River Biologists on July 21, 2005 along the S-22 road at the Big River Unit of Mendocino Headlands State Park. Follow-up surveys in this same area also detected a murrelet on July 23 and July 26. It was speculated that the subject bird(s) may have been departing from suitable habitat in the Albion River drainage, flying south over the ridge to Big River, on a return trip to the coast (S. McAllister, Mad River Biologists pers. comm. to D. Roja, Department of Parks and Recreation, September 15, 2005).

Table VII 6.6.8. Partial list of Inland Marbled Murrelet surveys resulting in possible or positive detections within a 10-mile (16-km) radius of the JDSF assessment area; excluding surveys within JDSF.

Year	Location	Done to protocol[a]	Specific Survey Date(s)	Detections	Source
1976	Russian Gulch State Park	No (Incidental observation)	5/9/76	Yes—2 birds observed flying inland at dawn	Paton and Ralph, 1988; D. Erickson, pers. comm., 1997
1988	0.6 mi (1 km) east of the town of Mendocino	No (Incidental observation)	11/16/88	Yes—2 birds heard flying inland in the late afternoon	Paton and Ralph, 1988
Each Year	*Russian Gulch*	*unk*	*unk*	*yes, breeding behavior indicates nesting in upper Russan Gulch Watershed.*	*DFG for Burkett and State Parks, Pasquinelli*
1995	*Greenwood Creek*	*Unknown*	6/24, 5/26	*Yes, 5 detections; Incl. breeding behave*	*Mendocino Redwood Co.1999*
1998	Russian Gulch State Park and adjoining JDSF lands	Partial	6/9, 6/10 7/22, 7/23, 7/29, 7/30, 8/3	Approx. 12 murrelets detected flying E.	E. Burkett, pers. comm., 1998; CDFG, 1998
1999	Big River	Radar	8/5	1 murrelet type radar inbound	Hammer Environmental 1999 for CALTRANS
1999	Russian Gulch State Park	Ground; to PSG protocol	5/16,5/30, 7/4,7/21, 7/30	81 observations all indicating breeding behavior	DFG and State Parks
1999	Lower Greenwood Creek	Radar	5 dates	7 murrelet type radar	Mendocino Redwood Company
2000	Albion, Enchanted Meadow	radar	4 times	13 murrelet type radar	Mendocino Redwood Company
2000	Navarro River Mouth	radar w/ 1 ground observer	6/21, 6/29, 7/27	6 murrelet type radar, no ground detection	Mendocino Redwood Company
2000	Navarro River 1.1 miles up from mouth	radar w/ 1 ground observer	7/29	24 murrelet type radar, no ground detection	Mendocino Redwood Company
2000	Greenwood Creek	radar	4 times	30 murrelet type radar	Mendocino Redwood Company
2001	Albion (Enchanted Meadow)	radar	3 times	6 murrelet type radar	Mendocino Redwood Company

Table VII 6.6.8. Partial list of Inland Marbled Murrelet surveys resulting in possible or positive detections within a 10-mile (16-km) radius of the JDSF assessment area; excluding surveys within JDSF.

Year	Location	Done to protocol[a]	Specific Survey Date(s)	Detections	Source
2001	Greenwood – Morrison House	radar	2 times	1 murrelet type radar	Mendocino Redwood Company
2001-2002	Noyo, The Worm 1		3 times '01 2 times '02	None '01 1 in '02	Mendocino Redwood Company
2001-2003	Noyo, The Worm 2		2 times '01 3 times '02	None *	Mendocino Redwood Company *possible detection of 2 in '02 believed to be error by CDFG
2001	Navarro River 1.1 miles up from mouth	radar w/ 2 ground observers	6/21	5 murrelet type radar, no ground detection	Mendocino Redwood Company
2001	Navarro River. 4.2miles up from mouth (near Flume/ Barton)	radar w/ 2 ground observers	6/22	5 murrelet type radar, no ground detection	Mendocino Redwood Company
2001	Ten Mile River Main Stem	radar		murrelet type radar	Campbell Timberland Management
2002	Navarro West, R&B Flattop		5 times	1	Mendocino Redwood Company
2002	Navarro River 1.1 miles up from mouth	radar		9 murrelet type radar	Mendocino Redwood Company
2002	Navarro River. 7.3 miles up from mouth	radar		2 murrelet type radar	Mendocino Redwood Company
2002	Ten Mile River Main, Gulch 2	radar and ground	6/26, 7/2	5 murrelet type radar	Campbell Timberland Management
2002	Ten Mile ,Upper Chadborne Gulch	radar	7/24	1 murrelet type radar	Campbell Timberland Management
2002	Middle & North forks of Ten Mile confluence	radar	6/28, 7/20	5 murrelet type radar	Campbell Timberland Management
2002 2003	Ten Mile Middle Fork/ Horsetail Gulch	radar and ground	7/14, 7/23	1 murrelet type radar (2002) 16 (2003)	Campbell Timberland Management2002, DFG Martinelli 2003
2002	Ten Mile North Fork –East Skimmernorn Ridge	radar	7/26, 7/28	1 murrelet type radar	Campbell Timberland Management

[a] *Standard protocol guidelines set forth by the Pacific Seabird Group, Marbled Murrelet Technical Committee (Ralph et al., 1994), and endorsed by USFWS, specify two consecutive years of intensive surveys.*
[b] *No USFWS protocol was available at this time.*

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
1976	Russian Gulch State Park	No (Incidental observation)	5/9/76	Dick Erickson	Yes—2 birds observed flying inland at dawn	Paton and Ralph, 1988; D. Erickson, pers. comm., 1997
1988	0.6 mi (1 km) east of the town of Mendocino	No (Incidental observation)	11/16/88	F. Sharpe	Yes—2 birds heard flying inland in the late afternoon	Paton and Ralph, 1988
1988	Mendocino Woodlands	No[b]	6/24/88, 7/30/88	N/A	None	Paton and Ralph, 1988
1988	Navarro River	No[b]	6/22/88, 7/21/88	N/A	None	Paton and Ralph, 1988
1988	Russian Gulch/ Van Damme	No[b]	6/14/88, 7/29/88, 8/1/88	N/A	None confirmed	Paton and Ralph, 1988
1988–1989	Hwy. 20: Middle (T17N, R15W, S8) Centered in the Camp 20 Area	No[b]	N/A	N/A	None	Paton and Ralph, 1990
1988–1989	Hwy. 20: West (T18N, R16W, S31). Centered in the Paterson Gulch Area	No[b]	N/A	N/A	None	Paton and Ralph, 1990
1989	Fort Bragg: Sherwood Road (18N, 17W, S2)	No[b]	N/A	N/A	None	Paton and Ralph, 1990

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
1989	Ukiah–Mendocino Road (also known as the Comptche–Ukiah Rd.) (surveys centered near Tom Bell Flat)	No[b]	N/A	N/A	None	Paton and Ralph, 1990
1994	Big River (Georgia-Pacific lands)	No (one year only)	10 times	G-P staff	None	G-P, 1994
1994	South Fork Ten Mile River (Georgia-Pacific lands)	No (one year only)	9 times	G-P staff	None	G-P, 1994
1994	Greenwood Creek O	No	1		None	Mendocino Redwood Company
1995	Caspar Creek	No[c]	N/A	N/A	None	Eric Spry, pers. comm., 1997
1995	Hare Creek	No[c]	N/A	N/A	None	Eric Spry, pers. comm., 1997
1995	Albion, Enchanted Meadow A		8 times		None	Mendocino Redwood Company
1995- 1996	Albion, Enchanted Meadow B		8 times ’95 3 times ’96		None	Mendocino Redwood Company
1995–1996	Russell Brook, L-P ownership (T17N, R15W, S 26 and 36)	Unknown	6/17/95, 7/1/95, 7/14/95, 7/20/95, 7/27/95, 5/16/96, 5/23/96, 6/6/96, 7/16/96	N/A	None	Bill Stevens, pers. comm., 1997 Also MRC

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
1995–1996	Upper Big River, L-P ownership	Unknown	N/A	N/A	None	Bill Stevens, pers. comm., 1997
1996	Greenwood Creek D		4 times		None	Mendocino Redwood Company
1997-1998	Navarro East, Wholy A		4 times '97 1 time '98		None	Mendocino Redwood Company
1997	Navarro East, Wholy B		4 times		None	Mendocino Redwood Company
Each Year	*Russian Gulch*	*unk*	*unk*	*unk*	*yes, breeding behavior indicates nesting in upper Russan Gulch Watershed.*	*DFG for Brukette and State Parks, Pasquinelli*
unk	*Hendy Woods*	*yes*	*unk*	*unk*	*None*	*State Park Staff, Pasquinelli*
unk	*Montgomery Woods*	*no*	*unk*	*unk*	*None*	*State Park Staff, Pasquinelli*
1998	Russian Gulch State Park and adjoining JDSF lands	Partial	6/9/98, 6/10/98, 7/22/98, 7/23/98, 7/29/98, 7/30/98, 8/3/98	N/A	Approximately 12 murrelets detected flying E.	E. Burkett, pers. comm., 1998; CDFG, 1998
1999	Navarro River	Radar	7/20	Jim Spikler, Ron Yarbarough, Martha Priebe	none radar, none ground	Hammer Environmental 1999 for CALTRANS
1999	Big River	Radar	8/5	Jim Spikler,	one murrelet target inbound	Hammer Environmental 1999 for CALTRANS
1999	Caspar Creek	Radar	8/6	Jim Spikler	None	Hammer Environmental 1999 for CALTRANS
1999	South Coast,		5 dates		none	Mendocino Redwood

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
	Barn Gulch Confluence					Company
1999	Lower Greenwood Creek	Radar	5 dates		7 murrelet type radar	Mendocino Redwood Company
1999	Greenwood – Morrison House	radar	3 tines		0	Mendocino Redwood Company
1999-2000	Greenwood Creek D		5 times '99 7 times '00		None	Mendocino Redwood Company
2000	Albion		4 times		none	Mendocino Redwood Company
2000	Albion, Comptche-Ukiah		4 times		none	Mendocino Redwood Company
2000	Albion, Enchanted Meadow	radar	4 times		13 murrelet type radar	Mendocino Redwood Company
2000	Albion, Deadman		4 times		None	Mendocino Redwood Company
2000	Big River, Escola		4 times		None	Mendocino Redwood Company
2000	Big River, Russel Brook		4 times		None	Mendocino Redwood Company
2000	Navarro West, 8-mile		4 times		None	Mendocino Redwood Company
2000	Navarro River Mouth	radar w/ 1 ground observer	6/21, 6/29, 7/27	unk	6 murrelet type radar, no ground detection	Mendocino Redwood Company
2000	Navarro River 1.1 miles up from mouth	radar w/ 1 ground observer	7/29	unk	24 murrelet type radar, no ground	Mendocino Redwood Company

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
					detection	
2000	Alder Creek		2 times		None	Mendocino Redwood Company
2000	Greenwood Creek Mouth		3 times		None	Mendocino Redwood Company
2000	Greenwood Creek		7 times		None	Mendocino Redwood Company
2000	Greenwood Creek	radar	4 times		30 murrelet type radar	Mendocino Redwood Company
2000-2001	Navarro River at Dimmick	yes ground also radar	5/19/00, 6/9/00, 7/6/00, 7/18/00 6/8/01, 6/19/01, 6/25/01, 7/3/01, 7/17/01	unk	None	Mendocino Redwood Company
2000-2001	Navarro River at Flume /Barton	yes	5/12/00, 6/2/00, 6/30/00, 7/14/00, 6/5/01, 6/20/01, 6/26/01, 7/5/01, 7/24/01	unk	None	Mendocino Redwood Company
2001	Albion Confluence		6 times		None	Mendocino Redwood Company
2001	Lower Albion		5 times		None	Mendocino Redwood Company
2001	Albion (Enchanted Meadow)	radar	3 times		6 murrelet type radar	Mendocino Redwood Company
2001	Greenwood – Morrison House	radar	2 times		1 murrelet type radar	Mendocino Redwood Company
2001	Greenwood Creek (4.67)		2 times		None	Mendocino Redwood Company

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
2001	Greenwood Creek (4.67)	radar	1 time		None	Mendocino Redwood Company
2001	Big River, Russell Brook A		1 time		None	Mendocino Redwood Company
2001	Big River, Russell Brook B		1 time		None	Mendocino Redwood Company
2001	Big River, Russell Brook C		3 times		None	Mendocino Redwood Company
2001	Big River, Russell Brook D		2 times		None	Mendocino Redwood Company
2001	Big River (Russell Brook)	radar	1 time		None	Mendocino Redwood Company
2001	Navarro West, Barton		5 times		None	Mendocino Redwood Company
2001	Navarro West, Marsh A		2 times		None	Mendocino Redwood Company
2001	Navarro West, Marsh B		1 time		None	Mendocino Redwood Company
2001	Navarro West, Marsh C		2 times		None	Mendocino Redwood Company
2001	Navarro West, Navarro (1.1)		1 time		None	Mendocino Redwood Company
2001	Navarro West, Navarro (4.2)		1 time		None	Mendocino Redwood Company
2001	Navarro West, Navarro (7.3)		1 time		None	Mendocino Redwood Company
2001- 2002	Navarro East, Rose Creek 1		2 times ’01 3 times ‘02		None	Mendocino Redwood Company
2001- 2002	Navarro East, Rose Creek 2		3 times ’01 2 times ‘02		None	Mendocino Redwood Company

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
2001	Noyo, Chao-Chao/Shake 1		1 time		None	Mendocino Redwood Company
2001	Noyo, Chao-Chao/Shake 2		2 times		None	Mendocino Redwood Company
2001	Noyo, Chao-Chao/Shake 3		2 times		None	Mendocino Redwood Company
2001- 2002	Noyo, The Worm 1		3 times '01 2 times '02		None '01 1 in '02	Mendocino Redwood Company
2001- 2003	Noyo, The Worm 2		2 times '01 3 times '02		None *	Mendocino Redwood Company *possible detection of 2 in '02 believed to be error by CDFG
2001	Navarro West, Navarro 1.1		1 time		None	Mendocino Redwood Company
2001	Navarro River 1.1 miles up from mouth	radar w/ 2 ground observers	6/21	unk	5 murrelet type radar, no ground detection	Mendocino Redwood Company
2001	Navarro River. 4.2miles up from mouth (near Flume/ Barton)	radar w/ 2 ground observers	6/22	unk	5 murrelet type radar, no ground detection	Mendocino Redwood Company
2001	Navarro River. 7.3 miles up from mouth	radar w/ 2 ground observers	7/29	unk	None	Mendocino Redwood Company
2001	Ten Mile River Main Stem	radar			murrelet type radar	Campbell Timberland Management
2002	Navarro West, R&B Flattop		5 times		1	Mendocino Redwood Company

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
2002	Navarro West, Newguard 1		3 times		None	Mendocino Redwood Company
2002	Navarro West, Newguard 2		2 times		None	Mendocino Redwood Company
2002	Navarro River 1.1 miles up from mouth	radar		unk	9 murrelet type radar	Mendocino Redwood Company
2002	Navarro River. 4.2miles up from mouth (near Flume/ Barton)	radar		unk	none	Mendocino Redwood Company
2002	Navarro River. 7.3 miles up from mouth	radar		unk	2 murrelet type radar,	Mendocino Redwood Company
2002	Ten Mile River Main, Gulch 2	radar and ground	6/26, 7/2		5 murrelet type radar	Campbell Timberland Management
2002	Ten Mile, Mouth of Chadborne Gulch	radar and ground	6/27		None	Campbell Timberland Management
2002	Ten Mile ,Upper Chadborne Gulch	radar	7/24		1 murrelet type radar	Campbell Timberland Management
2002	Ten Mile Middle & North forks confluence	radar	6/28, 7/20		5 murrelet type radar	Campbell Timberland Management
2002 2003	Ten Mile Middle Fork/ Horsetail Gulch	radar and ground	7/14, 7/23		1 murrelet type radar (2002) 16 (2003)	Campbell Timberland Management2002, DFG Matenelli 2003

Table VII 6.6.9. Partial list of Inland Marbled Murrelet surveys and incidental observations within a 10-mile (16-km) radius of the JDSF assessment area excluding surveys within JDSF.

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	Surveyor(s) (if different than cited in Source)	Detections	Source
2002	Ten Mile North Fork –East Skimmernorn Ridge	radar	7/26, 7/28		1 murrelet type radar	Campbell Timberland Management

[a] *Standard protocol guidelines set forth by the Pacific Seabird Group, Marbled Murrelet Technical Committee (Ralph et al., 1994), and endorsed by USFWS, specify two consecutive years of intensive surveys.*
[b] *No USFWS protocol was available at this time.*

Incidental Marbled Murrelet at-sea observations and at-sea transects within a 10-mile (16-km) radius of JDSF and adjacent areas are summarized in Table VII 6.6.10. Offshore aerial surveys and incidental offshore sightings indicate that moderate numbers of murrelets are present off the coast in the vicinity of JDSF during the breeding season The presence of murrelets offshore near JDSF, in combination with inland sightings, suggest that a small population of murrelets may nest on or in the vicinity of JDSF.

Table VII.6.6.10. Partial list of "positive at-sea" records of Marbled Murrelets in California near JDSF (Some of transect survey area includes shore within 10 miles (16 km)).

Date	Location	Type of observation	Date(s) of surveys	Detections	Source
1976	Mendocino	Incidental observation	7/9/76	1 bird	Carter and Erickson, 1988
1977	McKerricker Beach State Park	Incidental observation	4/5/77	1 alternate, 1 basic plumage	Carter and Erickson, 1988
1994	Humboldt county line to Fort Bragg	Incidental to Regional Monitoring	7/24	44 adult 3 juveniles	Crescent Costal Research,2003 for USFWS , Ca DFG and NOAA
1994	Fort Bragg to Point Arena	Incidental to Regional Monitoring	7/25	12 adults	Crescent Costal Research,2003 for USFWS , Ca DFG and NOAA
1994	Fort Bragg Hardy Creek round trip	Incidental to Regional Monitoring	7/26	32 adults 6 juveniles	Crescent Costal Research,2003 for USFWS , Ca DFG and NOAA
1995	Humboldt county line to Fort Bragg	Incidental to Regional Monitoring	7/24	189 adult 5 juvenile	Crescent Costal Research,2003 for USFWS , Ca DFG and NOAA
1995	Fort Bragg to Point Arena	Incidental to Regional Monitoring	7/25	22 adult	Crescent Costal Research,2003 for USFWS , Ca DFG and NOAA
1995	Laguna Pt. to Navarro Head. *Onshore and near shore*: 1,000–1,500m offshore. *Offshore*: 1,000–1,500m to 2,000–4,000m offshore.	Aerial surveys	7/95	*Onshore and nearshore*: 0–1.6 birds/km^2; *offshore*: 0–1.5 birds/km^2	Varoujean II and Williams, 1996

Table VII.6.6.10. Partial list of "positive at-sea" records of Marbled Murrelets in California near JDSF (Some of transect survey area includes shore within 10 miles (16 km)).

Date	Location	Type of observation	Date(s) of surveys	Detections	Source
1997	Mouth of Pudding Creek, just north of Fort Bragg	Incidental observation	9/4/97	2 birds	Dorothy Tobkin GGAS, 1997
1999	Humboldt county line to Fort Bragg	Incidental to Regional Monitoring	7/15	4 adult	Crescent Costal Research, 2003 for USFWS , Ca DFG and NOAA
1999	Fort Bragg to Point Arena and into coves	Incidental to Regional Monitoring	7/15	12 adult	Crescent Costal Research, 2003 for USFWS , Ca DFG and NOAA
2000	Rockport landing to Fort Bragg	Incidental to Regional Monitoring	7/15	8 adult	Crescent Costal Research, 2003 for USFWS , Ca DFG and NOAA
2000	Fort Bragg to point Arena	Incidental to Regional Monitoring	7/21	2 adult	Crescent Costal Research, 2003 for USFWS , Ca DFG and NOAA
2004	McKerricker Beach State Park	Incidental to Regional Monitoring	7/28/04	4 adult murrelet and 1 fledgling	Crescent Costal Research, 2004 for USFWS

Table VII 6.6.11. Inland Marbled Murrelet surveys conducted in JDSF. (All surveys were conducted In the breeding season unless otherwise noted).

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	No. of Stations	Surveyor(s) (if different than cited in Source)	Detections	Source
1988	Caspar Creek	No[a]	6/24/88, 7/20/88	22		None	Paton and Ralph, 1988
1992 1996-1997	Dresser Grove (aka NF James Creek old-growth patch)	No [1992] Yes [1996-97]	7/8/92, 7/15/92, 7/24/92, and an unknown date 7/12/96, 7/25/96, 7/18/96, 8/1/96 7/3/97, 7/8/97, 7/16/97, 7/31/97	No stations 1992 (polygon survey) 3 (1996) 4 (1997)	Seth Bunnell, CDFG Pam Town	None	Pam Town, pers. comm., 1997 CDFG, 1996d, 1997c
1992 1993-1994 1996	McGuire/Dunlap Grove (located near the Chamberlain Grove aka Chamberlain Creek)	No[b] Yes[c] 1996 only one year; two required)	7/7/92, 7/13/92, 7/31/92, and an unknown date 7/7/93, 7/18/93, 7/24/93,7/30/93 5/14/94, 6/12/94, 7/3/94, 7/11/94 7/16/96, 7/24/96, 7/30/96, 8/6/96	No stations'92 (polygon survey) 3(1993) 4 (1994) 3 (1996)	Seth Bunnell, CDFG Charles Papke,/ Dana Cota Pam Town	None	Pam Town, pers. comm., 1997 RMA, 1994 CDFG, 1996d, 1997c
1993-1994	Brandon Gulch/Riley Creek	No	7/16/93, 7/23/93, 7/29/93,8/5/93, 5/15/94, 6/9/94 7/1/94, 7/10/94	4	Charles Papke,/ Dana Cota	None	RMA, 1994
1993–1994	Mendocino Woodlands	No	7/8/93, 7/17/93, 7/23/93, 7/29/93 5/16/94,6/11/94,7/2/94, 7/9/94	4	Charles Papke,/ Dana Cota	None	RMA, 1994
1993–1994	Noyo Hill	No	7/17/93,7/23/93, 7/29/93, 8/4/93 5/15/94, 6/10/94, 6/30/94, 7/8/94	4	Charles Papke,/ Dana Cota	None	RMA, 1994

Table VII 6.6.11. Inland Marbled Murrelet surveys conducted in JDSF. (All surveys were conducted In the breeding season unless otherwise noted).

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	No. of Stations	Surveyor(s) (if different than cited in Source)	Detections	Source
1992 1996-1997, 2000 2001	Waterfall Grove (called Swanson on 1996 forms, also called W. Chamberlain Creek)	No 1992 Yes[c] (1996-1997)	7/8/92, 7/15/92, 7/24/92, and an unknown date 7/15/96, 7/23/96, 7/31/96, 8/7/96 6/30/97, 7/7/97, 8/7/97 6/5/00, 6/19/00, 7/10/00, 7/18/00, 5/26/01, 6/22/01, 7/13/01, 7/23/01, 7/30/01	No stations (polygon survey) 2 (1996) 3 (1997) 3(2000) 5 (2001)	Seth Bunnell, CDFG Pam Town / Janet Stein	None	Pam Town, pers. comm., 1997 CDFG, 1996d, 1997 Town, 2000 ,2001
1996–2001	Upper NFSF Noyo old-growth patch. (aka Pentagon grove)	Yes for 2 stations 1996 Yes 1997-2001	7/13/96, 7/22/96, 7/29/96, 8/5/96 7/1/97, 7/14/97, 7/25/97, 7/29/97 6/5/98, 6/24/98, 7/24/98, 7/31/98 6/4/99, 6/29/99, 7/19/99, 7/27/99 7/18/00, 5/11/00, 6/25/00, 7/6/00 5/25/01, 6/22/01, 7/7/01, 7/20/01, 7/28/01	2 (1996) 4 (1997) 4 (1998) 4 (1999) 4 (2000) 5 (2001)	Pam Town/ Janet Stein	None	CDFG, 1996d, 1997c, 1998*, 1999*Town 2000, 2001
1997-1998, 1999 2000	HiLo Trestle old-growth patches (aka NFSF Noyo old growth patches Rd 1070&330)	Yes	7/2/97, 7/7/97, 7/15/97, 7/21/97, 7/24/97, 7/28/97, 8/1/97, 8/7/97 5/27/98, 5/28/98, 6/25/98, /26/98, 7/20/98, 7/21/98, 7/27/98, 7/28/98 5/24/99, 5/2799, 6/21/99, 6/28/99, 7/13/99, 7/15/99, 7/22/99, 7/28/99 5/5/00, 5/10/00, 5/12/00, 6/8/00, 7/8/00, 6/11/00, 7/11/00, 7/17/00, 7/22/00	3 (1997) 8 (1998-200)	Pam Town / Janet Stein	None	CDFG, 1997c,1998 Town 1999, 2000

Table VII 6.6.11. Inland Marbled Murrelet surveys conducted in JDSF. (All surveys were conducted In the breeding season unless otherwise noted).

Year	Location	Done to protocol	Specific Survey Date(s) (Station No.)	No. of Stations	Surveyor(s) (if different than cited in Source)	Detections	Source
1999-2000 2001	Lower Hare Creek THP Digger Creek	Yes	5/28/99, 6/24/99, 7/14/99, 7/21/99 7/7/00, 7/20/00, 6/11/00, 6/7/00 5/28/01, 6/23/01, 7/06/01, 7/14/01,7/21/01, 7/27/01, 8/01/01	4 (1999-2000) 6 (2001)	Pam Town/ Janet Stein	None1999-2000. Two possible 2001, none on follow-up	CDFG 1999, Town 2000, 2001.
1999-2001	Upper Parlin THP	Yes	6/1/99, 6/22/99, 7/7/99, 7/26/99 7/21/00, 6/26/00, 7/14/00, 6/19/00 5/23/01, 6/19/01, 7/09/01, 7/20/01,7/28/01	4 (1999-2000) 5 (2001)	Pam Town	None	CDFG 1999 Town, 2000, 2001.
1999 2002-2003	Volcano Camp Old growth (Camp 3, or Road 1000 and 360 Old growth grove)	Yes	6/3/99, 6/30/99, 7/08/99, 7/29/99 6/5/02,6/21/02,7/9/02,7/16/02, 6/31/02 6/8/03,6/15/03, 7/15/03,7/22/03, 8/4/03	4	Pam Town (1999) Bill Stevens (2002) Ron LeValley, David Fix (2003)	None	CDFG 1999 Stevens, 2002. Mad River Biologists, 2003
1998 2001	Russian Gulch upslope (JDSF)	No	7/22/98, 7/23/98, 7/29/98, 8/3/98 7/22/01	4	Pam Town	none	Pam Town 1998,2001

[a] *No USFWS protocol was available at this time.*
[b] *Initial survey followed protocol that was current at that time. Only one year was completed.*
[c] *Standard protocol guidelines set forth by the Pacific Seabird Group, Marbled Murrelet Technical Committee (Ralph et al., 1994), and endorsed by USFWS, specify two consecutive years of intensive surveys.*
[d] *Protocol described in Ralph et al. (1993).*

Forest Detectability Methods

The 2003 inland survey protocol recommends 2 basic survey types: intensive auditory and visual surveys and radar surveys (Evans Mack et al. 2003). Intensive auditory and visual surveys use a single ground-based observer positioned at a single survey station located in potential breeding habitat during a 2-hour survey period near dawn. These surveys are designed to determine presence or probable absence at a specific site, determine if a site is occupied, and document activity levels. Intensive surveys also have been used to locate nest sites; examine habitat relationships by comparing habitat at sites determined to be occupied and unoccupied, or between high and low detection sites; and examine seasonal and environmental factors that affect murrelet activity patterns.

Radar surveys use a stationary marine radar system, modified for use in the terrestrial environment, to detect and track murrelets in flight. There are currently no survey protocol guidelines for radar; however, survey recommendations have been published by Cooper and Hamer (2003) (fide McShane et al. 2004).

Radar studies indicate that audio-visual observers detect an average of 10 to 23% of all Marbled Murrelets within 656 feet (200 m) during intensive murrelet surveys, although the percent detected varies widely among sites and among days within a station (Cooper and Blaha 2002). The greater efficiency of radar surveys over standard surveys is due to radar's ability to detect murrelets regardless of light levels and over a greater portion of the landscape.

Population Size and Trend

The Marbled Murrelet was listed largely because of the loss of older forests that serve as nesting habitat (Ralph et al. 1994, USFWS 1996b). Gill-net fishing operations, oil spills, marine pollution, and changes in prey abundance and distribution also are considered potential threats to murrelets (USFWS 1996b, Ralph et al. 1994).

The world population size of Marbled Murrelets is recently estimated at 947,500 birds, with 91% in Alaska, 7% in British Columbia, and 2% in the 3-state listed range. The size of the North American population of Marbled Murrelets is not known but updated information for several regions estimate a total of 600,000 to 1 million birds. While murrelets within the listed range make up only a small fraction of current world population size, this area represents 18% of the linear range of the species and probably supported greater populations historically. Available data on genetic and ecological differences suggest at least 3 primary populations of the species: (1) Aleutian Islands; (2) Alaska Peninsula to Puget Sound; and (3) western Washington to California. The size of the listed population in Washington, Oregon, and California has been estimated at 18,550 to 32,000 birds (Ralph et al., 1994; Nelson, 1997a). Ralph and Miller (1995) estimated a population of about 6,450 murrelets in California. Based on monitoring data collected for the Northwest forest Plan, the estimated population size at sea along the Oregon California coast during the breeding season (May to July) over 3 years (2000-2003) averaged 12,133 birds (McShane et al. 2004).

California surveys by Ralph and Miller (1995) found the highest at-sea density of murrelets (5.2-22.8 birds per square mile) from the California/Oregon border to Loleta, Humboldt County. Murrelet densities decrease markedly south of this point and become patchy in occurrence as one moves south of this point to the southern extreme of the species distribution. A major gap in the at-sea distribution of murrelets is found between Humboldt and San Mateo counties. Murrelets have recently been found to breed in small patches of nesting habitat still extant in Mendocino County. A moderate to low density (1.8-3.9 birds per square mile) was recorded from Loleta, Humboldt County to Albion, Mendocino County and no birds were recorded from Albion, Mendocino County to Half Moon Bay in San Mateo County. At Half Moon Bay, densities of 4.72 birds per square mile were noted. Offshore occurrence of murrelets during the breeding season generally correlates with inland nesting habitat.

Recent increases in the body of research on California, Oregon and Washington populations of Marbled Murrelets have improved our understanding of important demographic parameters and confidence in expected population trends. McShane (2004), as part of the 5 year status review of this species, summarized information on murrelet demographics, estimates of population size and trends, genetic variability, and potential threats on a population or demographic scale.

Population decline within the listed range appears related primarily to the effects of historic and ongoing loss of breeding habitat in old-growth forests, combined with poor reproductive success from relatively high levels of corvid nest predation in remaining forest patches, especially those near human settlements (McShane et al. 2004). Demographic analysis of Marbled Murrelets populations showed predicted rates of decline of 4-6% annually (Beissinger 1995). Hebert et al. (2003) noted hatching success in 2001 and 2002 in Redwood National and State Parks for 26 nests to be 50%. Overall, minimum reproductive success (#fledglings/nesting attempts) was 15.4% (4/26) and maximum reproductive success was 38.5% (10/26) excluding 9 murrelets captured with well-developed brood patches that were also probably unsuccessful nesters. They concluded that "reproductive success in the northern California population is insufficient to maintain current population levels" (p. 57). California has a nest failure rate of 85% (n=53) compared to 57% for Oregon (n=21) and 42% (n=7) in Washington (McShane et al. 2004).

Demographic modeling suggests that the population within the listed range will decline over the next 40 years, with largest relative declines in California. While a major decline in near-shore densities of murrelets has been validated only in Oregon since 1992, only very small populations of poorly reproducing birds currently occur in central California (Mendocino and San Mateo/Santa Cruz counties), where local extirpation may be a concern (McShane et al. 2004).

The Northwest Forest Plan monitoring program standardized at-sea monitoring efforts to facilitate comparison across Recovery Zones beginning in 2000. However, given the short-time series of this standardized effort, trend information is not available. Average population estimates from 2000-2002 increased in

Recovery Zones 1 and 2, remained stable in Zones 3 and 4, and remained extremely low in Zone 5 (approximately 100-300 birds) (southern boundary of Humboldt County south to mouth of San Francisco Bay and including Mendocino County).

Population Projection Modeling
Models of murrelet population dynamics allow researchers to project population trends and extinction/extirpation probabilities by integrating important demographic measures (e.g. life span, survival and population recruitment rate, nesting success, juvenile: adult ratios), random environmental events and habitat loss and other large-scale disturbances.

A primary objective of the 5-Year Murrelet Status Review (McShane et al. 2004) was to assess status and trends of Marbled Murrelets populations within each of the 6 Recovery Zones (USFWS 1997). Several population models for the Marbled Murrelets have been developed and evaluated and data collected to support and improve population measures. The Status Review effort built on prior modeling work, sensitivity analysis, and demographic information to prepare Leslie Matrix models for each Recovery Zone (see McShane et al. 2004 for a detailed description of the model, model assumptions, and application).

The "Zone Model" (a female-only, multi-aged, discrete-time stochastic Leslie Matrix model) developed focused on expected trends in population size over a 40-year period and the probability of extinction/extirpation over the next 100 years. Extinction was defined as less than 30 individuals (50/50 sex ratio) in the zone population; a subpopulation level at which "extinction was almost certain". No data on nest success or adult: juvenile ratios are available for Recovery Zone 5 (which includes Mendocino County and JDSF). Therefore, Zone 6 nest success values (0.00-0.16) were utilized given the very limited extent and likely poor quality of forest habitats and similar geographic position (southern portion of the breeding distribution).

After 100 years, the average population size for murrelets in Washington, Oregon, and California (current listed portion of the species range) was projected to be 45 birds (all in Zone 1) with a probability of extinction of 16% (extinction was assumed to be independent in each zone and thus the product of extinction probabilities in each zone). This calculation was assumed to be optimistic since it assumes that the range of population parameters used does not change over 100 years, nesting habitats are not greatly different from today, and mortality from gill-nets and oil spills are similar to recent years.

The Zone Model projected an extirpation probability of 100% within 40 years for Recovery Zones 5 and 6 with a 2% annual migration rate into the zone. This projection is consistent with other sources and modeling efforts (population decline of 4-7% per annum) (USFWS 1997, Beissinger and Nur 1997). Higher fecundity and immigration rates would lengthen the time to extirpation in Zones 5 and 6. Conversely, slightly lower immigration rates in Zone 5 would hasten extirpation. Additional research is needed to refine these demographic parameters. Reduction of oil spill and gill net mortalities served to reduce rate of decline in Zones 2 and 6 but had little effect on other Zones.

Habitat Characteristics

Because of the murrelet's small body size, cryptic plumage, crepuscular activity, fast flight speed, solitary nesting behavior, and secretive behavior near nests, relatively few nests have been located (Hamer and Nelson 1995a). Nest sites are typically located on large, moss-covered limbs of coastal conifer species including: Douglas-fir, redwood, Sitka spruce, and western hemlock. In Washington's Olympic Peninsula 18 of 22 nest trees were western hemlock (Meekins and Hamer 1999). In California, of 10 nests reviewed by Hamer and Nelson (1995a), five were in redwood; four in Douglas-fir, and one was in western hemlock. The average distance between these nest trees and salt water was 7.8 miles (13 km) with the farthest being 17.34 miles (28.9 km) inland. Ralph and Miller (1995) found the greatest frequency of presence (89.05%) and occupancy (21.91%) of murrelets within six miles (10 km) of the coast. Most murrelet nest trees in the Meekins and Hamer (1999) study area were located on terraces near or adjacent to drainages, or in areas that were otherwise topographically protected from environmental extremes.

According to Ralph and Miller (1995), the most important factor in indicating occupied stands was density of the old-growth canopy cover. Occupied stands had a greater percentage of old-growth canopy cover than stands with only murrelet presence or no detections (Ralph and Miller 1995). Hamer and Nelson (1995a) reported that overall canopy closure of most stands where nests were found was moderate to high, averaging 48 percent for 45 nest sites (range 12 to 99 percent). Canopy closure at seven stands inCalifornia where nests were discovered ranged from 25 to 48 percent and averaged 39 percent (Hamer and Nelson 1995a). Cover directly over the nests averaged 85% of nests located in the Pacific Northwest (Hamer and Nelson 1995a). Of the 44 nests trees in the Pacific Northwest that were reviewed by Hamer and Nelson (1995a), 64% were recorded as alive/healthy, 36% as declining, and none were in snags. Potential nest trees are generally more than 32 inches dbh with the presence of large branches, deformities, or other formations providing platforms of sufficient size to support adult birds (Hamer and Nelson 1995a).

Most nests are located on large or deformed moss covered branches; however, a few have been located on smaller branches, and some nests are situated on duff platforms composed of conifer needles or sticks rather than moss (Hamer and Nelson 1995a). In California, nest sites have been located in stands containing old-growth redwood and/or Douglas-fir. Potential nest trees are generally more than 32 inches dbh with the presence of large branches, deformities, or other formations providing platforms of sufficient size to support adult birds (Hamer and Nelson, 1995). The diameter of nest branches, measured at the tree trunk, averaged 11 inches and ranged from 8 to 24 inches (Hamer and Nelson 1995a). Nests were typically located in the top third of the dominant tree canopy layer and usually had good overhead protection. Such locations seem to allow easy access to the exterior of the forest and provide shelter from potential predators (Nelson, 1997a).

Overhanging branches, limbs above the nest area, or branches from neighboring trees provided overhead protection for the nest.

Examination of 7 nest sites in Redwood National and State Parks showed nest trees averaged an estimated 21 large platforms (greater than or equal to 20cm in diameter) and an estimated 23 small platforms (10 to 19.9 cm in diameter)(Hebert et al. 2003). Meekins and Hamer (1999) found that the most important characteristic of nest trees were the structural components of limbs. Platforms selected had greater vertical and horizontal cover, larger diameter (>11cm in diameter), larger platform area, and greater moss depth (>15% cover). Tree DBH did not account for all of the variation in the number of platforms in their Olympic Peninsula study site. Murrelets in this location were apparently selecting suitable platforms and not necessarily seeking out large trees although large trees typically have more platforms. Moss cover may act to increase platform diameter and platform area, aid in the stabilization of the egg, and/or provide insulation to the egg and chick. Burger (2002 fide McShane et al. 2004) described nest tree characteristics as follows: located near openings in the canopy for access to the nest site; large potential nest platforms provided by branch structure or deformities (branches or deformities); substrate for the nest cup provided by moss or duff accumulations; horizontal and/or vertical cover over nest site; and adequate tree height to facilitate entry and exit of the nest site.

General landscape condition may influence the degree to which Marbled Murrelets nest in an area. In Washington, detections of murrelets increased when old-growth/mature forests comprised more than 30 percent of the landscape. Raphael et al. (1995) found that the percentage of old-growth forest and large sawtimber was significantly greater within 0.5 mile of sites that were occupied by murrelets than at sites where they were not detected. Raphael et al. (1995) suggested sites with 35 percent old-growth and large sawtimber in the landscape are more likely to be occupied. However, Raphael et al. (2002) found that murrelet numbers on the Olympic peninsula, Washington, increased as the amount of core area of late-seral forest and proximity of patches increased, and decreased with increasing amounts of edge of late-seral patches. Numbers were not correlated with the percent of late-seral forest, patch density, patch size, road density, or habitat diversity.

Similarly, Ripple et al. (2003) examined Oregon Coast Range landscape scale attributes of murrelet nest sites and found a greater proportion of pole-young conifer habitat at nest sites than randomly located but similar unoccupied sites, less high contrast edge, and more cohesive nest patch shape. They hypothesize that nest site selection may be an anti-predator strategy as young (simple structure) conifer stands adjacent to nesting areas may decrease predation rates. These findings contrast somewhat with those of Meyer (1999) (fide Raphael et al. 2002) for California landscapes. In that study, patch size and isolation were important attributes of sites occupied by murrelets; at a broader scale, proximity of habitat patches to each other and amount of habitat in the largest patch predicted murrelet densities in adjacent offshore areas. This may be due to the relatively high amounts of late seral habitat (>66%) in the Olympic peninsula landscapes studied (Raphael et al. 2002).

Miller and Ralph (1995) ”did not find that larger stands were more likely to have murrelets present” in Del Norte, Humboldt and San Mateo counties of California. The density of old-growth cover and the presence of coastal redwood were the strongest predictors of presence. Juxtaposition of stands to other old-growth stands and stand management history may have masked the effects of stand size on murrelets presence and use. Meyer and Miller (2002) examined whether southern Oregon old-growth (defined as forest patches that contained at least 10% canopy cover in large, old remnant trees) fragmentation and proximity to the marine environment were associated with murrelet use. They found that a decrease in old-growth core area corresponded to a decrease in use of an area by murrelets. Murrelets generally occupied low-elevation inland sites with relatively low fragmentation of old-growth forest patches that were close to the coast and productive marine environments (bays, river mouths). Nearly all occupied areas occurred in the fog-influenced vegetation zone. Management efforts should focus on protecting or creating large, contiguous blocks of old-growth forest near the coast.

Landscape-scale models indicate that the probability of murrelet occupancy or nesting was associated with stand age, tree height class, vertical canopy complexity, basal area (larger tree diameters), canopy closure, slope, distance to marine areas, fragmentation level, and elevation (McShane et al. 2004). Increased levels of nest site predation as a result of forest fragmentation and increased amounts of edge are considered the most significant cause of nest failure (corvids being the principal predator). Over half of the active nests examined in recent studies have failed with the majority of those (78%) due to predation. The highest risk of predation from corvids occurs in areas less than 1 km from human food sources (McShane et al. 2004).

Forest interiors likely provided greater protection from predators and lower ambient temperatures than those associated with forest edges. Recent research has focused on the linkage between forest management, nest predation, and population viability of murrelets. Marzluff et al. (2000) examined the utility and design of buffers to reduce nest predation. Nest sites located less than 50 m from the edge of forests failed more commonly than those in the interior of stands. Their research suggests that “buffering murrelets habitat in the traditional sense (circumscribing mature forest patches occupied by murrelets with a 100-m-wide ring of complex or very complex mature to old-growth forest) will not uniformly increase murrelets productivity by reducing nest predation” (p. 1136). Increasing the contiguity of mature, complex, and especially old-growth forests near human activity (less than 1 km) may actually reduce the productivity of nesting murrelets since many avian nest predators are also most abundant in those habitats. In their study area (western side of the Olympic peninsula of Washington State) providing landscapes that include mixtures of simple-structured, mature forest, and old-growth forest likely to be occupied by murrelets could increase nest success and productivity relative to landscapes of pure old-growth because those portions of the landscape with mature stands of relatively simpler structure would hold fewer avian nest predators. Managing landscapes rather than buffering individual stands will require an understanding of the influence of mixture and juxtaposition of stand structures on productivity.

Interestingly, with all the attendant problems associated with edge environments (predation, microclimate, epiphyte distribution, etc.) most murrelet nests are located near edges, either natural or man-made. McShane (et al. 2004) summarized research efforts that located nests by random tree climbing or radio telemetry and 76% (152 nests) were within 164 feet (50m) of the forest edge. Edges may provide adults and fledglings easier access to and exit from the nest site. Alternatively, given that the proportion of forest edge relative to forest area is not known, this apparent edge selection may be the result of a prevalence of natural and man-made edge environments on the landscape. Research results do not show a clear relationship between nest success and distance to edge; however, it is apparent that predator abundance is affected positively in the managed landscape and predation risk is higher in proximity to human activities.

Habitat Extent

Rough estimates of the amount of suitable Marbled Murrelet habitat in the listed range are available for the 3-state listed area (McShane et al. 2004). The amount of existing occupied habitat was determined by quantifying the amount of known occupied habitat, as determined by survey data, and applying occupancy indices to unsurveyed suitable habitat. Based on the available data, the Service estimates that as of 2003, slightly more than 2.2 million acres (890,312 ha) of suitable Marbled Murrelet nesting habitat occur within the listed range The estimate of suitable murrelets habitat is a general approximation that cannot be directly compared to other estimates due to the evolving definition of suitable habitat and methods used to quantify habitat. In addition, these figures are likely an overestimate given the lack of details on platform presence on many ownerships. Washington State contains approximately 48% of the suitable habitat in the 3-state area, with Oregon and California containing approximately 35% and 17%, respectively.

Federal lands account for the majority of suitable murrelet habitat in the 3- state area. Approximately 2 million (93%) of the 2.2 million total acres (809,375 of the total 890,312 ha) are located on Federal lands. Other public lands (e.g., State and County) and private ownership account for approximately 8% of the total area, while Tribal lands account for less than 1% of the total area of suitable habitat. In California, the FWS estimated 393,586 acres (suitable and remnant) with 66,626 likely to be occupied (McShane et al. 2004). These estimates did not include Demonstration State Forest lands.

Eleven old-growth stands, totaling 459 acres, occur on JDSF. These stands range in sized from 5 to 101 acres. Although these stands are classified as old-growth, they represent marginal murrelet habitat at best (B. Valentine and P. Town Personal communication, 2002). In addition to the old-growth stands, other forested stands of various CWHR classes may provide suitable habitat in the form of single or small groups of large old-growth residuals. However, specific data is not available. Therefore, for purposes of this analysis, JDSF provides 459 acres of old-growth and numerous scattered residuals that are considered potential murrelet habitat (DFMP Appendix V, Table 2). The suitability for Marbled Murrelets would depend on the specific characteristics of the stand, including the presence of mature trees with large branches, deformities, and other formations that provide nesting platforms. For this analysis, these habitat types are used to represent potential habitat for Marbled Murrelets, although it is important to recognize that many of these stands may not provide suitable habitat.

Other areas of JDSF bear discussion regarding their current or long-term potential as Marbled Murrelet habitat. Given their proximity to the ocean and watercourses; species mix, age, and structure; adjacency to State Park lands; history of murrelet activity detections; and other factors, the following areas are discussed (Figure VII.6.6.8b).

Russian Gulch Within JDSF, upper Russian Gulch can be characterized as a mixture of redwood forest, pygmy forest, and rural residential parcels. Lower Russian Gulch is occupied primarily by dense redwood forest. Within the state forest, the lower slopes adjacent to the watercourses are densely forested by second-growth redwood and Douglas-fir, becoming more open as one moves further up canyon and up slope, primarily as a result of historic logging activity. The gentle ridges adjacent to Road 408 are pygmy forest and transitional between pygmy and redwood forest with a substantial component of Bishop pine. Most of the scattered rural residential parcels are located within the pygmy forest, although some are within or adjacent to redwood forest.

A substantial area of redwood forest is well connected along waterways downstream through Russian Gulch State Park to near the Pacific Ocean. Marbled Murrelets have been detected within Russian Gulch State Park near its border with JDSF near the two upper forks of Russian Gulch. Aside from the popular campgrounds and beach area, public use of the forested slopes can be characterized as relatively light, although there is some public use of roads and trails in the area. Moving upsteam along the two forks of upper Russian Gulch, redwood forest forms cooridors along the creek over ¼ mile wide, eventually connecting to the Woodlands Special Treatment Area, Mendocino Woodlands State Park, and the Big River extension of Mendocino Headlands State Park. Scattered large residual old-growth trees can be found within this area.

There are approximately 780 acres of redwood or Douglas-fir forest within the portion of upper Russian Gulch that is part of the state forest in 3 non-contiguous blocks of 433, 320 and 26 acres.

Lower Big River The lower Big River area of JDSF is that portion of the state forest within the Big River watershed but downstream of Mendocino Woodlands State Park. This area contains some of the oldest and largest second-growth forest within the state forest, including a substantial number of large residual old-growth trees. This area is connected to the upper Russian Gulch area by stands

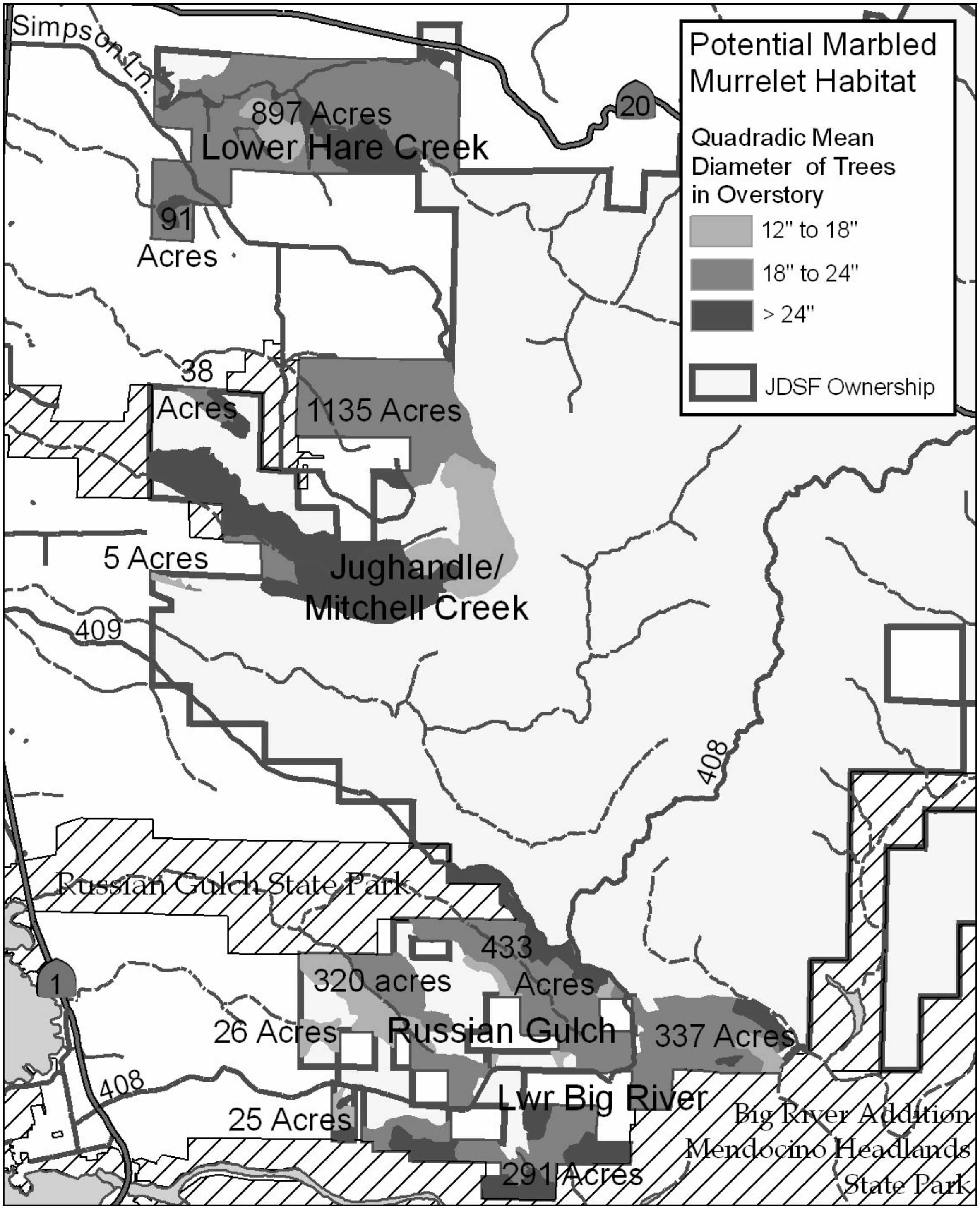


Figure VII.6.6.8b. Potential Murrelet Habitat Recruitment Areas and Current Quadratic Mean Diameter of Canopy Trees. (Light colored areas within featured stands do not have redwood in the overstory as species 1, or Douglas-fir as species 1 and redwood as species 2. Most of these areas are pygmy forest and have Bishop pine in the overstory.)

of redwood and pygmy forest. This area lies upslope and adjacent to the new Big River addition to the Mendocino Headlands State Park, providing connected forest habitat downslope and downstream to near the mouth of Big River. Scattered rural residential parcels border this area to the north near Road 408. There are not many roads within the area managed by CDF, but there some residential access roads and some old logging roads located downslope within the new park area. There is some recreational use of these roads and trails, and this use can be characterized as light to moderate upslope of the main haul road along lower Big River.

There are approximately 653 acres of redwood or Douglas-fir forest within the portion of lower Big River that is part of the state forest in 3 non-contiguous blocks of 337, 291 and 25 acres.

Mitchell/Jughandle Creek The portions of Mitchell and Jughandle Creeks located within JDSF can be characterized by a mixture of redwood and pygmy forest types. This block of forest is located adjacent to rural residential parcels toward the west, and adjacent to forested area of JDSF to the east and south (South Fork Hare Creek and Caspar Creek). Most of the forested area of the Mitchell Creek and Jughandle Creek watersheds is a mixture of redwood and Douglas-fir. The second-growth here is some of the oldest within the state forest, with stand initiation occurring prior to 1900. These areas have been selectively logged in the past, creating a multi-story stand structure. This forest area of JDSF is approximately ¼ to ¾ miles wide. There is some recreational use of the roads and trails in the area, primarily by the residential neighbors, and this use can be characterized as light to moderate.

There are approximately 1,256 acres of redwood or Douglas-fir forest within the portion of Mitchell and Jughandle Creeks that is part of the state forest in 4 non-contiguous blocks of 1,135, 91, 38 and 5 acres.

Lower Hare Creek The area of lower Hare Creek located within JDSF is characterized by second-growth redwood forest, most of which has been selectively harvested in the past. The area adjacent to Hare Creek is densely forested by a stand of relatively large second-growth which originated at about the turn of the century. Moving upslope towards the ridges, the forest becomes thinner due a combination of past stand management and lower growth potential. The block is approximately ½ mile wide and 2 miles long (east to west). Rural residential parcels border this block to the north and south. There is some recreational use, of the roads and trails in the area primarily by the adjacent residents, and this use can be characterized as light to moderate. The area is connected to privately-owned and managed redwood forest downstream to near the Pacific Ocean, and connected upstream to redwood forest and the remainder of JDSF.

There are approximately 890acres of contiguous redwood or Douglas-fir forest within the portion of lower Hare Creek that is part of the state forest.

It is noteworthy that the 433 acre block in Russian Gulch and the 337 acre block of Lower Big River are contiguous/adjacent to one another.

Habitat Trend

McShane et al. (2004) examined loss of nesting habitat since listing of the species in 1992 for Washington, Oregon, and California using two types of data. They analyzed ESA Section 7 and California Department of Fish and Game consultation records as well as information received from Federal land managers to estimate habitat loss. “The total loss of suitable murrelet habitat from the 3-state area from 1992-2003 can be approximated by combining the estimates obtained from the 2 analysis as follows: 17,034 acres (6,893 ha) (0.8%) of habitat lost from natural causes (as reported by Federal land managers) plus 209,046 acres (84,598 ha) (9.4%), as estimated from consultation records (and assuming that the 5,364 acres of suitable murrelet habitat reported as harvested by land managers were included in the 209,046 acres (84,598 ha) covered by consultation). Thus, the total loss of suitable murrelet habitat from 1992-2003, not counting degraded habitat (defined as not entirely removed but degraded in condition or function) (28,119 acres [11,379 ha]), is approximated at 226,080 acres (91,492 ha), or about 10% of the current estimate of 2.2 million acres (890,312 ha) of suitable habitat.” (p 4-107). The Biscuit fire of 2003 in southwestern Oregon accounted for a significant amount of habitat loss attributed to natural events.

In California Recovery Zones 4 and 5 Federal land habitat loss from 1992-2003 totaled 2,537 acres (estimates submitted by federal land managers). No habitat was lost to harvest or natural events on federal lands during this period in Recovery Zone 5 (all National Park Service lands) (McShane et al. 2004). California habitat loss (1992-2003) resulting from consultation with the USFWS under Section 7 of the ESA or California Department of Fish and Game consultation on individual Timber Harvesting Plans (5,933 acres) expected to be removed totaled 27,365 acres (a subset of that total shows 4,696 acres were occupied—PALCO HCP; 7,878 acres were not surveyed). Total California Federal habitat loss and consultation habitat loss from these two data sources was 29,902 acres. No data are available to show net change in murrelet habitat (i.e., recruitment minus loss) (McShane et al. 2004).

Acreage estimates resulting from consultation records likely present a worst-case evaluation for a variety of reasons (excerpted from McShane et al. 2004):

- Information on project implementation was largely unavailable, so it was impossible to validate whether the consulted-on habitat loss actually occurred as planned.
- Habitat loss authorized under HCPs may occur over a long period of time (e.g., several decades); however, under Section 7, this habitat is removed from the environmental baseline at the time the consultation document is issued.

- The estimates of habitat loss do not take into account the terms and conditions that minimize the take (the PALCO Headwaters agreement of 1996 established Marbled Murrelets conservation areas of 7,500 acres and an additional 2,535 acres of late successional forest may develop suitable habitat structure over the next 50 years).
- The information regarding the quality of the affected habitat was not consistent among consultation documents; therefore, this analysis considers all habitats to be of equal value to the murrelet.
- In California and Oregon, some of the habitat impacts included in consultation records are outside of what is currently considered the range of the murrelet.

The rate of decline in suitable habitat also has varied by ownership class. Critical habitat designation and Northwest Forest Plan Guidelines on federal lands have reduced risk of habitat loss and modification on 91% of suitable murrelet habitat in the 3-state area. Rate of habitat decline for private and State lands also vary by State. Washington has developed comprehensive protection guidelines that have likely reduced loss of occupied habitat. Rate and risk of habitat loss in Oregon and California has remained high since species listing in 1992 because unoccupied habitat is generally available for harvest. Outside of stochastic events like the Biscuit fire, the greatest loss of suitable habitat is attributed to consultations on individual harvest units, individual trees, and suitable habitat harvest through HCPs (McShane et al. 2004).

Marbled Murrelets are known to nest in habitats other than old-growth. In Oregon, nests have been located in mature forests (80-200 years) and young (65-80 years) hemlock forests with mistletoe infestations and stands of low canopy cover (Nelson and Wilson 2001; S.K. Nelson pers. comm. March 11, 2004). In California, nests have been located in residual redwood trees. The most important features of murrelets nest sites are the abundance of nest platforms and the presence of nesting substrate (moss or duff) (Meekins and Hamer 1999). Canopy cover at the nest site appears more critical than at the scale of the forest stand. As such, additional habitat may be created in a relatively short time period given current conditions on JDSF (K. Nelson pers. comm. March 11, 2004). The long-term population sustaining value of nesting attempts in apparently marginal habitat is unknown. Other features such as adjacent stand conditions, topographic location, off-shore food availability, and other variables may combine to facilitate nesting success and sustainability.

Restoration of Marbled Murrelet Habitat

The Sustainable Ecosystems Institute convened a scientific panel to recommend silvicultural approaches to accelerate the recruitment of Marbled Murrelet habitat in second-growth forests of the redwood region if warranted by the scientific evidence (Carey et al 2002). This panel found that there was strong scientific evidence that 1) nesting habitat was an important limiting factor; and 2) predation on eggs and chicks was an important factor that limited nest success. Efforts to accelerate the development of suitable nesting habitat are warranted if carried out in a fashion that does not increase the risk of nest predation. The panel also concluded that there were many opportunities to accelerate the development of Murrelet nesting habitat by at least several decades, particularly in the highly productive Coast Redwood Region of California. Natural stand processes that would recruit suitable Murrelet nesting habitat are slow and have limited predictability in both time and space.

The primary habitat management approach would combine 1) uniform thinning from below to reduce overall stand densities; and 2) additional release of selected potential nest trees to stimulate development of large branches. Structural and compositional diversity and creation of understory food sources is to be avoided in the lower canopy to reduce predator population response.

Disturbance Effects

Human activities near breeding birds can have a negative influence on productivity either directly by effecting occupancy or breeding and rearing activity or indirectly by influencing the density of potential predators of eggs, young or adults. Little quantitative information is available concerning how murrelets productivity responds to various types of human disturbance. Hamer and Nelson (1998) examined response of adults and chicks at a single nest site in Washington located less than 8 meters from U.S. Highway 101. For all categories of disturbance measured, adult murrelets reacted more frequently (2-10 times more) that the chick. Human disturbance such as standing or walking near the nest site and visual human disturbance elicited the most severe response from adults resulting in aborted nest visits or flushing from the nest and least from vehicle disturbance. Both adults and chick showed highest proportion of behavioral response (noticeable though not severe) to corvid disturbance (visual observation of corvid by the murrelet).

The presence of suitable habitat can reduce the distance required for noise sources to reach ambient levels. Most noise was reduced to near ambient levels in the forest environment in 50 meters for automobiles, 75 meters for trucks, 75 meters for chainsaw, and 150 meters for a shotgun blast (Hamer and Nelson 1998). Reducing visual disturbance followed by noise levels near potential nest sites should be the principal disturbance concerns of land managers.

To avoid adversely affecting Marbled Murrelets DFG and the US Fish and Wildlife Service routinely recommend that there be no helicopter operations within 0.5 mile of known or suspected murrelet breeding sites during the murrelet breeding season March 24- Sept.15. This is to minimize noise disturbance and to prevent rotorwash from disturbing the stand.

Hebert et al. (2002) examined the effect of human generated noise, visual human disturbance, and influence of those variables on predator attraction in Redwood National and State Parks in northern California. Successful nests tended to be farther on average from a trail (0.42 +/- 0.1 km; n=6) than unsuccessful nests (0.08 +/- 0.1 km; n=2) and unsuccessful nests may have been due to the proximity to forest edge and higher predator densities. Short-term changes in the number of corvids seen did not vary between pre-disturbance, disturbance, and post-disturbance periods although the number of corvids heard did vary. Neither adult or chick murrelets flushed from the nest when exposed to an operating chainsaw (50+ and 70+ dB at idle and full throttle; 25 meters away) although as one would expect, both spent significantly less time at rest during disturbance periods. Fledging success, when exposed to chainsaw noise, suggests that disturbance during the incubation period may be more detrimental than during the chick rearing period.

Natural disturbance events like fire, windthrow, and insects and disease have the potential to affect the amount and quality of current and future Marbled Murrelet habitat. Large stand replacing fire events are relatively rare however in the Pacific Northwest. In 1902, the Yacolt fire and in 1933 the Tillamook fire each burned approximately 240,000 acres. The 2003 Biscuit fire in southern Oregon may have removed nearly 15,000 acres of murrelet habitat. Windstorm effects are generally local in nature and extent of damage is related to stand condition and topographic position. Dense stands that develop without thinning, fragmented stand edges and shelterwood prescriptions seem particularly susceptible. Disease and insect outbreaks can affect entire stands and result in significant tree mortality and loss of growth. However, these same diseases and insect attacks can result in tree deformities that facilitate the creation of nest platforms (McShane et al. 2004).

Other Threats

The 5-Year Status Review (McShane et al. 2004) also summarized population and demographic threats unrelated to the marine or terrestrial environment but having a potentially interactive or cumulative effect and are reported below.
For Marbled Murrelets in Washington, Oregon, and California, the primary population and demographic threats include:

- Loss of Genetic Variation Among Populations. Given that there are at least 3 genetically distinct populations of Marbled Murrelets, loss of any of these populations would reduce the species' genetic resources and compromise its long-term viability.

- Low Recolonization Potential. Low immigration rates and concomitant strong genetic structure in murrelets indicate that the species would probably be slow to recover from local disturbances.

- Declining Populations. Modeled trends indicate that Marbled Murrelets populations in Washington, Oregon, and California are in a state of decline. The probability for extirpation is especially prominent for Marbled Murrelets in Zones 5 and 6.

- Disease. Recent emergence of bacterial, fungal, parasitic, and viral diseases and biotoxins in seabirds poses an increasing threat to Marbled Murrelets. In addition, the recent expansion of West Nile Virus to the western United States poses an additional threat to nesting murrelets from mosquitoes in forest habitats.

Because Marbled Murrelets nest in forests where mosquitoes are present, and in some cases abundant, they may be as susceptible to West Nile Virus (WNV) as other forest bird species, and potentially more susceptible than other seabird species. Alternatively, Marbled Murrelet nesting behavior (not colonial) and nest site location and potentially short exposure time (except during incubation), may reduce their susceptibility to WNV and/or lower transmission risk within populations. Decline in corvid populations which appear particularly susceptible to the virus could benefit murrelets toi an unknown degree. See also http://www.vetmed.ucdavis.edu/whc/pdfs/wnvreportnopix.pdf

Loss of genetic variation among individuals and inter specific hybridization do not appear to be current threats to murrelets. Inbreeding depression (the increase of deleterious alleles in a declining and inbreeding population) does not appear to pose an immediate threat to the species as molecular evidence provides no evidence of inbreeding. Similarly, variation among individuals in the population is not an immediate concern for murrelets. Estimates of the distribution of neutral genetic variation in Marbled Murrelets indicate that population loss in California, British Columbia/mainland Alaska, or the Aleutians would however compromise long-term viability of the species and adaptive variation.

Marine Threats

The primary threats to Marbled Murrelets in the marine environment are described in detail by McShane et al. (2004) with excerpts below:

- Reduced prey availability from overfishing--Impacts to murrelets that results from overfishing of commercial fish species are likely greatly reduced or completely mitigated given opportunistic foraging on a wide range of available prey, large potential foraging areas, and local shifts in foraging distribution. It is unlikely that murrelets are affected by current levels of overfishing although local impacts may influence murrelets distribution at sea.

- Trends in prey availability from oceanographic variability--Natural variation in ocean currents and episodic events like El Nino influence fish populations. However little is known concerning the influence of these kinds of events on near-shore fish communities. Reproductive success of murrelets in central California was lower during years of decreased prey availability (Becker 2001 fide McShane et al. 2004).

- Oil spills--Mortality from oil pollution is an important consideration for murrelet conservation efforts. Oil spills in California, Oregon and Washington typically occur close to shore. The principal impact to murrelets is reduction in population size, decreased breeding success, and potential loss of use of certain nesting areas if relatively large numbers of birds are killed. Oil from some spills (e.g., Puerto Rican, Apex Houston, Point Reyes Tarball Incidents, and Command) off the Golden Gate and areas farther south in Zone 6 moved north into Zone 5, and dead seabirds have been found over a wide area from Bodega Bay to Monterey Bay. Single murrelets were recovered in Zone 5 during the *Puerto Rican* and Point Reyes Tarball Incidents, but the associated assessments of mortality did not make separate estimates for murrelets killed per zone. All murrelets estimated killed in the *Apex Houston* and *Command* spills were assigned to Zone 6.

Oil spills have occurred in Recovery Zone 4. In 1997, the *M/V Kure* collided with a loading dock in Humboldt Bay, spilling several thousand gallons of bunker fuel oil. A total of 951 birds were collected as a result of this incident including 9 Marbled Murrelets. On September 6, 1999 the dredge vessel *Stuyvesant* spilled 48 barrels of bunker fuel in Humboldt Bay. A total of 1200 birds were oiled including 24 Marbled Murrelets that subsequently died. It was estimated from modeling results that 135 murrelets were likely lost in this incident (M. Sowby OSPR, California Department of Fish and Game pers. comm.. October 11, 2005). Further north, the *New Carissa* ran aground on the Oregon Coast near Coos Bay in February 1999. The resulting spill of 70,000 gallons of fuel oil killed or injured 2,465 seabirds including 262 Marbled Murrelets.

Increased regulations have reduced the threat of oil mortality, however increases in shipping traffic, chronic oil release and pollution from sunken vessels, or additional offshore development increase risk. Although the threat of a large spill is very low, such an event has the potential to kill most of a zone population, or result in extirpation where populations are small, as is the case in Recovery Zone 5. For all zones except Recovery Zone 6, levels of current mortality from oil spills are less than 1% of the zone population and are not thought to have had significant effects on populations.

- Gill-nets--Marbled Murrelets bycatch mortality from coastal gill net fishing can be a significant management concern in some recovery zones given potential to reduce population size, lower breeding success, or result in abandonment of certain nesting areas where there are low populations. Little to no gill-net fishing takes place off the coast of Oregon and northern California (Recovery Zones 3-5) so there are no related effects on murrelets in these areas. In Recovery Zone 6, gill net fishing in waters less than 60 fathoms from Point Reyes (Marin County) to Point Arguello (Santa Barbara County) was closed by the California Fish and Game Commission in 2002. Between 1979 and 1987 an estimated 175-300 murrelets were lost in this zone to gill nets (Carter and Erickson 1992 fide McShane et al. 2004).

- Other marine contaminants--Reproductive impairment from marine pollutants is not expected over wide areas because murrelets are distributed mainly in areas with lower pollutant threats, have wide foraging areas with seasonal dispersal, and feed extensively on transient juvenile and subadult midwater fish species expected to have low pollutant loads. However, murrelets that feed regularly in localized areas near major pollutant sources may be significantly affected. Specific studies are needed in high threat areas to better assess possible impacts.

- Disturbance from recreational boating and research and monitoring efforts-- No research on Marbled Murrelets has empirically correlated disturbance in marine environments with effects on either large-scale regional population distribution or reproductive success. The opportunities for research are limited by the inability to systematically track large numbers of breeding birds from marine environments to isolated nest sites. In addition, the unique breeding biology of the murrelet also makes it difficult to compare to other seabird species that have been studied to determine potential effects of longterm sublethal disturbance in marine environments.

Marbled Murrelet Critical Habitat and Recovery
The ESA requires designation of critical habitat for species listed as federally threatened or endangered. Critical habitat is defined as “(I) the specific areas within the geographic area occupied by a species on which are found those physical and biological features (i) essential to the conservation of the species, and (ii) that may require special management considerations or protection; and (II) specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species.” Critical habitat is protected under the ESA. Critical habitat is protected under the ESA in that a federal agency that authorizes funds or implements an action with the potential to affect critical habitat must consult with the USFWS to ensure that the action does not result in the destruction or adverse modification of critical habitat.

The USFWS designated critical habitat for the Marbled Murrelet in 1996. In the Final Rule, the USFWS determined that the physical and biological habitat features (referred to as the primary constituent elements) associated with the terrestrial environment that support nesting, roosting and other normal behaviors are essential to the conservation of the Marbled Murrelet and require special management consideration. Within areas essential for successful Marbled Murrelet nesting, the USFWS focused on the following primary constituents: (1) individual trees with potential nesting platforms, and (2) forested areas within 0.5 miles of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site potential tree height. This includes all forest, regardless of contiguity. These primary constituent elements are considered essential to provide and support suitable nesting habitat for successful reproduction of the Marbled Murrelet. In addition, on a landscape basis, forests with a high canopy height of at least one-half the site potential tree height in proximity to potential nest trees are likely to contribute to the conservation of the Marbled Murrelet.

JDSF was included in the critical habitat designation (USFWS 1996b). Criteria for critical habitat include the presence of suitable nesting habitat, presence of murrelets, and proximity to foraging habitat. Critical habitat also was designated in zones of current low use by murrelets. These areas are intended to support the USFWS goal to reduce gaps in the species nesting distribution, and help buffer the species from future catastrophic events such as oil spills and forest fires. JDSF is the largest contiguous parcel of public land on the Mendocino County coast. In California, 175,500 acres (71,040 ha) of state lands were designated as critical habitat, of which JDSF constitutes about 29 percent.

The Marbled Murrelet Recovery Plan (USFWS 1997) established 6 recovery zones and management strategies across the distribution of the murrelet in Washington, Oregon and California. The zones were delineated based on current population and habitat distribution, threats, and geopolitical boundaries with the objective of maintaining a well-dispersed population, considered essential for the long-term survival and recovery of the species. Jackson Demonstration State Forest falls within the Mendocino Zone (Zone 5) that extends from the southern boundary of Humboldt County California, to the mouth of San Francisco Bay. It includes waters within 2 kilometers (1.2 miles) of the Pacific Ocean shoreline and extends inland a distance of up to 40 kilometers (25 miles) from the Pacific Ocean shoreline.

Murrelet population status in each zone is highly varied, as is their potential to contribute to recovery objectives. Although the Mendocino Zone, “can not be relied on to contribute to the recovery of the species” and given the near total historical habitat loss in this zone, “may eventually lead to the extirpation of this population no matter what conservation efforts are made,” (USFWS 1997 p. 115-116). Conservation measures here could still benefit the species. Murrelets along the coast of Mendocino, Sonoma and Marin Counties are considered important to future reconnection of murrelet populations in northern and central California. Recovery efforts in Zone 5 may improve survival and recovery in adjacent zones by reducing the current geographic gap in breeding distribution. Given that the population of murrelets in this zone is so small, longer-term recovery efforts geared toward the development of new habitat may be most important (USFWS 1997).

Murrelet habitat protection and recruitment in the westernmost portions of the forest will likely provide the greatest probability of occupancy and nesting success given proximity to the ocean and foraging areas, current centers of murrelet activity, and cooler and wetter microclimate conducive to nest substrate formation (e.g. moss covered limbs providing a platform structure).

The Marbled Murrelet recovery plan identifies a number of actions that will contribute to population stabilization and eventual recovery of the species. Those actions potentially implemented by JDSF include:1) protect occupied and unoccupied but suitable nesting habitat to prevent further population reduction, 2) provide for the maintenance and recruitment of suitable, high quality habitat over the long-term (50-100 years), 3) develop and implement management strategies that address Marbled Murrelet habitat requirements in protected areas, 4) maintain potential and suitable habitat in larger contiguous blocks with low levels of fragmentation, 5) maintain and enhance buffer habitats adjacent to occupied habitat to protect nest sites from predation, edge effects, and human disturbance, 6) conduct surveys to protocol prior to land-disturbing events, 7) facilitate research into silvicultural techniques to enhance the development of high quality nesting habitat at scales of the stand and individual tree limb structure as well as factors limiting forest nesting success, 8) participate in a regional west coast data center to share research, monitoring, and inventory results.

Northern Spotted Owl (*Strix occidentalis caurina*)

Federal: Threatened
State: Species of Special Concern
BOF: Sensitive

A complete account of the taxonomy, ecology, and life history characteristics of the Northern Spotted Owl is found in the following reports: Conservation Strategy for the Northern Spotted Owl (Thomas et al. 1990); the Determination of threatened status for the Northern Spotted Owl (USFWS 1990a); Recovery Plan for the Northern Spotted Owl (USFWS 1992c); Report of the Forest Ecosystem Management Assessment Team (FEMAT 1993); USFWS status reviews (USFWS 1987, 1990b); the 1989 status review supplement (USFWS 1989); and the biological opinion of the USFWS on Alternative 9 of the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USFS and BLM 1994); and the Protocol for surveying proposed management activities that may impact Northern Spotted Owls, as amended (USFWS 1992a). Preliminary findings of the draft report Status and Trends in Demography of Northern Spotted Owls, 1985-2003 (Anthony and others 2004) was used to summarize current research results on population status and trends regionally.

Biology and Ecology

Northern Spotted Owls occur in a variety of coniferous forest types in the Pacific Northwest. Suitable habitat is generally described as forest stands with multiple canopy layers, both conifers and hardwoods; moderate to high canopy closure; substantial decadence in the form of live trees with deformities (e.g., cavities, broken tops) and snags; and a large accumulation of logs and woody debris (Thomas et al. 1990). However, Spotted Owls are observed to use previously logged forests with late-seral forest characteristics in coastal California (Thomas 1990).

Spotted Owls nest in tree or snag cavities, on platforms (abandoned raptor or raven nests, squirrel nests, mistletoe brooms, debris accumulations), or on the top of broken-off snags. In older-age forests, Spotted Owls tend to use broken-top trees and cavities more frequently than platforms (Gutierrez et al. 1995). Breeding pairs defend large, exclusive territories. Nesting takes place from March to June and results in a clutch averaging two eggs. The female incubates the eggs while the male forages for food. Young reach maturity at about three years of age and mated pairs may return to the same nest site for up to 10 years. Home ranges for Northern Spotted Owls in California vary from 1,258 ac to 7,823 ac (503 ha to

3,129 ha) (Thomas et al. 1990). Adult Northern Spotted Owls are usually nonmigratory (Gutierrez et al. 1995).

Juvenile Spotted Owls disperse from natal areas in the fall. Thomas et al. (1990) described adequate dispersal conditions as landscapes in which 50 percent of the area consists of trees with an average dbh greater than 11 inches and with a canopy closure of at least 40 percent. The USFWS (1992c) described dispersal habitat as stands with tree size and canopy closure adequate to provide protection from predators and at least minimal foraging opportunities.

Distribution

The Northern Spotted Owl is currently distributed in varying densities and numbers in suitable habitat throughout its range in Washington, Oregon, and California. The Northern Spotted Owl was listed as threatened under the FESA.

The Spotted Owl is divided into three subspecies, two of which occur in California. The Northern Spotted Owl (S. o. *caurina*) and the California Spotted Owl (S. o. *occidentalis*) are believed to be closely related. Only the northern subspecies is federally listed as threatened. The California subspecies, a U.S. Forest Service sensitive species, is confined to the western portion of the Sierra Nevada range, as well as some mountainous sections of Monterey and Santa Barbara counties, and a few localized sites in southern California (Verner et al. 1992). The Mexican Spotted Owl (S. o. *lucida*), a federally threatened species, is found from southeastern Utah and central Colorado southward through the mountains of Mexico (Ehrlich et al. 1992). The Northern Spotted Owl breeds from southwestern British Columbia south through western Washington and western Oregon to Marin County, California (USFWS 1994b), and there are a few confirmed records from the Santa Cruz Mountains, but it is not known if these are of the northern subspecies (Small 1994).

In general, Northern Spotted Owls are considered to be an uncommon resident breeding species in northwestern California. Most (about 80 percent) owl pairs rangewide occur on federally managed lands. Distribution of these pairs varies by land ownership, state, and physiographic province. Inventories are least complete in California; however, 40 percent of the state population and habitat of Spotted Owls may occur in the California Coast Province. The California Coast Province encompasses about 40 percent of the Northern Spotted Owl range in California (USFWS, 1992c).

Local Distribution

The first Northern Spotted Owl surveys in JDSF were initiated in 1989 (Henry 1990), and consisted of a general forest-wide reconnaissance. From 1990 forward, a number of formal protocol surveys have been conducted (Roberts et al. 1991, Jones and Stokes Associates 1994, RMI 1996, and others) (Tables VII.6.6.12 and VII.6.6.13). A thorough forest-wide inventory was conducted from 1990 to 1992 and 2001(Roberts et al. 1992, Stephens 2001), and most of the known territories

Table VII 6.6.12. Partial summary of territories and nest productivity on JDSF from 1998 to 2004.

Territory Name	CDFG MD	site first assigned	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Park Gulch	2	pre 1995	nc	nc	N, 2F	N ncr	N, 0F	x	nc	x	nc	x	x	x	x	nc	x	nc
Caspar Creek	91	pre 1995	MF	nc	P	P	P	P	P	P	P	P	N, 1F	P	P	N, 1F	P	P
NF of SF Noyo River	92	pre 1995	M	N	P, ncr	P	N, 1F	M	CH	x	CH	CH	CH	F	P	nc	F	CH x
NF James Creek	93	pre 1995	MF	P	N, 2F	P, ncr	N, 0F	N, 2F	N, 2F	N, 0F	N, 0F	P	N, 1F	M	N, 2F	P	P	N, 0F
Chamberlain Creek	124	pre 1995	MF	N, 2F	P	N, ncr	P	N, 1F	x	M	U	P	P	P	x	nc	nc	nc
Dunlap	142	pre 1995	nc	P	N, 2F	x	x	x	nc	x	nc	x	x	x	x	x	x	nc
Camp 3	163	pre 1995	nc	nc	P	N, 2F	P	N, 1F	x	N, 1F	P	P	N, 0F	N, 1F	N, 1F	P, ncr	P, ncr	M, ncr
Berry Gulch	164	pre 1995	nc	nc	M	P	P	N, 2F	x	x	N, 1F	P	N, 1F	P	N, 1F	P	P	P
Hare Creek	165	pre 1995	nc	nc	F	U	x	x	x	x	x1	MD 91 forage this territory						
Deadman's Trestle	237	pre 1995	nc	nc	N, 1F	P, ncr	N, 0F	N, 1F	P	N, 1F	N, 0F	N, 0F	N, 0F	N, 2F	N, 2F	P	P	N, 1F
W. Chamberlain Creek	258	pre 1995	nc	nc	F	P	M	N, 2F	x	M	M	M	M	x	x	Male moved to MD 92 territory		
Lower James Creek	259	pre 1995	nc	nc	F	N, ncr	x	P	F	P	N, 1F	N, 1F	N, 1F	N, 1F	P	x	nc	nc
James Creek	309	pre 1995	nc	nc	nc	N, 1F	P	N, 1F	N, 2F	N, 2F	P, ncr	P, ncr	P, ncr	N, 1F	N, 2F	P	M,F	nc
Parlin Creek	311	pre 1995	nc	nc	nc	P	x	x	x	nc	x	x	x	x	P	P	P	N, ncr
Bear Gulch	523	pre 1995							nc	nc	P, ncr	P	P	N, 2F	N, 1F	P	P	N, 0F
Mid Parlin	550	2001						x	x	nc	x	x	x	x	N, 1F	P	P	P
Camp Six	551	2001						nc	nc	x	x	x	x	nc	M	N, 1F	P	P
Little N.F. Big	(292) 558	2002						x	M	nc	x	x	x	nc	x	P, 2F	x	nc
Parlin fork	559	2002						nc	nc	nc	x	x	x	nc	x	F	x	x
Caspar Orchard	585	2002						x	x	nc	nc	nc	nc	nc	x	U	U	N, 0F
Northspurr	582	2002						x	nc	nc	x	nc	nc	x	x	P	P	A

Key: M=Male, F=Female, U=Unknown sex, P=Pair , N=Nesting pair, F=Fledged young, nc=not checked, x=No owls detected, CH=Pair on Campbell Hawthorne former G-P and TTC, ncr=Number of young not checked

Table VII 6.6.13 Summary of JDSF Northern Spotted Owl surveys.

Year	Survey Summary	Surveyors	Done to Protocol	Banding	Source
1989	Point and cruise survey methods conducted for seven nights in May and July 1989; 70–80 miles of roads surveyed which were distributed fairly evenly over JDSF, but "represent a fairly small sample of each area" (Henry, 1990).	JDSF staff and CDFG biologists	No	No	Henry, 1990
1990 - 1992	Forest-wide inventory from April 1990–August 1992 to determine density, distribution, and reproductive rates. Small mammal study. Most areas called at least twice; proposed THPs called at least six times.	G-P and CDFG staff	Yes[a]	Yes	Roberts et al., 1992
1994	Eleven of 14 known territories surveyed, with expansions in some cases where suitable habitat was present.	Jones and Stokes Associates, Inc. and JDSF staff	Yes[b]	Yes	Jones and Stokes Associates, Inc., 1994
1994 – 1995	THP surveys from April 1994–June 1995 at 13 sites across JDSF.	RMI staff	Yes[b]	No	RMI, 1996
1996	Thirteen of 15 known territories surveyed. THP surveys also conducted.	Pamela Town, and other CDFG, G-P, and JDSF staff	Yes[b]	No	CDFG, 1996d
1997	Twelve of 15 territories surveyed. THP surveys also conducted.	Pamela Town, and other CDFG, G-P, and JDSF staff	Yes[b]	Yes (limited)	CDFG, 1997c
1998	Monitoring of 15 known territories and surveys for THPs.	P. Town, G-P, MRC, and others	Yes	No	CDFG 1998
1999	Monitoring of 16 known territories and surveys for THPs.	P. Town, TTC, MRC, and others	Yes	Yes	CDFG1999a
2000	Monitoring of 16 known territories and surveys for THPs.	P. Town, NCASI, Campbell Group, MRC	Yes	Yes, NCASI	Town 2000b
2001	Entire JDSF ownership surveyed	NCASI	Yes	Yes	Stephens 2002
2002	Telemetry Research, 5 pairs	NCASI	Yes	Yes	Stephens 2002
	Surveys for THPs, Monitor 4 territories	Bill Stevens, JDSF Staff	Yes	No	JDSF , Stevens 2002

Table VII 6.6.13 Summary of JDSF Northern Spotted Owl surveys.

Year	Survey Summary	Surveyors	Done to Protocol	Banding	Source
2003	Telemetry Research, 5 pairs	NCASI	Yes	Yes	Stephens 2003
	Surveys for THP, Monitor 4 territories	Mich Stolfus, JDSf Staff	Yes	No	JDSF, Stolfus
2004	Telemetry Research, 5 pairs	NCASI	Yes	Yes	Stephens 2004
	Surveys for THPs, Monitor 4 territories	JDSF Staff	Yes	No	JDSF

[a] *Surveys in some areas used protocol of Forsman (1983), with updates as recommended in USFS (1988).*
[b] *According to protocol in USFWS (1992)*

were resurveyed in 1994 (Jones and Stokes Associates 1994). From 1995 to 1999, and 2002 to present annual forest-wide surveys were not conducted due to time constraints; survey efforts were concentrated on known activity centers and areas being studied in preparation for timber harvesting plans (P. Town, pers. comm., 1997).

From 1990 to 1997, a total of 23 adult and subadult ("after hatch year") and 11 young ("hatch year") Northern Spotted Owls were banded in JDSF. After hatch-year birds received numbered aluminum bands in addition to individual colored plastic leg band (color band) combinations. During 1991 and 1994, banded hatch-year owlets received "cohort bands", which consist of a single striped color band with a different color combination for each year. Hatch-year young banded in other years did not receive a color band. Banding efforts were most intensive during 1994 (Jones and Stokes 1994). This program was conducted cooperatively with Georgia-Pacific (now Campbell- Hawthorne and Louisiana-Pacific (now Mendocino Redwood Company).

In 2001 banding was done by NCASI in conjunction with their Adaptive Management study. They banded an additional 10 adults and six fledglings, bringing the total banded adults observed on JDSF to 22 in 2001. Banding has continued in conjunction with that study with two additional adults and 3 fledglings outside of the study area.

There are several instances of fledgling and adult migration from JDSF to adjacent lands, but no pattern is apparent. For example, a banded Northern Spotted Owl that was produced by the Camp 3 pair in 1994 was discovered in 1996 at Admiral Standley Recreation Area, which is located 19 mi (30 km) north of the nest (CDFG 1996)

Intensive forest-wide surveys were conducted from 1990 to 1992. Fourteen active Spotted Owl territories were recorded as of that date (Roberts et al. 1994, p. 8). Active territories included not only sites with paired owls, but also sites where unpaired individuals have been recorded. In subsequent years, survey effort has been less intensive and the number of active territories has varied from six in 1995 to ten in 1997. Five territories were declared inactive or unoccupied at the end of 1997 because either no Northern Spotted Owl responses had been obtained after three years of survey (Park Gulch, Hare Creek, Dunlap, and Parlin), or the pair moved to an adjacent ownership. (CDFG 1997). From 2000 through 2004 both research and operational THP surveys were conducted. NCASI conducted year round telemetry studies on five pairs on JDSF and additional pairs on nearby Campbell-Hawthorne and Mendocino Redwood Company lands. Consulting Wildlife Biologists and JDSF staff have conducted protocol surveys for THPs and other projects. These surveys have typically covered at least four other active territories.

The entire JDSF ownership was surveyed in 2001 (Stephens 2002). Thirteen occupied Spotted Owl territories, consisting of 10 pairs and 3 singles, were recorded. Subsequent protocol surveys focusing on planned project areas have identified three new territories as of 2004. Survey efforts have varied in intensity and the number of active territories has varied from four in 1989 to 14 in 2001.

Details on territories and nest productivity on JDSF are summarized above in Table VII 6.6.12. From 1990 to 1997 the eastern portion of JDSF had produced 61% of the 33 fledged young documented in JDSF. Results from studies on banded birds show that most JDSF hatch-year Northern Spotted Owls are not refound in subsequent years. However, many after-hatch-year owls have been resighted in consecutive years at JDSF. Roberts et al. (1992) reported that “JDSF showed slightly lower estimated crude population densities of owls (0.07 territories/km^2) than intensively managed neighboring areas” (pp. 8–9). Because the survey effort has been less intense in recent years, it is not possible to make recent comparisons. Due to the inconsistent survey effort, in conjunction with the limiting effects of small sample size and large natural annual oscillations in reproductive success, it is not possible to draw conclusions regarding average number of young produced per season, occupancy rate of territories, and proportion of pairs breeding each year.

Town (pers. comm., 1997) notes that in the central region of the Forest many of the Northern Spotted Owl territories were located close to JDSF boundaries, and the pairs often eventually moved to “adjacent intensively managed private forests.” The more recent establishment and re-occupancy of several territories the mid forest where closed canopy second growth stands have recently been harvested has been noted.

Regional Population Size and Trend

Northern Spotted Owl demographic data from 14 study areas in Washington, Oregon, and northwestern California and collected from 1985-2003 has recently been analyzed (Anthony et al. 2004). The main objective of was to provide an assessment of the status and trend of Northern Spotted Owl populations throughout most of its geographic range on federal, tribal, private, and mixed ownership lands. There were 4 study areas in Washington, 6 study areas in

Oregon, and 4 study areas in California (Northwest California, Simpson Resource area, Hoopa Tribal area, and Marin) that collectively covered approximately 12% of the range of the subspecies. Forest conditions varied across study areas, ranging from predominately young forests (<60 years old Simpson Resource area) to areas on federal lands where >40% of the landscape was mature (80-200 years old) or old-growth (>200 years old) forests. The demographic variables assessed included fecundity, apparent survival, and annual rate of population change.

- Fecundity: The number of young produced per female varied across the 14 study areas. Estimates by region and averaged over the years of study, showed that fecundity was highest for the mixed-conifer region in Washington and lowest in the Douglas-fir region of Washington and Oregon. Number of young produced declined in one of 4 study areas in Washington, 2 of 6 areas in Oregon, and 2 of 4 areas in California (Northwestern California and Simpson Resource area).

- Apparent Survival Rate: Survival rates were declining on five of the study areas and stable on the remaining 9. Major downward trends in survival were noted on all 4 study areas in the mixed-conifer and Douglas-fir regions of Washington. In California, a significant linear decline in apparent survival was noted for the Northwestern California study area, a slight decline on the Simpson Resource area and no detectable trend for the Hoopa or Marin study areas.

- Annual Rate of Population Change: Population declines were noted for 12 of the 13 areas where there were sufficient data to calculate this parameter. Two of the 4 study areas in California (Northwestern California and Hoopa) showed slight decline to stable population levels. Four of the 13 study areas showed strong evidence that populations had declined during the study (Simpson Resource area in California being 1 of the 4). The average overall decline was 4.1% per year for all study areas. Over the last decade, populations under study that have showed declines (4 of 4 for Washington, 3 of 6 in Oregon, 2 of 3 in California--although insufficient precision in the Northwestern California study area) have declined by 40-50% in Washington, 20-50% in Oregon, and approximately 20% in California.

Overall, demographic rates of Northern Spotted Owls in California are stable to slightly decreasing during the 1985-2003 period. Fecundity rates are generally high with slight declines noted for the Northwestern California and Simpson Resource area study locations. Survival rates are generally high but declining over the long-term for the Northwestern California Study area. The slight declines in fecundity and apparent survival for this study area may be caused by a slow decline in owl population. Populations declined on the Simpson Resource area, the only long-term demographic study within the coastal redwood zone, by about 3% per year (Anthony et al. 2004).

Northern Spotted Owl population on the Hoopa Tribal study area remained stable in spite of continued harvest of older forests on that area. The current Tribal Forest Management Plan does not allow intensive clear-cut logging and 30% of the forested lands are retained as old forest reserves in riparian protection zones, tribal reserves, and Spotted Owl core nesting areas. Selective logging is used throughout most of the Reservation and some large trees are retained in all harvest units (Anthony et al. 2004).

There is no clear trend in Northern Spotted Owl population in the redwood region surrounding JDSF with the exception of the Simpson and Marin study areas described above that are dominated by coastal redwoods and evergreen hardwoods. Although Northern Spotted Owl reproduction has been studied in the JDSF area for over a decade, natural oscillations in the population caused by year-to-year variation in abiotic factors, variation in sampling techniques and lack of sufficient data prevent an assessment of overall trend (Roberts et al. 1992, J. Ambrose, pers. comm. 1999). On G-P lands, fecundity over the 1990–1995 period was estimated at 0.22, and this value is “lower than the mean for adult birds from across the range of the subspecies, but higher than means for one- and two-year-old birds” (p. 4-54) (G-P 1997a).

Most (about 80 percent) owl pairs rangewide occur on federally managed lands. Distribution of these pairs varies by land ownership, state, and physiographic province. Inventories are least complete in California; however, 40 percent of the state population and habitat of Spotted Owls may occur in the California Coast Province. The California Coast Province encompasses about 40 percent of the Northern Spotted Owl range in California (USFWS 1992c).

Inventories from 1987 through 1991 (some areas included 1992 surveys) indicated that Spotted Owls were located at approximately 4,600 sites, including 3,602 pairs and 957 resident single owls (USFS and BLM 1994). The estimates covered various ownerships, including federal, state, county, and private ownerships throughout the owl’s range. Current estimates of population are undoubtedly underestimates, because not all suitable habitat has been surveyed. Gould (1995) reported that 978 Northern Spotted Owl activity centers were known in the three California coastal counties of Del Norte, Humboldt, and Mendocino. Sixty-seven percent of these sites were on privately owned timberlands that had been subject to timber management for decades.

Barred Owls

Barred Owls, a species formerly found only in eastern United States, have been extending their range to include California. Barred Owls sometimes hybridize with the Northern Spotted Owl (Martin 1996). Presence of either Great Horned or Barred Owls can displace Northern Spotted Owls from their territories.

There are several records of Barred Owls from JDSF or adjacent properties that date from at least the early 1990s. More recently, Barred Owls were detected repeatedly on JDSF and in the Mendocino Woodlands area in 2001 although detections did not indicate the presence of a pair. A male Barred Owl from the Mendocino Woodlands site was captured in 2005, banded, and fitted with a temporary tail-mount transmitter. Reproduction status at the Woodlands site is unknown. In 2005, surveys resulted in identification of a new pair of Barred Owls on the border of Russian Gulch State Park and JDSF near Road 409. Reproduction status at this new site is also unknown (M. Stephens, NCASI, pers. comm. October 16, 2005).

Barred Owls had a negative effect on apparent survival for two of the 4 study areas in Washington, where Barred Owls are most numerous, have been present the longest, and where Spotted Owls are doing the poorest. No evidence was found for a negative effect of Barred Owls on Spotted Owl survival in Oregon. Study areas in California had the lowest occurrence of Barred Owls at Spotted Owl territories (<5%), so the potential effect was judged minimal compared to more northern study areas. No negative effects of Barred Owls on Northern Spotted Owl fecundity were noted. Barred Owls may be having a greater negative effect on Spotted Owl territory occupancy although this parameter was not evaluated by Anthony et al. (2004). Although hybridization with the Barred Owl occurs occasionally, it is not considered a major threat or a significant problem at current population levels of Northern Spotted Owls (US Fish and Wildlife Service 2004). Kelly and Forsman (2004) summarized records of hybridization between Northern Spotted Owls and Barred Owls in Oregon and Washington through 1999. The small number of hybrids recorded (41) suggests that isolating mechanisms that separate these species are working. Direct competition between the two species for food and space was considered a more serious threat to Northern Spotted Owls.

Habitat Characteristics

The Northern Spotted Owl usually uses dense, old-growth forest or mid- to late-seral stage forests, with a multi-layered canopy cover for breeding habitat. Nests are usually located in mixed conifer, Douglas-fir, and redwood forests.

Although Northern Spotted Owls will nest in mid-seral stage forest, ideal habitat consists of stands with mature trees from 150 to 200 years old (Thomas et al. 1990). The age of the forest may not be as critical as the presence of stands of large, old trees located in cooler microhabitats, such as those found in the bottom of drainages and/or on north-facing slopes. Successful reproduction has also occurred in relatively young second-growth stands (Thomas et al. 1990).

Spotted Owls depend upon naturally occurring nest sites. Nests are typically located in tree cavities, or platforms of sticks or other debris on limbs or broken tops of trees (Forsman et al. 1984, Zeiner et al. 1990a). Platform nests may include abandoned raptor or squirrel nests and clumps of mistletoe or debris. The presence of suitable nest sites is suggested as a possible basis for the use of late successional forests (Forsman et al. 1984). In managed redwood forests of northwestern California, Thome (1997) found about one-third of the nest sites to be in stands without old-growth or residual components.

In coastal Mendocino County, habitat use by Northern Spotted Owls in managed redwood/Douglas-fir stands has been described by Pious (1994, 1995). Pious

(1995) notes that Spotted Owls were frequently associated with streamside management zones along rivers and streams. There was a tendency for Northern Spotted Owls occupying forest landscapes with a relatively high degree of fragmentation to have larger home ranges than those found in more contiguous blocks of forestland. When compared with other studies, nests were located in relatively young (< 100 years) forests, which could be attributable to the early development of suitable structural attributes within the coastal redwood forest habitat type. No information was available on nesting success in these relatively young Mendocino County stands; the report notes that “it is not known whether the nest-site occupation indicates selection or merely random occupation of marginally acceptable sites” (Pious 1994, p. 9). Nests (N = 97) were placed on stick platforms supported by branches (65%), in lateral cavities (16%), or on broken top cavities or platforms (14%). The majority of the nests occurred in coastal redwood (73%), with the remainder in Douglas-fir (14%), and tanoak (8%). The nesting habitat generally consisted of forest stands dominated by medium (21 to 35 inch [54 to 87 cm] DBH) and small (10 to 20 inch [25 to 50 cm] DBH) size-classes of coniferous trees, with hardwoods and other conifers as an understory component; multi-storied (two or more layers) canopies with high (> 70%) total canopy cover; and presence of a considerable amount of downed logs and other woody debris. A subset (N = 52) of the nest stands had a total canopy closure of 83%, while roost stands (N = 22) had a total canopy closure of 85%.

Since 1990, records have been kept on JDSF Northern Spotted Owl nest trees, nest stands, and other physical and vegetative parameters. These data are summarized in CDFG (1997). Twenty-four nest trees had species-specific information. Seventeen nests were in redwood, 4 nests were in Douglas-fir, 2 nests were in tanoak, and 1 nest was in chinquapin. In JDSF, 27 Northern Spotted Owl nests had data recorded for age of stand or successional stage (CDFG 1997). For eleven of the nests documented between 1990 and 1992, stand data were presented in years rather than in successional stage (old growth or second growth). Of the 27 nest trees, 8 were located in old-growth stands, 1 nest tree was situated in a stand consisting of second-growth trees with residuals, and 19 nest trees were located in second-growth stands.

Information on DBH was recorded for twenty-three JDSF Northern Spotted Owl nest trees. The average DBH was 34 inches (85 cm) (range 12 inches to 82 inches [30 cm to 205 cm]).

In JDSF, as with other portions of Mendocino County (Pious 1994), Northern Spotted Owls commonly nest on platforms rather than using cavities. Old squirrel nests are often chosen; although the exact reason for this is unknown it may be attributable to the presence of suitable platforms in conjunction with a lack of suitable snags (P. Town, pers. comm., 1996). Of the 19 JDSF Northern Spotted Owl nests for which the nest type was determinable, 17 nests were built on platforms, one nest was built in a cavity, and one nest was built on the top of a broken tree or snag (CDFG 1997).

Although timber harvesting has removed most of the late seral forest in JDSF, Jones and Stokes Associates (1994) note that: “certain portions of the Forest retain or have developed good-quality Spotted Owl habitat. Most of the stands that Spotted Owls occupy on the JDSF consist of a two-tiered structure with older second growth and scattered older, larger trees. Most sites have a dense (70 to 90%) canopy closure. The sites tend to be fairly diverse, with a hardwood component, shrub layer, and down logs and other material. Thus, although the Forest is relatively young, good-quality owl habitat is present. The lack of abundant older trees on the Forest may explain why Spotted Owls on the JDSF tend to use stick nests, rather than cavities, as nest sites” (p. 4).

Sensitivity to Disturbance

Timber harvesting and road building can directly affect Spotted Owl nesting, roosting and foraging habitat by removing large trees and opening the canopy layer. Forest habitat for this owl has been reduced by 60% since 1800, and continues to be lost at a rate of 1% to 2% per year (Shuford 1993). Forest fragmentation isolates remaining populations, and provides open habitat for great horned owls, a predator of Spotted Owls (Forsman 1976).

According to Wasser et al. (1997), timber harvesting and road building activities can also indirectly affect Northern Spotted Owls by increasing physiological stress levels, which can eventually lead to decreased reproductive success. Male Northern Spotted Owls exhibited a significant rise in fecal corticosterone levels if they were centered within 0.27 mi (0.41 km) of a major logging road or recent (10 years to present) timber activity. No differences were recorded among females. The 0.27 mi (0.41 km) distance was based on USFWS guidelines regarding the distance at which timber harvest disturbance is likely to affect an owl. Additionally, male corticosterone levels were higher in home ranges in proximity to clear-cut versus selectively logged areas. There was a short-term elevation of stress hormones in female owls during the 1.5-month interval when young begin to fledge.

West Nile Virus

West Nile virus (WNV) could affect the Northern Spotted Owl since it is an arbovirus that is primarily transmitted by mosquito vectors and avian species are the primary hosts. The Northern Spotted Owl five-year review conducted by the US Fish and Wildlife Service (US Fish and Wildlife Service 2004) notes that health officials expect eventual emergence of the virus throughout the native range of Northern Spotted Owls in California, Oregon, and Washington. Boyce et al. (2004) modeled the potential impacts of WNV on wildlife in California and suggests that spotted owl populations in the coastal mountains of northwestern California are at a relatively greater risk of exposure. They mapped risk of WNV in California by combining predicted vector abundance and the distribution of avian amplifying hosts. The risk of virus transmission was highest in California’s Central Valley, the Pacific Coast and nearby inland regions, and areas around the Salton Sea and the lower Colorado River in southern California.

Although owls in general appear susceptible to WNV, the degree to which Northern Spotted Owl populations throughout their range will be affected is uncertain. A number of unknowns exist concerning rate and distribution of spread of the disease, how the disease is most likely spread to Northern Spotted Owls (either directly or through consumption of prey species), levels of likely mortality and change in population structure, and degree to which resistance to the virus can be developed by the population (US Fish and Wildlife Service 2004).

Vaux's Swift (*Chaetura vauxi*)

Federal: None
State: Species of Special Concern
BOF: None

The Vaux's Swift breeds in western North America and winters in Mexico and Central America. In California, they primarily nest in the Coast Ranges south to Monterey County, but are also likely breed in low densities in Lake, Butte, Tehama, Plumas, and other interior California counties. Vaux's Swifts are most commonly encountered in portions of Humboldt and Del Norte Counties, including Redwood National Park (Sterling and Paton 1996). Early migrants arrive in the first week of April, with the majority of birds arriving and passing through the state from mid-April to late May (Small 1994).

Sterling and Paton (1996) reported low numbers of Vaux's Swifts in northern California; the species' occurrence was limited to 7 of 29 Breeding Bird Survey routes. Vaux's Swift populations are believed to be declining throughout the species' range (Bull and Collins 1993). Natural cavities and burned-out hollow trees are preferred nest sites (Small 1994). The removal of large broken-top trees and large hollow snags, most of which are found in late-seral stage forests, has an immediate effect in removing nest sites (Bull and Collins 1993).

Vaux's Swifts feed primarily on insects and spiders (Bull and Collins 1993). Foraging occurs above the Forest canopy, and at lower levels in meadows, over lakes, rivers and ponds, and above burned areas (Bull and Collins 1993, Small 1994).

Vaux's Swifts nest in coniferous forests along the central and northern California coast, and mixed oaks and conifers in the interior mountain ranges. At study sites in Oregon, nest trees averaged 26 inches (67.5 cm, n=21) in diameter (Bull and Cooper 1991). Vaux's Swifts are often found in old-growth forest, probably because of the greater availability of large, hollow trees. Many of the trees chosen for nesting have been decayed by fungus and excavated by pileated woodpeckers (Sterling and Paton 1996). Access to hollow trees also occurs via holes in broken-topped trees or snags (Bull and Cooper 1991).

Large-diameter, hollow trees or snags are also important for roosting non-breeders, recently fledged young, and post-breeding adults. In Oregon, 100 non-breeding Vaux's Swifts used a roost throughout the summer (Bull and Cooper 1991), and over 500 swifts, some of which were radio-tagged, were observed roosting communally some distance from the nesting trees (Bull and Blumton 1997).

The Vaux's Swift is considered a common summer resident and nesting species in northwestern California (Harris 1996). In Mendocino County, there are a number of sightings for the coastal area, especially near Russian Gulch, Van Damme, and Standish Hickey State Parks; but in the interior portion of the county records are less frequent (Sterling and Patton 1996). Vaux's Swifts have been recorded on JDSF and adjacent private lands.

Purple Martin (*Progne subis*)

Federal: None
State: Species of Special Concern
BOF: None

The Purple Martin is a Neotropical migrant that breeds from southern Canada to northern Mexico. In California, it occurs in low abundance in the inner Coast Range in Lake County and northern Napa County. It is found along the east slope of the Sierra-Cascade crest and locally at a few locations in the foothills of the Sierra Nevada. In northern and central California, Purple Martins are discontinuously distributed through the Coast Range and in the Siskiyou Mountains (Small 1994).

There has been a long-term decline of the Purple Martin over its entire continental range, despite a substantial shift to use of human-made nest sites by martins in the eastern and southern states (Arbib 1979, Brown 1997). Purple Martins began to decline in California in the late 1950s (Small 1994).

Peak nesting activity occurs in June with pairs, depending on the availability of sites, nest colonially or singly. According to most accounts (Small 1994, Brown 1997), during the nesting season in California the Purple Martin is most closely associated with coniferous and mixed conifer/hardwood forests that have large snags with cavities. Purple Martin are generally associated with open forest stands than the dense stands typical of redwood forests (G-P 1997).

Purple Martin feed on a large variety of insects, including beetles, true bugs, flies, dragonflies and damselflies, leafhoppers, butterflies, wasps, bees, and spiders (Brown 1997). Martins sometimes feed to heights of 492 ft (150 m). They forage over riparian areas, forests, and open woodlands.

For nesting, Purple Martins use large-diameter snags. Suitable snags for nesting may occur in older conifer forest stands or in natural or manmade clearings.

In northwestern California, the Purple Martin is an uncommon summer resident and nesting species (Harris 1996). Although it has not been recorded within JDSF, there are records of Purple Martin occurring in the vicinity (CNDDB 2004, G-P 1997).

Yellow Warbler (*Dendroica petechia brewsteri*)

Federal: None
State: Species of Special Concern
BOF: None

The Yellow Warbler is a Neotropical migrant that breeds in suitable habitats from Central America to Alaska, and throughout most of North America and Canada. In California, they breed the length of the state except for the Central Valley, southern Sierra Nevada, and southern desert regions (Zeiner et al. 1990a). Harris (1996) considers Yellow Warblers a common breeder in northwestern California. The decline in Yellow Warbler populations is attributed to habitat destruction and brood parasitism by brown headed cow birds (Small 1994).

Yellow Warblers are generally associated with deciduous riparian plants, preferring willows, cottonwoods, aspen, sycamores, and alder for nesting and foraging (Zeiner et al. 1990a, Small 1994, CNDDB 2004). They also breed in dry montane chaparral with scattered trees and in montane coniferous forests with Ceanothus and manzanita (Small 1994). In migration, it occurs in woodland, forest, and shrub habitats (Zeiner et al. 1990a).

Nests are constructed between 2-16 feet off the ground in a deciduous sapling or shrub (Zeiner et al. 1990a). However, Small (1974) considers Yellow Warblers as high canopy nesters and feeders. They glean and hawk insects and spiders in the upper canopy of deciduous trees and shrubs in low, open canopy riparian woodlands (Zeiner et al. 1990a).

Harris (1996) considers the Yellow Warbler a locally common summer resident and breeder. Yellow Warblers have been occasionally observed on JDSF. Kitchen (1992) reports one in a redwood stand (CWHR 3D) and CDFG (1996) reports one near the road leading to Chamberlain Creek Conservation Camp.

Olive-sided Flycatcher (*Contopus cooperi*)

Federal: Federal Species of Concern
State: None
BOF: None

Olive-sided Flycatchers are Neotropical migrants that breed in suitable habitat from Alaska to Baja California, the Rocky Mountains, and throughout much of Canada and the Great lake states. In California, they occur in the Sierra-Nevada and Siskiyou mountains and Coast Range from the Oregon border to San Luis Obispo County.

Breeding habitats include mixed conifer, montane hardwood-conifer, Douglas-fir, redwood, red fir, lodgepole pine, and eucalyptus (Zeiner et al. 1990a, Small 1994, Fix and Bezener 2000). Within coniferous forests, they are most often associated with openings, edges near openings (e.g. meadows, canyons, watercourses, or harvest units) or in semi-open stands (Altman and Sallabanks 2000). In early successional habitats, this species appears to be dependent on the presence of snags or residual live trees that are used for foraging and singing perches (Altman and Sallabanks 2000). According to Rosenberg and Raphael (1986 in Altman and Sallabanks 2000), Olive-sided Flycatchers are the only common species detected more often at forest edges than in the interior portion of Douglas-fir stands in northwestern California. In Idaho, Olive-sided Flycatchers were significantly more abundant in watersheds with clearcuts than those without (Evans and Finch 1994 in Altman and Sallabanks 2000).

Nests are usually constructed on a horizontal branch of a conifer located well away from the bole (Fix and Bezener 2000). Foraging and singing perches are generally located in the uppermost branches of the tallest trees in the vicinity (Zeiner et al. 1990a). Olive-sided Flycatchers sally for flying insects over openings or forest canopy (Zeiner et al. 1990a).

Harris (1996) considers Olive-sided Flycatchers as a common resident and breeder in woodlands and forests with a conifer component in northwestern California. Olive-sided Flycatchers are known to occur on JDSF. Kitchen (1992) reported numerous observations from within a variety of habitats and CDFG (1996) reports two incidental sightings.

Sonoma Red Tree Vole (*Arborimus pomo*)

Federal: None
State: Species of Special Concern
BOF: None

The Sonoma red tree vole is distributed along the Pacific coastal lowlands in northern California South of the Klamath River. In California, this species is restricted to coastal forests in the humid fog belt north of San Francisco Bay. (Williams 1986). Little information is available on the current status and trends in the population of Sonoma red tree voles. Because of the species apparent association with late-successional and old-growth forests and limited dispersal capabilities (Huff et al. 1992), it has been considered vulnerable to loss and fragmentation of forested habitats from logging, road and power line construction, as well as urban and agricultural development (Williams 1986). Swingle (2005) noted that red-tree vole (*A. longicaudus*) in western Oregon had a range typically limited to a few trees near nests with occasional movements of 10-140 meters to nests in different trees. Home range area for 52 voles ranged from 36-10,308 square meters.

Red tree voles consume the needles of Douglas-fir and grand fir needles (Zeiner et al. 1990b) and Bishop pine (T. Wooster personal communication,). This species has been associated with late-successional Douglas-fir forests in some studies (Meiselman 1987, Meiselman and Doyle 1996, Aubry et al. 1991), but has also been known to nest in second-growth stands (PALCO 1998, D. Embree, pers. observ.). In Mendocino County, Meiselman and Doyle (1996) found that 77 percent of Sonoma red tree vole nests occurred in old-growth (greater than 200 years old) or mature (100 to 200 years old) forests characterized by a canopy cover of greater than 93 percent. All nests were found in Douglas-fir trees (mean nest tree was 46.5 inches dbh and 185 feet tall). Similarly, in California, Zentner (1977) found old-growth Douglas-fir stands to contain more red tree vole nests and larger colonies than second-growth stands. The youngest stand in which red tree voles (*A. longicaudus*) were captured in the Oregon Coast Range was 62 years old (Huff et al. 1992). Early seral forest may limit dispersal capabilities of this species (Hayes 1996).

The presence of Douglas-fir is clearly important to maintaining viable populations of red tree voles. Huff et al. (1992) found that even though basal area and density were highly variable among stands, the basal area of Douglas-fir was greater than 40 percent of the total stand basal area in 15 of the 18 stands where red tree voles were captured in Oregon. In the Oregon Coast and Cascade Ranges, Huff et al. (1992) found that stands with red tree voles had a mean of 12 large Douglas-fir trees per acre (greater than 39 inches dbh), whereas those without voles had significantly fewer large Douglas-firs (6 per acre).

Red tree voles were captured in stands ranging in size from 75 to 1,280 acres (475-acre mean) in the Oregon Coast Range and were not captured in stands less than 75 acres in size (Huff et al. 1992). However, there is no conclusive information available concerning the minimum size stand necessary to support a population of red tree voles. Factors such as the number of suitable nest trees, canopy closure, predators, and past and present disturbances may be more important to the suitability of a stand than its acreage.

The Sonoma red tree vole has been recorded frequently on JDSF (CNDDB 2004).

Pacific Fisher (*Martes pennanti pacifica*)

Federal:	Species of Concern
State:	Species of Special Concern
BOF:	None

Regional Distribution

Fishers exhibit a discontinuous distribution in Washington, Oregon, and California from the more continuous populations of Canada and the eastern United States. Regionally, gaps are also noted in the Klamath region populations studied by Carroll et al. (1999). Land uses in this region that incorporate short rotation timber harvest may further isolate remnant populations, minimize recruitment from source populations, and reduce sustainability of marginally isolated populations.

The great variation in Pacific fisher presence and abundance at the scale of the region makes reliable stand level habitat relationships findings problematic. Regional variation in Pacific fisher occurrence in the redwood zone may be related to large scale environmental factors beyond typical habitat considerations at the scale of the stand or planning watershed. Cooperrider et al. (2000) suggest that regional factors such as higher mean elevation and distance to the coast (Klug 1996) or precipitation may be as influential as patch size, or other landscape level habitat attributes. Regional variation in detection rates between both parklands and managed timberlands may be reflective of these large scale regional attributes. Reoccupancy of suitable habitat at any population density may be difficult given landscape scale changes in habitat condition working in concert with the regional biogeographic factors described (Cooperrider et al. 2000).

Regional variation in distribution and abundance of Pacific fishers may also be explained by metapopulation structure. Areas of occupied habitat with relatively high density such as the lower Trinity River provide a source of recruitment to more isolated populations while suitable but unoccupied habitat in more distant locations remains unoccupied or unable to sustain viable population levels. Long-term viability of populations at the scale of the region may be limited by the size and spacing of patches of suitable habitat.

The Pacific fisher is a resident of California's north coast region and portions of the Sierra Nevada. Recent surveys indicate that it is distributed across the northern Coast Range and Klamath Mountains (Zielinski et al. 1995). In the northern Coast Range and Klamath Province of California, Pacific fishers are located at elevations ranging from 83 to 3,300 ft above sea level (25 to 1,000 m) (Golightly 1997).

In California, observations compiled between 1961 and 1982 show fishers occurring in the northwestern portion of the state and throughout the Sierra Nevada Mountains (Maj and Garton 1994). Recent survey information indicates that the current distribution of fisher in California is now smaller with a gap between the northwestern population and the Sierra Nevada population (Zielinski et al. 1995). The northwestern coastal population in California appears stable with a relatively high abundance of fishers as compared to other populations in the western United States. The Pacific fisher has not been recorded on JDSF. According to the CNDDB (2004), there are four reports of fishers in Mendocino County, the most recent in 1995. Kitchen (1992) distributed 25 cameras and scent stations for 10-day intervals at various unspecified locations and dates on JDSF to detect furbearers; no Pacific fishers were detected.

Local Distribution

JDSF is at the southern limits of the coastal distribution of the Pacific fisher (Hall 1981) although they may have ranged as far south as Point Reyes in Marin County. There are no confirmed sighting of Pacific fisher on JDSF. In August 1995, Scott Harris, biologist with DFG, reported seeing a Pacific fisher on the Middle Fork of the Eel River 2-3 miles below Fern Point in the Yolla Bolly Wilderness of the Mendocino National Forest. In 1999, Biologist Harris recovered the skeleton of a male Pacific fisher from a pool at the base of “Asa Bean Roughs” on the Middle Fork Eel. Historical records occur in the Upper Noyo River drainage east of JDSF. More recently, unconfirmed sightings have occurred in the Usal Creek drainage to the north of JDSF (Hughes, no date).

Recent mesocarnivore survey work occurred on JDSF in 2003 and 2004. Three bait/camera stations were established in the James Creek area and were monitored from 1/31/03 to 3/3/03. In 2004, one station was established in Dresser Grove (monitored from 2/3/04 until 3/3/04), 4 stations in the Camp 3 area (monitored from 3/10/04 to 4/15/04), and three stations in the Brandon Gulch area (monitored from 3/19/04 until 4/30/04). No marten or Pacific fisher were detected with these surveys (B. Valentine CDFG, pers. comm. September 28, 2004).

Habitat Requirements

Klug (1996) surveyed for Pacific fisher on commercial timberlands in the redwood zone of Humboldt and Del Norte Counties and noted a positive correlation between Pacific fisher detection ratio and greater basal area of hardwoods of all size classes, canopy closure and volume of logs and less conifer basal area in the 52-90 cm size class. Significant differences exist in detection ratios between redwood and Douglas-fir forest types being highest in the latter. Klug also observed that at the scale of the stand, there was significantly less redwood both in basal area of young growth and density of residual trees in those stands recording Pacific fisher detections. No significant difference in stand age was noted between sampling stations with and without detections. Pacific fishers were less likely to be detected in redwood-dominated stands than Douglas-fir or redwood-Douglas-fir mix forest types in the predominately early seral stage commercial timberlands surveyed. Douglas-fir/mixed evergreen hardwood is the most extensive forest type in the Klamath region of northwestern California and southwestern Oregon (Carrol et al. 1999), which is also that portion of the western United States with likely the largest remaining Pacific fisher population (Powell and Zielinski 1994).

Carrol et al. (1999) found a correlation of high detection rates and large hardwoods in a mixed hardwood-conifer forest in northern Humboldt County. Their multivariate model containing landscape and regional scale variables performed as well as predictive models using fine scale data. Pacific fisher distribution was associated with landscapes with high canopy closure, precipitation (as an influence on prey species composition) and, at the scale of the sampling plot, large diameter hardwoods. Large hardwoods provide resting and denning sites and may be associated with higher prey densities given the mast they produce. Landscapes with high levels of canopy closure may influence density and availability of preferred prey, lower energy costs of travel, and protection from predation (Buskirk and Powell 1994; Powell and Zielinski 1994; Carroll et al. 1999). “Maintaining viable and well distributed Pacific fisher populations may require increased levels of canopy closure and retention of large hardwoods on managed lands, especially in areas that appear from habitat analysis to be plausible regional habitat linkages.” (Carroll et al. 1999 p 1357).

Additional survey work is needed to assess the relative habitat value of late-seral redwood stands given the large variation in detection rates with survey work done to date (Cooperrider et al. 2000).

Several Pacific fisher researchers suggest that management for fisher be conducted at a landscape scale such that a variety of forest habitat conditions (young, mid and late seral stages) and riparian areas as connections to preferred habitats are provided across the landscape (Jones and Garton 1994; Buck et al. 1994; Self and Kerns 2001). Self and Kerns (2001) recommend that lower elevation areas and up to 2500 feet from water are focus areas for the creation of those varied forest conditions with special emphasis on stands with both relatively open and closed canopies. Open forest stands lacking a significant brush or hardwood component and other openings without overhead conifer cover are not suitable habitat. Optimal proportions of these seral stages have not been described (Buck et al. 1994) and probably vary geographically. Additional research on Pacific fisher habitat use in managed forests is needed to further identify important habitat relationships.

Breeding, resting, and foraging habitat for Pacific fisher usually consists of old-growth or late successional coniferous forests with greater than 50% canopy closure (Zeiner et al. 1990b). However, Klug (1996) found no relationship between Pacific fisher occurrence, old-growth habitats, stand age, or topography on managed forest lands in Humboldt and Del Norte counties, California. Denning and resting occur in live trees with cavities, snags, downed logs, and a variety of other cavities (Zielinski 1995). Young are born between February and May (Zeiner et al. 1990b). In northern California, natal and maternal dens have been found in medium to large (21 to 58 inches dbh) live trees and snags, and in a 39-inch downed log (Zielinski et al. 1995). Natal and maternal dens of Pacific fishers on Simpson Timber Company lands in northwestern coastal California have also been found in medium-to-large (25 to 73 inches dbh) live trees and snags of a variety of tree species (tanoak, chinquapin, Douglas-fir, western red cedar (R. Klug, pers. comm.).

Throughout their range, Pacific fishers display variation in habitat use. For example, in the eastern United States, fishers occur in various age-classes of both hardwood and conifer forests, while in the Pacific states they appear to prefer late-successional coniferous forests (Powell and Zielinski 1994). Not all habitats used, however, should be considered of equal quality without habitat-specific information that allows comparisons of survivorship and fecundity (Powell and Zielinski 1994). While late-successional conifer forest is generally considered suitable Pacific fisher habitat in the Pacific states, other habitats are undoubtedly of value to Pacific fishers as long as suitable canopy closure and specific habitat elements are present. Klug (pers. comm.) also thought that large expanses of late-successional forest habitat were not required by Pacific fisher, and that younger stands with late-successional characteristics (e.g. LWD, snags, decadence, and hardwoods) would provide suitable habitat. Accordingly, the use of late-successional forest to define Pacific fisher habitat should be considered conservative.

Riparian areas serve as travel corridors for Pacific fishers. Although Pacific fishers tend to avoid open areas with less than or equal to 40 percent canopy cover, they are known to use heavily harvested riparian areas for travel (Buck et al. 1994, Jones and Garton 1994). In northern California, Pacific fishers have been detected in open areas and in second-growth forests (Klug pers. comm.). Use of these areas is generally attributable to individuals foraging where prey availability may be higher.

Population

The regional status of forest carnivores including the marten and Pacific fisher has been most recently summarized by Cooperrider et al. (2000). Of the 15 species currently inhabiting the redwood region, only 4 (ringtail, *Bassariscus astutus*;

marten now considered extremely rare or extinct; Pacific fisher; and river otter *Lutra canadensis*) are protected from harvest. The remainder are considered either regulated game species whose populations can sustain certain harvest levels or are unprotected non-game species. The California grizzly bear (*Ursus arctos*) was a formerly common species occurring in a variety of habitat types in the redwood region but is now extirpated.

Increases in the occurrence of hardwoods and Douglas-fir as a result of logging activities may have favored the occurrence of Pacific fishers, to the degree observed today, at the expense of the Humboldt marten. Lack of deep snow and occurrence of more mixed forest types may have given the Pacific fisher a competitive advantage and hampered the recolonization of marten habitat (Cooperrider et al. 2000).

Historically, over-harvesting (trapping) of Pacific fishers has resulted in population reductions and extirpations over much of their original range (Aubry and Houston 1992, Powell and Zielinski 1994). Currently, the primary threat to the Pacific fisher is the reduction and fragmentation of late-successional forests, and the associated loss of habitat components necessary for resting and denning (Aubry and Houston 1992, Powell and Zielinski 1994). Increased fragmentation may cause Pacific fishers to travel long distances through unfamiliar or unsuitable habitat, thus increasing possible predation by coyotes, mountain lions, and other predators (Powell and Zielinski 1994). Based on the review of recent survey efforts, Pacific fisher populations may become increasingly and genetically isolated throughout the western states. The apparent gap between populations can be as much as 500 to 600 miles long as is the case of the Southern Sierra and Klamath Mountain populations, in California.

Humboldt Marten (*Martes americana humboldtensis*)

Federal: None
State: Species of Special Concern
BOF: None

The Humboldt marten (*Martes americana humboldtensis*) historically occurred in the coastal redwood zone from the Oregon border south to Fort Ross in Sonoma County (Grinell et al. 1937). The subspecies is now considered “extremely rare or extinct” in Humboldt and Del Norte Counties despite numerous survey efforts there (Kucera et al. 1995). Although the subspecies was not surveyed for in Mendocino County by Kucera et al. (1995), Kitchen (1992) did not detect the subspecies on Jackson Demonstration State Forest. Yocum (1974) reported Humboldt marten sightings in 1961 and in 1971 for southern Humboldt and northern Mendocino Counties respectively. However, sightings data need to be treated cautiously since they are impossible to verify (Kucera et al. 1995). Likewise, Zielinski (unpublished data: fide Cooperrider et al. 2000) reported two marten sightings near the eastern limit of the subspecies range in Douglas-fir forest, however, it was uncertain to which subspecies these sightings should be attributed to. Zielinski and Golightly (1996) note that observations of marten in the range of the Humboldt subspecies have been increasingly uncommon since 1946 for this readily detected species. In addition, no local trappers, or mustellid survey efforts between 1991 and 1996 have detected Humboldt marten in their historic range. However, in early July, 2002, a marten was observed by DFG biologist Scott Harris on the Middle Fork Eel River near Rattlesnake Creek along with unconfirmed sightings of marten on the Mendocino National Forest near Kneecap Ridge and Corbin Creek. Each of these locations is within the historic distribution of the Humboldt marten (Hughes, no date).

Although survey effort in Mendocino and Sonoma Counties is lacking, marten were historically more scarce in these counties than those to the north (Twinning and Hensley 1947 fide Zielinski and Golightly 1996). Several causes have been suggested for the rangewide decline: trapping (although the subspecies has been protected from commercial harvest since 1946), timber harvest and associated habitat disturbance to large live and dead woody structures, and/or interspecific interaction with Pacific fisher resulting in displacement from timber harvest modified habitats (Zielinski and Golightly 1996). Cooperrider et al. (2000) notes that the Hoopa Tribe has existed on the eastern edge of the redwood zone since before recorded history and the use of furbearer skins in their historic ceremonial regalia did not include marten, which may have been related to availability of the species. The prognosis for natural recovery of marten in the redwood forest is considered poor (Cooperrider et al. 2000).

6.6.2 Regulatory Framework for the Protection of Wildlife Resources

State agencies, including CDF, are directed through a variety of programs and policies to protect and manage California's wildlife resources. These include:

- CEQA
- California Forest Practice Rules
- California Fish and Game Code
- California State Endangered Species Act (CESA)
- Federal Endangered Species Act (FESA)

CEQA
CEQA provides that public agencies whose activities may affect the environment shall prevent environmental damage (CCR § 15000-15387). Rare, threatened, or endangered species, subspecies, and varieties are specifically considered in various sections of CEQA (CCR § 15380). State certified regulatory programs are subject to the provisions in CEQA regarding the avoidance of significant adverse effects on the environment, including rare, threatened, and endangered species, where feasible (CCR § 15250).

California Forest Practice Rules
Forest management activities on the Forest are subject to the requirements of the Forest Practice Act (FPA) as administered through the Forest Practice Rules (FPR). Registered Professional Foresters (RPFs) follow the provisions of the FPA and FPRs in preparation of timber harvesting plans (THPs). The THP preparation and review process substitutes for the EIR process under CEQA pursuant to PRC section 21080.5. THPs are designed

to achieve maximum sustained production of high quality forest products while giving consideration to values relating to recreation, watershed, wildlife, range and forage, fisheries and aesthetic enjoyment as directed by PRC 4651.

The FPRs require timber operations to be designed in a manner that maintains functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed and retains or recruits late and diverse seral stage habitat components for wildlife concentrated in the WLPZs and as appropriate to provide for functional connectivity between habitats [14 CCR § 897(b)(1)(B)-(C)]. In addition, the FPRs require RPFs to consider the proposed timber operations in the context of the larger forest and planning watershed in which they are located, so that biological diversity is maintained within larger planning units and adverse cumulative impacts are reduced [14 CCR § 897(b)(2)]. The appendix to Board of Forestry Technical Rule Addendum No. 2 instructs the RPF to consider the factors set forth therein when evaluating cumulative impacts. Factors that the RPF must consider are:

- Any known rare, threatened, or endangered species or sensitive species (as described in the Forest Practice Rules) that may be directly or indirectly affected by project activities;
- Any significant, known wildlife or fisheries resource concerns within the immediate project area and the biological assessment area;
- The aquatic and near-water habitat conditions on the THP and immediately surrounding area (pools and riffles, large woody material in the stream, near-water vegetation); and
- The biological habitat condition of the THP and immediately surrounding area (snags/den trees, hardwood cover, downed, large woody debris, late seral (mature) forest characteristics, multistory canopy, late seral habitat continuity, road density and special habitat elements).

Furthermore, the FPRs require the RPF to specifically address wildlife under Article 9 sections 919 through 919.18. In doing so, the RPF must:

- Retain all snags to provide wildlife habitat, except in certain specific cases (near main ridge tops suitable for fire suppression; near public roads, permanent roads, seasonal roads, landings, and railroads; where safety laws and regulations require snags removal; near structures maintained for human habitation; merchantable snags; and for insect or disease control [14 CCR § 919.1(a)-(e)].
- Provide general protection for sensitive species [per 14 CCR §§ 895.1 and 898.2(d)]. This includes: A mandatory pre-harvest inspection; protection of nest tree(s), designated perch trees(s), screening tree(s), and replacement trees(s) during timber operations; commencement of timber operations as far as possible from occupied nest trees; and protection of the occupied nest tree, screening trees, perch trees, and replacement trees if discovered during timber operations [14 CCR § 919.2(a)-(d)]. Some exceptions to these requirements are allowed.

- Provide specific protection for sensitive species (Bald Eagle, Peregrine Falcon, Golden Eagle, Great Blue Heron, Great Egret, Northern Goshawk, and Osprey). The specific protection measures include buffer zones around all nest trees containing active nests; year-around restrictions within buffer zones; establishment of critical periods for each species with applicable requirements during these critical periods; and limits on helicopter logging during the critical period (14 CCR § 919.4(a)-(e)).
- Incorporate feasible practices to reduce impacts (as described in 14 CCR § 898) where significant adverse impacts to non-listed species are identified (14 CCR § 919.4).
- Ensure that timber operations will not result in “take” of the Northern Spotted Owl and Marbled Murrelet (14 CCR §§ 919, 919.10 and 919.11).
- Provide habitat structure information for late succession forest stands proposed for harvesting where such harvest will significantly reduce the amount and distribution of late succession forest stands or their functional wildlife habitat value so that it constitutes a significant adverse impact on the environment. Also, the RPF must provide a statement of objectives over time for late succession forest stands on the ownership and include a discussion of how the proposed harvesting will affect the existing functional wildlife habitat for species primarily associated with late succession forest stands in the plan or the planning watershed, as appropriate, including impacts on vegetation structure, connectivity, and fragmentation.
- Where timber operations will result in long-term significant adverse effects on fish, wildlife, and listed species known to be primarily associated with late successional forests, feasible mitigation measures to mitigate or avoid such long-term significant adverse effects must be described and incorporated. Where long-term significant adverse effects cannot be avoided or mitigated, the RPF must identify the measures that will be taken to reduce those remaining effects and provide reasons for overriding concerns pursuant to 14 CCR § Section 898.1(g), including a discussion of the alternatives and mitigation considered [14 CCR § 919.16(a)-(b)].

California Fish and Game Code and CESA

The California Endangered Species Act (CESA) (Fish and Game Code § 2050-2116) was enacted in 1984 and enhanced protection for endangered, rare, and threatened species. Under CESA, “it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat” (Fish and Game Code § 2052). It is also state policy to disapprove projects that are proposed without feasible mitigation to reduce the impacts below the level of significance and that would jeopardize the continued existence of any endangered or threatened species or result in the adverse modification of habitat essential to the existence of those species (Fish and Game Code § 2053 - 2055). CESA generally parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (DFG). CESA prohibits the "taking" of listed species except as otherwise provided in State law. Unlike its Federal counterpart, CESA applies the take prohibitions to species petioned for listing (state candidates). Section 86 of the Fish and Game Code defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

State lead agencies are required to consult with DFG to ensure that any action it undertakes is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of essential habitat. A "lead agency" is defined under the California Environmental Quality Act as the public agency which has principal responsibility for carrying out or approving a project that may have a significant effect on the environment. (PRC §21067)

Federal Endangered Species Act (FESA)
The Federal Endangered Species Act (FESA) requires formal or informal consultation with the US Fish and Wildlife Service or NOAA Fisheries where it is likely that the project could affect federally listed threatened or endangered species. The purpose of the ESA is to conserve the ecosystems upon which listed species depend. The laws ultimate goal is to “recover” listed species such that the protections of the Act are no longer needed. The ESA requires that recovery plans be developed that describe the steps necessary to restore the species. Similarly, the ESA provides for the designation of “critical habitat” when prudent and determinable. Critical habitat includes geographic areas where those physical and biological features essential to the conservation of the species are found and which may require special management considerations or protection. Critical habitat designations affect only Federal agency actions or federally funded or permitted activities. The Act also makes it unlawful to kill or injure a listed species, which includes significant habitat modification or degradation where it actually kills or injures listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

6.6.3 Project Measures for Protection of Resources

The DFMP builds on the 1983 plan by elevating wildlife and other resources to a level of importance equivalent to the demonstration, research, timber management and education programs. The DFMP includes specific protection measures for important wildlife habitat elements including riparian areas, old growth and late seral characteristics, hardwoods, snags, and LWD.

Protection Measures

Riparian Areas: Refer to Section VII.6.1 Aquatic Resources for a complete description of protection measure for riparian areas. The goal of the JDSF riparian and stream management program is to maintain "properly functioning" riparian and stream ecosystems, i.e., systems that provide essential ecological function. JDSF's management strategy will go beyond simply preventing significant detrimental effects to aquatic and riparian habitats. The goal is to ensure that the aquatic and terrestrial resources and the ecological functions of riparian areas are protected and improved or restored. JDSF will manage forested stands in watercourse and lake protection zones (WLPZs) to promote their ecological succession to late-seral forest conditions. JDSF will retain and enhance the vertical structural diversity of these stands, and protect riparian zone special habitat elements such as snags and LWD to improve habitat values.

- Old Growth and Late Seral: Refer to section VII.6.3 Timber Resources for a complete discussion of the old growth and late seral protection measures. Existing old growth groves will be retained, as will aggregations. Individual old growth trees found outside of stands or aggregations and having with specified charcteristics (see DFMP, page 60) also will be retained, with limited exceptions where the tree presents a public safety issue or retention would result in the potential for greater long-term environmental damage. Approximately 20% of the Forest land base is designated as late seral development areas.

- Hardwoods: JDSF will maintain the naturally occurring hardwood components in riparian stands (WLPZs) and other special concern areas when consistent with the objectives of that area. The goal is to maintain hardwood tree composition at approximately 10 percent (West End) to 15 percent (East End) of the stand basal area. Maintaining and recruiting hardwoods on JDSF, including larger size classes, will enhance not only wildlife species diversity but also forest structural diversity.

- Snags: A goal for the entire forest is to attain one snag per acre (on a 160-acre sub-watershed scale) that is at least 30 inches DBH. The desired future condition for snags in all wildlife special concern areas is to have three snags per acre, of which two are at least 20 inches DBH and one is at least 30 inches DBH, averaged over a 160-acre sub-watershed area. Periodic sampling will be utilized to monitor snag density, as part of the CFI inventory system. Snags will be unevenly distributed across the forested landscape in both riparian and hillslope areas. The distribution pattern of snags will include grouped and scattered single trees. JDSF also will recruit snags through indirect measures, such as retention of larger conifers (at least 30 inches DBH) in select areas to provide wildlife habitat.

- Large Woody Debris: JDSF will manage for a minimum of two downed logs per acre that are at least 20 feet in length with a diameter of 16 inches on the large end and one log per acre at least 24 inches in diameter on the large end and at least 20 feet long. Log densities are averaged over a 160-acre subwatershed area. WLPZs and special concern areas will contribute a greater proportion of downed logs.

- Species of Concern: The DFMP includes general riparian protection measures for the Yellow Warbler and Olive-sided Flycatcher. The DFMP includes specific protection measures for the Northern Spotted Owl, Osprey, Snag and Cavity Dependent Species of Concern, Marbled Murrelet, Northern Goshawk, Cooper’s Hawk, Vaux’s Swift, Purple Martin, and Sonoma red tree vole. For other species, JDSF will evaluate the potential for individual land management actions to have a significant impact on listed (rare, threatened, or endangered) species. In those cases where that impact may be significant, appropriate survey and mitigation measures will be implemented. Although individual project circumstances will dictate the procedures to be used to determine degree of project associated impacts, in general, a scoping process followed by surveys and mitigation development will occur. An assessment area that extends beyond the boundaries of the planned activity also may be required for some species. For unlisted species identified as sensitive, evaluation and mitigation practices are likely to vary according to identified need, the current state of species knowledge, and through consideration of input provided by CDFG

- DFMP Wildlife Goal: Protect or improve current populations and habitat.

Species Surveys

Special status species make an important contribution to forest biological diversity and are addressed in federal and State law and as appropriate through JDSF and THP planning processes. JDSF's objective for long-term special status species management is to determine what forest management objectives are needed to assure long-term conservation. The JDSF management plan outlines programmatic species and/or habitat management protections and management actions to meet that objective. To better identify and conserve species and meet our commitment to maintain biologically diverse and healthy ecosystems, JDSF conducts pre-project species scoping and implements surveys as necessary to assess ecological requirements and species driven management opportunities and constraints.

1. Pre-Project Scoping
   Pre-project scoping will occur prior to conducting pre-project focused species surveys. JDSF will engage in a scoping process to identify those special status species likely to occur in the affected environment of a project area and potential risk of negative effects. A variety of sources of information will typically be consulted and contribute to the planning process. These include the California Natural Diversity Database, California Native Plant Society inventory, JDSF GIS database, local herbaria, as well as a variety of completed forest-wide survey and focused species inventory and research efforts (see section VII.6.2 Botanical Resources). The scoping process will evaluate likelihood of species presence, habitat availability, survey methodology and timing, and possible mitigations or opportunities for habitat enhancement. Population density and detectability of the special status species, habitats occupied, and the level of habitat disturbance expected from the land management action guide survey intensity. Current literature and species authorities will be consulted as necessary.

   Pre-project scoping also will consider the specific features and potential impact of the proposed project. For example, road surface maintenance and roadside brushing are ongoing activities that create repeated periodic disturbances, whereas precommercial thinning typically occurs a few years following the more substantial disturbance of a commercial harvest, and shaded fuel break construction targets ground cover vegetation. Pre-project special status species scoping is expected to become increasingly efficient over time as habitat relationship and occurrence data are collected and incorporated into the Forest GIS.

2. Training
   JDSF will provide for, on an as-needed basis, a sensitive plant and animal identification training program to enhance the ability of field personnel to recognize sensitive resources. Personnel who will be responsible for botanical surveys will meet the recommended qualifications for botanical consultants included in DFG

survey guidelines (DFG 2000). JDSF also supports personnel seeking more formal instruction and training in this area.

3. Biological Surveys

Management and the analysis of cumulative effects must ultimately shift away from a single-species approach to one that is inclusive of single species and ecosystem structure and function. Concentration on the needs of individual species can result in mis-management of other more common species and their habitat, additional listings, public polarization, and an unstable regulatory environment. In general, it is more efficient to evaluate risk to a species by examining impacts to its habitat, when that information is available, rather than directly counting or modeling population levels over time. Key components of this approach involve a temporal evaluation of amount, quality, and spatial arrangement of habitat. Implementing forest planning with a habitat approach requires descriptions of species-habitat relationships and landscape pattern that capture the diversity within the region (Wildlife/Science Committee 1994). Broad resource assessments and analyses as informed by all-species surveys are an important first level element.

Floristic and faunistic surveys (all-species surveys), as distinct from focal species surveys, can be beneficial to project and species management planning and cumulative effects analysis when sufficiently supported over the long term. These kinds of surveys can help identify unique or previously unknown habitat associations, range extensions, evaluate the likelihood of congeneric species presence, and assist in the validation of species-habitat relationship models. One additional benefit of an all-species survey is that currently common species can be related to habitat measures and form an informational base for the development and validation of spatial habitat relationship models and improved cumulative effects analyses.

Conversely, all-species surveys are beset with many of the same issues as focal species surveys but at a somewhat greater scale and cost, particularly for animals. Variable wildlife migration or activity period, and the variety of survey methodologies required for wildlife species make all-species surveys at any scale relatively problematic and costly. In general, it can be expected that a greater number of surveyor visits will be required to fulfill the objectives of an all-species presence/absence determination. This level of survey also requires a greater level of surveyor biological expertise to achieve desired accuracy and consequently, greater upfront costs over the short-term. In addition, formal listing of a species previously noted in an all-species survey would not obviate additional survey visits for any new project planning and implementation to ensure appropriate protections are put in place. Similarly, floristic survey costs are influenced by the ability and experience of the surveyor, market factors driven by surveyor availability, efficiencies realized in the mobilization of qualified personnel and layout of survey areas and other factors.

JDSF is making iterative progress toward this broader inclusive ecocentric approach through the development of species and habitat conservation strategies, and analytical tools to assess impacts and biological change at various scales of consideration. However, the relative lack of information regarding ecosystem processes and wildlife and plant habitat relationships frequently makes an ecocentric approach difficult and at times unsupportable.

Additional administrative support is necessary to increase the research required for the development of ecosystem management guidelines as well as the assessment of large-scale impacts and assumption testing. Under current budgetary and personnel constraints, all-species surveys for JDSF are not practical or realistic. JDSF must rely, during the foreseeable future, on current sources of predictive habitat relationship models, occurrence data, and pre-project scoping that is followed by focused survey effort for special status species as necessary. Included are continued development of a forest GIS database of species occurrence, data capture from prior project survey effort, and forest wide research/survey results completed by other agencies and academia. It is expected that over time and with consistent data capture in JDSF's database that improvement in the predictability of the status and occurrence of special status species will emerge. Floristic and faunistic survey effort to address the occurrence of all-species regardless of status remains a managerial option pending need and resource and personnel availability.

Surveys conducted for special status animal species, when indicated following pre-project scoping, will be to established protocols, after consultation with federal or state wildlife management agencies as appropriate, or practices commonly accepted by CDF and CDFG for Timber Harvesting Plan review. In general these species are listed and may be among those considered Species of Special Concern by the California Natural Diversity Database or otherwise recognized by State or federal endangered species acts. Surveys for special status species will include suitable habitat within the proposed project impact area and inquiries regarding occupancy or suitable habitat off-site that may be affected by project implementation. Surveys, irrespective of the state of protocol development, are conducted at a time of year that facilitates positive identification and maximizes the likelihood of contact in the field. Observations of rare, threatened or endangered plants, animals or plant communities will be recorded on Field Survey Forms and copies provided to the CDFG California Natural Diversity Database (CNDDB). Survey summaries will form the basis for the development of monitoring and adaptive management strategies that may include modification of the nature and location of land management prescriptions.

Parameters and Data Collection

- Raptors: Since 1989, Spotted Owl surveys have been conducted on JDSF (CDFG 1997). Between 1989 and 2000, surveys and monitoring of known nest sites were completed sporadically on JDSF. In 2001, the National Council for Stream and Air Improvement (NCASI) surveyed the entire JDSF for Northern Spotted Owls, monitored all known nest sites, and attempted to band all unbanded Spotted Owls (Stephens 2002). CDF is working cooperatively with neighboring private timber companies in a Northern Spotted Owl monitoring and banding program.

- CDF conducts Northern Goshawk surveys when suitable habitat is present within timber harvest plan boundaries or other project areas. JDSF will develop and implement a training program to assist personnel in raptor identification, nest sites, and survey techniques on an as needed basis.

- JDSF will conduct an annual aerial survey to assess nest site productivity for Osprey and survey project areas for other raptor species of concern. The survey may be conducted at the same time as other management activities if completed at the appropriate time of year and at altitudes suitable for survey purposes. JDSF will conduct ground-based surveys (Northern Spotted Owl, Accipiters) in project areas using established or generally accepted protocols prior to project implementation. The survey will include suitable habitat within the project area and the largest disturbance buffer established for proposed management activities within JDSF.

- Marbled Murrelet surveys since 1992 have generally been conducted in accordance with established survey protocols for this species. Survey efforts have focused on potential suitable habitat (old-growth groves) at various locations throughout JDSF. Existing old growth groves will be retained as will aggregations and individual trees with limited exceptions (refer to the section VII.6.3 Timber Resources). Approximately 20% of the Forest land base (or about 9,700 acres) is designated as late seral development areas.

- Snag and cavity dependent species of concern: Snag and down log occurrence, density and size data are collected as part of JDSF forest resource inventories. CDF will supplement plot data with additional plots where necessary to provide a special habitat element assessment at the scale of a 40-160 acre drainage area.

- Lotis Blue Butterfly: JDSF will identify and prioritize areas of suitable habitat for survey using protocols endorsed by the California Department of Fish and Game. JDSF will extend survey requirements in the event of a positive survey outcome.

6.6.4 Additional Management Measures

Contribution to Recovery of Marbled Murrelet Habitat

Since the release of the DFMP, CDF has developed the following additional measure for application to JDSF to facilitate the recovery of potential Marbled Murrelet habitat. This measure could be applied to alternatives B, C1, C2, D, and E.

The DFMP protects remaining old growth stands and trees and also designates about 20% of the area of JDSF, or about 9,700 acres primarily in stream corridors, for late seral forest development. The latter area has the potential to develop, over a time frame much longer than the 10-year life of the DFMP, the structural characteristics necessary to provide Murrelet habitat. However, as indicated by the information presented above on Marbled Murrelet, its habitat needs, and habitat availability in the assessment area, there are a number of important factors to consider regarding the best location and arrangement of habitat suitable for this species. Based on these considerations, CDF has identified four key areas for assessment of their suitability for current habitat and for future potential Murrelet habitat development and species recovery: Russian Gulch, Lower Big River, Mitchell/Jughandle Creek, and lower Hare Creek.

Under the Additional Management Measure, CDF proposes to conduct an assessment of what areas offer the greatest potential for current and future Marbled Murrelet habitat. This assessment will include areas the DFMP already establishes for old growth protection and late seral forest development, as well as the four areas identified above. The purpose of this Additional Management Measure is to ensure that management of JDSF contributes to providing additional suitable habitat that is intended to aid recovery of Marbled Murrelet populations (see “Restoration of Marbled Murrelet Habitat” above). This assessment process may result in a spatial reallocation of the acreage currently identified for the recruitment of late seral forest conditions and potential Marbled Murrelet habitat. Areas outside JDSF with murrelet sightings and potential to minimize fragmentation and edge effects, corvid predation, and human disturbance will be included among the factors to guide murrelet habitat emphasis areas. If late seral forest areas are reallocated to improve Murrelet habitat protection and improvement, there will not be a reduction in the total acreage designated for late seral development, and there may be an increase. Any reallocation will be done in a way so as to not compromise other resource protection values provided by the late seral forest allocation contained in the DFMP. Until the assessment is completed, the forest stands within the assessment area consisting of Russian Gulch, lower Big River (downstream of Mendocino Woodlands), Mitchell/Jughandle Creeks, and lower Hare Creek will generally be managed in a manner consistent with development of late-seral forest characteristics.

CDF proposes to conduct this assessment and potential late seral reallocation during the first 18-24 months of DFMP implementation. CDF would involve relevant wildlife agencies, adjacent landowners such as State Parks, and other interested parties in the assessment process.

Large Wood Debris Survey, Recruitment, and Placement

This Additional Management Measure, to be applied to alternatives B, C1, C2, D, E or F is described fully in part VII.6.1.5 of the Aquatic Resources section. It provides protections to ensure adequate recruitment of large woody debris to Class I and II streams to increase LWD loading to at least the standards developed by Bilby and Ward (1989). In addition to promoting improvement of instream habitat over time, this management measure also will help to improve the quality of riparian forests and their ecological function.

Accelerated Road Management Plan

This Additional Management Measure, to be applied to alternatives B, C1, C2, D, E, or F is described fully in part VII.6.1.5 of the Aquatic Resources section. It would result in faster reduction of road sediment sources, which could help to protect and improve habitat for amphibians and aquatic species.

6.6.5 Thresholds of Significance

Based on policy and guidance provided by CEQA (Public Resources Code (PRC) Section 21001 and the CEQA Guidelines), an impact of the proposed project would be considered significant if it results in one or more of the following:

- Have substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS.
- Reduce the number or restrict the range of a rare or endangered animal
- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with the provisions of an adopted Habitat Conservation Plan, or other approved local, regional, or State habitat conservation plan related to a wildlife resource.
- Cause a wildlife population to drop below self-sustaining levels or threaten to eliminate an animal community.

The degree to which demonstration, research, timber management, and recreational use would affect wildlife (mammal, bird, reptile, and amphibian) populations was assessed based on the current condition of existing habitat, modeled future conditions, general life histories, habitat requirements of selected species, and the projected effect on specific habitat parameters resulting from the proposed project and the alternatives.

6.6.6 Project Impacts

The DFMP has been developed to minimize the potential for adverse impacts to sensitive animal species or their habitat. Two of the aforementioned thresholds of significance referring to adverse effects on 1) species either directly or through habitat modification and 2) impediment of movement or nursery site use, contain several individual components that, depending on the species, could be affected by various management activities. The various elements within each threshold of significance and associated impacts for the proposed action (DFMP, Alternative C1) and the other six alternatives examined are considered below.

Project Impacts*: <u>Have substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS.</u> <u>Reduce the number or restrict the range of a rare or endangered animal.</u>* (Less than Significant with Mitigation)

Habitat Modification Impacts

Adverse impacts including direct mortality, permanent habitat loss or modification, or reduced reproductive success are considered significant. Species at risk typically rely on habitats or key elements that are rare or diminishing, or that may be currently rare but recovering. Therefore, modifications to these habitat types are more significant than they are to more common habitats. The proposed action does not propose the modification or removal of rare habitats; however, some key habitat elements, such as snags, depending on their location, could be at risk. In general, however, the DFMP recognizes and seeks to protect or enhance their availability.

Late Successional and Old-Growth Habitat

As described in the DFMP, the proposed action does not propose the removal of old-growth forest habitat. It includes retaining designated old-growth groves (459 acres), aggregations, and individual trees, maintaining special concern areas, and proposes the recruitment of late seral stands that are expected to total approximately 9,700 acres. Snags and LWD also will be retained in harvest areas. The DFMP allocates approximately 20% of the Forest to late seral development either through application of silvicultural treatments or designation of no-harvest zones. With the FPR requirements and restrictions for late successional habitat, snag and LWD recruitment, late-successional development, and the approximately 29% to 64% evenaged to uneven-aged management, respectively, the impacts of the proposed action under Alternative C1 are expected to be less than significant on late successional habitats and associated species on JDSF. The Contribution to Recovery of Marbled Murrelet Management measure also may increase extent of late-successional habitat over time. Proposed project impacts are expected to be “less than significant”.

Snags and Downed Wood

As described in the DFMP, the proposed action has specific snag and downed wood retention measures that require specific retention in general forest, WLPZs and special concern areas. In special concern areas, the goal is to have three snags per acre, one that is at least 30 inches dbh and the other two at least 20 inches dbh. The goal for the entire forest is one snag per acre (160 acres subwatershed scale) of at least 30 inches dbh. Currently, JDSF has less than one snag of at least 30 inches dbh per 100 acres and between three and four snags per 100 acres of between 20-29 inches dbh. Therefore, in order for JDSF to achieve their desired goal, all snags greater than 20 inches dbh will have to be retained, unless they pose a safety hazard. However, this does not consider snags of less than 20 inches dbh or the retention of the largest snags in a given subwatershed with excess snags. Since small snags are better than no snags and the majority of snags currently on JDSF are less than 20 inches dbh, without additional mitigation to protect small snags (less that 20 inches dbh), implementation of the proposed action could result in reduction of snags across the Forest. Since the availability of large snags is currently low, the loss of existing small snags could adversely impact species that require snags. A mitigation measure has been developed to address this potential impact. Proposed project impacts are expected to be “less than significant” with application of mitigation measures.

Hardwoods

As described in the DFMP, JDSF will maintain the naturally occurring hardwood component in the WLPZs and special concern areas and as 10 % (West end) to 15 % (East end) of the stand basal area in other managed portions of the Forest. Although some hardwoods may be harvested, the proposed hardwood management actions will maintain hardwoods as a significant component of the Forest. The management of hardwoods under the proposed action will ensure a thorough distribution of hardwoods throughout JDSF. Proposed project impacts are expected to be “No Impact”.

Riparian Habitats

JDSF will manage riparian habitats according to the FPRs with increased protection. As described in the DFMP, the size and management of the WLPZ will vary depending on the watercourse classification and slope. Within each WLPZ, snags, LWD, and hardwoods will be retained and the overall management direction will be for the development of late successional habitat. The Large Wood Debris Survey, Recruitment, and Placement management measure will further enhance riparian forest and stream habitat quality. Although some harvest activities may occur within the WLPZ, principally as a means to enhance recruitment of a late seral condition, these measures are expected to maintain or improve properly functioning riparian systems and important migration corridors and dispersal habitat. Proposed project impacts are expected to be “Beneficial”.

Other Unique and Special Habitat Features

As described in the DFMP, unique habitats and special feature will be protected. These include several rare and sensitive habitat types (e.g. *Sphagnum* bogs, pygmy forests, ponds, and meadow). Other key elements, such as old trees with cavities or goose pens will be protected either directly or indirectly through mitigation for other habitats or elements. Goose pens will be protected through the protection of old-growth and snags. Mitigation 1, below, has been developed to minimize potential impacts to snags and their special habitat features. Proposed project impacts are expected to be “Beneficial” with application of mitigation measures.

Species Specific Impacts

Direct impacts to wildlife species include direct mortality, permanent habitat loss, or lowered reproductive success. These impacts can usually be avoided for sensitive species through completing surveys and/or mitigating to minimize impacts. Indirect impacts may include, but are not limited to, the reduction of suitable nesting habitat or nest sites, habitat connectivity and dispersal corridors, canopy cover, and key habitat elements (hardwoods, snags, LWD, and trees with cavities). Many of these impacts affect habitat quality and/or suitability and, ultimately, can adversely affect reproduction and the continued persistence of a species in a given area. Specific species impacts are discussed below.

Lotis Blue Butterfly
Lotis blue butterflies have a close association with coast hosackia (*Lotus formosissimus*), its host species, which occurs in disturbed early successional wetland habitats or *Sphagnum* bogs. Under Alternative C1, JDSF would protect lotis blue butterfly habitat by not conducting timber harvesting in the Pygmy Forest Reserve and establishing riparian buffers around any *Sphagnum* bogs and other wetlands if timber harvesting is scheduled adjacent to one. Application of evenaged management or other harvest prescriptions could increase potential low quality habitat. Surveys would be completed as necessary and projects adapted accordingly. Proposed project impacts are expected to be "Beneficial".

Southern Torrent Salamander and Tailed Frog
Southern Torrent salamanders and tailed frogs find high habitat suitability in permanent cold headwater streams. There are approximately 186 miles of Class II streams on JDSF. As described in more detail in the DFMP and Aquatic Section of this document, the proposed protection measures for Class II watercourses, seeps, and springs, include variable width WLPZ (depending on slope) that includes a 25 foot wide inner band "no cut zone" or limited entry zone for habitat improvement. Basal area will not be reduced below 240 sq. ft. per acre. These measures exceed current FPRs and should ensure adequate canopy closures important for maintaining cool stream temperatures and sediment control. The Acclerated Road Management Plan, EEZ, Hillslope Management Guidelines, and other erosion control measures described in the DFMP also will minimize sediment input into watercourses and headwaters. Sediment issues are also further discussed in EIR sections VII.6.1 Aquatic Resources, VII.7 Geology and Soils, VII.10 Hydrology and Water Quality, and Appendix 11 Overview of Existing Sediment Studies Relevant to the JDSF EIR. These measures will help to minimize gravel embeddedness and subsequent deterioration of interstitial spaces of the gravel substrate. Per the DFMP and the Large Woody Debris Survey, Recruitment, and Placement management measure, LWD recruitment would benefit southern torrent salamanders and tailed frogs on JDSF. However, individuals could be harmed incidentally during scientific or timber management activities. Nonetheless, the impacts of the proposed action are not expected to adversely impact populations of southern torrent salamanders or tailed frogs. Proposed project impacts are expected to be "Less than Significant".

Northern Red-legged Frog
Red-legged frogs are found in the vicinity of quiet pools, marshes or ponds in a variety of habitats. On wet rainy nights, they can be found well away from permanent water. As described in more detail in the section VII.6.1 Aquatic Resources, the protection measures proposed for Class I and II watercourses, seeps, springs and ponds will protect the breeding habitat of red-legged frogs. These protection measures should avoid negative impacts to red-legged frogs by avoiding disturbance of streamside benches and vegetation that they use for basking, foraging, and cover. In the long term, red-legged frogs will benefit from the LWD and late successional development in the WLPZ as proposed in the DFMP and the Large Woody Debris Survey, Recruitment, and Placement management measure. The mosaic of early, mid and late successional upland habitats

will provide suitable habitat for foraging frogs during wet weather. Red-legged frogs are known to occur in JDSF and adverse impacts to red-legged frogs or their habitat are not expected to occur under the proposed DFMP. Proposed project impacts are expected to be “No Impact”.

Foothill Yellow-legged Frog

Foothill yellow-legged frogs are typically found associated with rocky streams or rivers in a variety of habitats. There are approximately 284 miles of Class I and II watercourses available on JDSF. Overall WLPZs and other DFMP protection measures (e.g. LWD, late successional development) are expected to improve habitat conditions for yellow-legged frogs. These measures should avoid negative impacts to yellow-legged frogs by avoiding disturbance of streamside benches and vegetation used for basking, foraging, and cover. The Road Management Plan and Hillslope Management Guidelines described in the DFMP will minimize sediment input into watercourses. However, individuals could be incidentally harmed by research and/or management activities. Yellow-legged frogs are known to occur in JDSF and no significant adverse impacts to yellow-legged frogs or their habitat are expected under the proposed alternative over the term of the project. Proposed project impacts are expected to be “No Impact”.

Northwestern Pond Turtle

Northwestern pond turtles are typically associated with slow moving water, ponds, or other permanent aquatic habitats and associated upland habitats that are used for nesting. There are approximately 284 miles of Class I and II watercourses, and several ponds on JDSF that represent potential aquatic habitat for this species. As described in more detail in the DFMP, the protection measures proposed for Class I and II watercourses and ponds will protect the majority of breeding, resting, and foraging habitat of northwestern pond turtles. In addition, pond turtles will generally benefit from the late successional advancement and LWD recruitment in the WLPZ. These measures will provide important rest sites and cover. However, pond turtles require sunlight for thermoregulation and generally rest under open to sparse canopy conditions. The relatively closed canopy conditions occurring in WLPZs over time under this and the other alternatives does not favor pond turtles. In addition, individual upland nest sites may be incidentally harmed by management activities. Upland breeding habitat outside the WLPZ also requires sunlight exposure and could be provided through an array of silvicultural prescriptions. Other habitats, such as grassland, pygmy forest, chaparral, and pockets of exposed riparian habitats will continue to provide potential nesting habitat for this species.

Non-spatial habitat capability projections were derived from the CWHR system for the Current to 2030 and 2030-2060 periods. These projections in habitat capability do not however accurately reflect habitat conditions potentially used by this species since change in upland forest acreage not used by the species is included. It is expected that forest and other habitat type openings with southerly exposure will exist in sufficient frequency to at least maintain pond turtle populations. Pond turtle population and habitat use monitoring should continue on JDSF under any alternative. Northwestern pond turtles are known to occur in JDSF and the impacts to pond turtles or their habitat is expected to be less than significant under the proposed alternative. Proposed project impacts are expected to be “Less than Significant”.

Northern Goshawk

Under the DFMP, the amount and quality of Northern Goshawk nesting habitat is expected to decline below existing conditions to 2010 and out to 2060 with reduction in acreage of high habitat capability conditions found in Montane Hardwood Conifer 4M and 4D. However, as described in the DFMP, the proposed action will also protect snags, hardwoods, old-growth stands, limit harvest in WLPZs, and focus management activities in designated areas to advance the development of late successional habitats. As described in the DFMP, take of Goshawks will be avoided through surveying potential habitat subject to timber management activities, protecting known nest sites (100-acre buffer) and post-fledging areas (300 acres), and contacting CDFG when an active Goshawk nest is discovered. Although suitable foraging habitat in the form of redwood of various size and density classes is expected to drop below existing conditions, this habitat type will remain abundant on JDSF throughout the life of the DFMP. Goshawks have been rarely observed and are not known to nest on JDSF. Proposed project impacts are expected to be “Less than Significant”.

Cooper’s Hawk

Cooper’s Hawks are generally associated with woodlands and mid-successional forest habits. Although redwood is not considered typical nesting habitat for Cooper’s Hawks by the CWHR, they do occasionally use this forest type for nesting and it is considered suitable for foraging and cover. Cooper’s Hawks would benefit from the mosaic of habitats and edge created through a variety of timber harvest prescriptions, WLPZ protection, and snag and hardwood retention as proposed in the DFMP. Pre-commercial thinning of young non-redwood habitats and the advancement of late successional habitats could degrade some potential habitat in the short and long term. However, this is not expected to occur at significant levels due to the limited presence of young non-redwood stands on the Forest. As montane hardwood conifer and Douglas-fir habitats mature, habitat quality and use by Cooper’s Hawk should also increase. As described in the DFMP, take of Cooper’s Hawks will be avoided through surveying potential habitat subject to timber management activities and protecting known nest sites through consultation with CDFG. Cooper’s Hawks have been observed on JDSF and a nest was found in 1996. The DFMP will continue to provide nesting and foraging habitat at levels similar to or slightly below existing conditions over the first decade. Average habitat capability outside of WLPZs is projected to decline by 11% by 2030. Proposed project impacts are expected to be “Less than Significant”.

Golden Eagle

Golden Eagles use cliffs or large trees/snags near open habitats for nesting. The DFMP will protect most snags, hardwoods, old-growth stands, limit harvest in WLPZs, and focus management activities in designated areas to advance the development of late successional habitats. These measures will protect potential nest trees. The evenaged management as proposed in the DFMP will maintain a continuum of early successional habitats that could be used by foraging Golden Eagles. Take will be avoided through the protection of nest sites, perch trees, screening trees, and replacement trees. However, potential temporary disturbance of foraging birds is possible. Golden Eagles are not known to occur on JDSF (although non-nesting individuals have been observed on adjacent ownerships) and the DFMP as mitigated will continue to provide nesting and foraging habitat. Overall habitat capability is expected to decrease 27% by 2030 but increase by 10% from 2030-2060. Proposed project impacts are expected to be "Less than Significant".

Bald Eagle

Bald Eagles construct a large stick nest within or on top of a large live tree, usually near large, fish-bearing waters. Approximately 98 miles of Class I watercourses are available on JDSF. Under the DFMP, take will be avoided through the protection of nest sites and winter roosts consistent with current FPRs and/or through consultation with CDFG or USFWS. Protection and development of potential habitat as described in the DFMP includes the retention of old-growth groves and buffers, snags, scattered individual old-growth trees where possible, and the development of late successional habitat in specified areas. Overall habitat capability for Bald Eagles outside of riparian zones declines (-14%) in the Current -2030 period and stabilizes in the 2030–2060 period. A mitigation measure has been developed for the retention of snags that supplements the snag protection presented in the DFMP and is presented below. The potential for temporary disturbance to roosting or foraging birds does exist. However, the very limited winter operations and lack of summer residence will minimize this possibility. Bald Eagles are not known to nest on JDSF, but may be occasional visitors to the area, and nesting habitat will continue to be provided at levels similar to existing conditions. Late seral habitat conditions present and developing within riparian areas will further contribute to overall nesting and roosting habitat capability. Proposed project impacts are expected to be "Less than Significant".

Osprey

Osprey typically construct a large stick nest on the top of a tall broken top tree or snag near large, fish-bearing lakes or rivers. There are approximately 98 miles of Class I watercourses on JDSF. Under the DFMP, take will be avoided through the protection of nest sites consistent with current FPR and through consultation with CDFG or USFWS. This will include, at minimum, the protection measures specified in the FPR which include the protection of the nest tree and silvicultural and noise disturbance buffers. These measures should prevent adverse impacts to nesting individuals. In addition and as described in the DFMP, the retention of old-growth groves and buffers, snags, scattered residuals where possible, and the development of late successional habitat in specified areas including riparian zones should improve habitat conditions in the long term. A mitigation measure has been developed for the retention of snags that supplements the snag protection presented in the DFMP and is presented below. The potential for temporary disturbance of foraging birds also exists. However, this also is not expected to adversely impact Osprey. Although foraging birds could be temporarily disturbed, all nest sites will be protected. Nesting Osprey have been recorded on JDSF and are not expected to be adversely impacted by implementation of the DFMP. Habitat capability in areas outside of riparian zones is expected to decline slightly (-5%) in the Current to 2030 period and increase slightly (+3%) in the 2030-2060 period. Proposed project impacts are expected to be "Less than Significant".

Peregrine Falcon

Peregrine Falcons typically nest on large cliffs, but have been occasionally observed nesting in tall trees with suitable cavities or on buildings. No suitable cliffs occur on

JDSF. Foraging habitat is available on JDSF in open habitats such as grasslands, chaparral, and early stages of forest development. The evenaged management as proposed in the DFMP will maintain a continuum of early successional habitats that could be used by foraging Peregrine Falcons

The proposed action does not propose management activities that would impact or disturb Peregrine Falcon nesting or foraging habitat. However, temporary disturbance to foraging birds is possible. If a Peregrine Falcon is found nesting on JDSF, protection measures, as specified in the FPRs, and in consultation with California Department of Fish and Game and the U. S. Fish and Wildlife Service will be implemented to avoid take. Proposed project impacts are expected to be "Less than Significant".

Marbled Murrelet

Marbled Murrelets have not been determined to use stands on JDSF, although they have been observed nearby. Marbled Murrelets nest in large old-growth trees possessing suitable limb platforms and forage off-shore in marine environments. The DFMP defines Marbled Murrelet habitat as any intact remnant stand of old-growth forest at least two acres in size and 200 feet across, or other forest areas agreed upon by consultation between CDF and CDFG. As described in the DFMP, JDSF will protect old-growth groves, associated buffers, and old-growth remnants. It also will manage designated areas to advance the development of late successional forest conditions and potential for Marbled Murrelet nesting. Although large limbs or other potential nesting platforms cannot feasibly be grown or created within the life of the DFMP, these conditions are expected to increase and improve murrelet habitat conditions in the long term.

Take of murrelets will be avoided through protecting habitat as defined above, and, prior to commencing management activities near potential habitat, completing surveys on a individual project basis, consulting with CDFG if occupied habitat is discovered as a result of surveys, and development of mitigations as necessary. Although efforts will be made to retain all individual old-growth trees of specific structural value under the DFMP, there is the potential for individual trees that pose a safety hazard to be removed. In addition, potential temporary disturbance of birds flying over JDSF is possible.

Extent of habitat provided is one measure of impact associated with a proposed project. Equally important is consideration of the spatial arrangement of habitat and likelihood that the habitat provided will in fact be utilized by the species of concern. Marbled Murrelet habitat value within current old-growth groves on JDSF and late seral forest conditions associated with WLPZs are discounted under the DFMP due to distance from the coast, reduced likelihood of certain nest site conditions given that distance and in the case of the latter, increased edge effect and potential for nest site predation.

Harvest of certain forest conditions under the DFMP could reduce the effective future recruitment of potential Marbled Murrelet habitat that by virtue of its location would have a higher probability of occupancy. Modeled, non-spatial habitat conditions for the Marbled Murrelet are projected to decline (-7%) in the Current to 2030 period and increase (13%) in the 2030-2060 period. The Contribution to Recovery of Marbled Murrelet Habitat Management measure has been developed to address spatial habitat arrangement, other concerns, and potential impact. Proposed project impact is expected to be "Less than Significant".

Northern Spotted Owl

Northern Spotted Owls are generally associated with older, closed-canopied coniferous forests, particularly for nesting and roosting. Broader arrays of forest habitats are used for foraging and depending on the presence of required forest structure, for nesting as well. Under the DFMP, JDSF would avoid take of Northern Spotted Owls by following the FPR requirements, which among other things, require nest site protection measures and minimum habitat retention standards. These requirements focus on protecting known and historic nest sites and retaining sufficient habitat around the nest site within specified distances. As described in the DFMP, JDSF will also protect snags, hardwoods, old-growth stands, limit harvest in WLPZs, and focus management activities in designated areas to advance the development of late successional habitats. These activities will protect and increase the quality of habitat for Northern Spotted Owls in the short and long term. Northern Spotted Owl habitat capability is projected to remain stable in the Current to 2030 period (-1%) and increase in the 2030-2060 period (+13%). The evenaged management proposed in the DFMP will benefit an important owl prey species in the redwood zone. Dusky-footed woodrat habitat capability is projected to increase in the Current to 2030 period (+18%).

The WLPZs, Special Concern Areas, and other stands of suitable habitat will provide habitat connectivity and provide dispersal habitat. However, potential temporary disturbance to non-nesting or dispersing individuals is possible. In general, management under the DFMP is expected to provide a mosaic of habitats, including late successional habitat and key habitat elements, and will avoid take of Northern Spotted Owls. Proposed project impact is expected to be "No Impact".

Vaux's Swift and Purple Martin

Vaux's Swift and Purple Martin are closely associated with large snags, with overall habitats in which those elements are found being of less importance. As described in the DFMP, the proposed action would implement snag retention and recruitment measures that seek to maintain habitat for Vaux's Swift and Purple Martin. This includes retaining three snags per acre, of which two are 20" dbh or greater and one at least 30" dbh. All snags that do not pose a safety hazard will be retained in areas subject to even-age management. Purple Martin, which prefer snags in more open habitats, will likely be benefited. However, the snag retention and recruitment measures described in the DFMP do not, necessarily, protect the largest snags in a given area. Although unlikely, this could result in the removal of potential habitat for these species. In addition, potential temporary disturbance to nesting birds is possible. Overall, habitat modeling results that assume the presence of suitable nesting structures for Purple Martin exhibit a modest decline in upland habitat capability (-19%) in the Current to 2030 period but a marked increase in habitat capability in the 2030-2060 period (+37 %). Vaux's Swift upland habitat capability is projected to remain essentially stable in the Current to 2030 period (-3%) and increase modestly in the 2030-2060 period (+14%).

Although the DFMP proposes snag retention and recruitment measures, the removal of large snags and/or residuals represents the potential loss of suitable habitat for these species resulting in a negative effect. In addition, the potential for disturbance to colonially nesting birds, although unlikely, could negatively impact the reproductive success of Vaux's Swift and/or Purple Martin. A mitigation measure has been developed for the retention of snags that supplements the snag protection presented in the DFMP. Proposed project impact is expected to be "Less than Significant" with application of the identified mitigation measure.

Yellow Warbler

Yellow Warblers are principally associated with riparian areas although early to mid-successional habitats and hardwoods are utilized to some extent in upland areas. Loss of riparian habitat and parasitism by Brown-headed Cowbirds are principally responsible for marked decline in populations of this species outside of Mendocino County. Although the CWHR system does not consider redwood habitat of any size or density class as suitable for nesting by Yellow Warblers, upon closer inspection, portions of the riparian zone may represent suitable nesting habitat. Under the DFMP, mixed chaparral habitats are not expected to be adversely impacted. As described in the DFMP, the WLPZ protection measures will protect riparian habitats and hardwoods that can be used for foraging, and possibly nesting. The harvest prescriptions described in the DFMP will provide early-successional, mid-successional, and edge habitats for this species during migration. Although hardwoods will be retained as described in the DFMP, they are expected to decline in extent outside the WLPZ, which will degrade upland habitats for Yellow Warblers.

Protection of riparian zones and hardwood retention in harvest areas are expected to mitigate for a projected reduction in extent of montane hardwood conifer types in uplands. Montane-Hardwood Conifer is considered to be of low habitat suitability for breeding, feeding, and cover requirements for this species. A large modeled change in extent of the type results in a marked reduction in overall habitat capability in spite of its generally low habitat value. Reduction in extent of Montane Hardwood Conifer 4M in the Current to 2030 period markedly reduces habitat capability for this species in upland habitats (-40%). A similar trend occurs in habitat capability for the area outside JDSF but within the cumulative effects assessment area. Proposed project impact is expected to be "Less than Significant".

Sonoma Red Tree Vole

Although some red tree vole habitat may be harvested or degraded under the DFMP, it will continue to be abundant throughout the life of the DFMP. As described in the DFMP, red tree voles would benefit from the conservation strategies designed to manage for this and other species, including maintaining potential Douglas-fir habitat in a connected state, additional watercourse protection measures, old-growth retention, and late successional development. These conservation strategies would all contribute to the maintenance and development of late-successional, closed-canopied forest conditions that red tree voles find to be highly suitable and provide dispersal corridors and habitat connectivity. Red tree voles are known to occur on JDSF and large quantities of suitable habitat are expected to remain available.

Overall habitat capability is expected to decline slightly in the Current to 2030 period (-4%) and increase in the 2030-2060 period (+6%). Habitat connectivity analysis for core red tree vole habitat using a 100-meter dispersal distance showed habitat polygons to be "connected" across much of JDSF under current conditions (approximately 26,000 acres of "core" habitat). Proposed project impact is expected to be "No Impact".

Pacific Fisher

Pacific fishers are not known to occur on JDSF or near JDSF. Pacific fishers are generally associated with structurally complex, late successional, closed-canopied coniferous forests, particularly for denning and resting. Downed wood and snags also are important habitat elements. As described in the DFMP, Pacific fishers would benefit from various conservation strategies, WLPZs, snag retention and old-growth retention, hardwoods management, and the advancement of late successional habitats as proposed. These conservation strategies would all contribute to the maintenance and development of late-successional, closed-canopied forest conditions that fishers find highly suitable and provide dispersal corridors and habitat connectivity. Under the DFMP, JDSF would continue to provide large quantities of suitable habitat for Pacific fishers that could potentially support this species. Potential Pacific fisher habitat capability shows a slight decline in the Current to 2030 period (-7%) but an increase in the 2030-2060 period (+8%). Proposed project impact is expected to be "Less than Significant".

Project Impact: *Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.* (Beneficial with Mitigation)

Specific potential impacts to candidate, sensitive or special status species are addressed above. No significant adverse impacts to these species regarding movement or establishment are anticipated as a result of the DFMP. As identified in the species accounts above, the potential exists for the loss of large snags without additional mitigation. Large snags have the potential to provide nest or den sites for native wildlife. A mitigation measure has been developed for the retention of snags that supplements the snag protection presented in the DFMP and is presented below.

Through the use of various silvicultural treatments, WLPZ protection measures, designation of approximately 20% of the Forest as having a late seral development emphasis and the other habitat related SCAs, the DFMP will provide for the habitat elements that allow movement, establishment, and rearing of native non-candidate, sensitive or special status species. Proposed project impacts are expected to be "Beneficial" with application of identified mitigation measures.

Project Impacts: *Conflict with the provisions of an adopted Habitat Conservation Plan (HCP), or other approved local, regional, or State habitat conservation plan related to a wildlife resource*. (No Impact)

JDSF is not subject to the provisions of an adopted HCP or other approved local, regional, or State habitat conservation plan related to a wildlife resource.

Project Impacts: _Cause a wildlife population to drop below self-sustaining levels or threaten to eliminate an animal community._ (Less than Significant)

The DFMP will provide for a variety of habitats including old-growth and late successional forest conditions, riparian forest, and uneven and even-aged stands. Management for key elements such as snags will maintain or improve forest habitat structure under this alternative. The overall effects of the proposed action on the wildlife communities of JDSF, including candidate, sensitive, or special status species, game species, Neotropical migratory birds, or other species that occur, would not threaten to eliminate an animal community and is not expected to cause a wildlife population to drop below self-sustaining levels. Proposed project impacts are expected to be "Less than Significant" or "Beneficial".

6.6.7 Mitigation and Monitoring

To address the potential impacts to snag and LWD dependent species, as discussed above, the DFMP should be revised to incorporate the following mitigation to supplement the snag retention standards presented in the DFMP.

Mitigation 1
Retain all snags within all timber harvest areas with the exception of snags that pose a fire or safety hazard, or are within the alignment of roads proposed for construction. The largest snags, including residual old-growth snags, should have priority for protection until the snag retention goals of the DFMP are met.

Monitoring 1
The DFMP establishes monitoring standards in-regard to the snag retention requirements. No changes to those standards are required.

6.6.8 Comparison of Alternatives

Approach

Potential impacts of each alternative (A-F) on key wildlife habitats and species were evaluated for JDSF. In addition, impacts associated with expected change in vegetation for lands outside of JDSF but within the Cumulative Effects Assessment Area also were analyzed. Note that for lands outside of JDSF, conditions do not vary with the seven alternatives, since these directly affect management of JDSF only. This analytical approach is a cumulative effects analysis since it considers change in habitat values over space and time.

The key approach for this analysis was modeling vegetation change over time and assessing change in habitat capability with the California Wildlife Habitat Relationships System. Current habitat and habitat conditions modeled through 2060 were assessed as part of this process.

The California Wildlife Habitat Relationships System (CWHR) is the principal model used to predict species occurrence and change in habitat capability. Habitat capability in this context is an acreage weighted numerical expression derived from the arithmetic mean of habitat values for breeding, feeding, and cover for each species in each CWHR habitat stage. The CWHR System (http://www.dfg.ca.gov/whdab/html/cwhr.html) contains life history, management, and habitat relationships information on 675 species of amphibians, reptiles, birds, and mammals known to occur in California. The model was developed to predict species occurrence and abundance response to habitat alteration. Species prediction accuracy varies based on habitat types, taxonomic class, presence or absence of special habitat elements, and level of habitat relationship model validation. CWHR Version 8.0 was used and presents species life history descriptions, habitat descriptions and custom reports of database queries. Each custom report includes a list of wildlife species projected to occur in a given location and set of habitat conditions. Habitat suitability indices are calculated for each species in a given habitat condition and these values are compared between two different habitat conditions for land use planning assessments.

The CWHR System is a model based on several assumptions regarding wildlife response to habitat conditions (Airola 1988) and includes:

- Habitat value ratings in the database evaluate only the potential value of habitat. Non-habitat factors that influence populations such as predation, competition, weather conditions, etc., also influence wildlife abundance and occurrence.
- Wildlife habitats can be described by a set of characteristics that meet species basic needs for food, water, and cover. These elements can be defined as discrete factors that in combination describe the habitats available to the species.
- The relative values of habitats and the relative importance of special habitat elements may be determined for each species.
- The value of a particular habitat is uniform throughout a species range and does not vary geographically within a habitat.

Species richness (the number of species present in an area) in contrast to species diversity (number of species and their relative abundance) provides one basic description of biological diversity. Species richness is typically greatest in those areas where a mosaic of stages of forest development is found since edge effects are high and species with a preference for a particular forest stage coincide. The richness metric must be interpreted with caution however since species preferring forest interior conditions may be negatively affected depending on forest patch size in the mosaic. Therefore, species specific findings relative to habitat capability gain or loss and current population status (e.g., listed species) are important CWHR model output points of consideration. CWHR is a non-spatial model, meaning that area or patch size requirements and juxtaposition are not factored into model predictions of species occurrence. Habitat queries, wherein habitat types are weighted by acreage of the type prior to calculating habitat capability, as used in this analysis, help avoid some of the issues associated with a species richness prediction based only on presence or absence of a particular habitat type.

The habitat extent projections are a non-spatial representation of habitat extent trends over time. As such, change in landscape measures beyond current mapped conditions due to expected trend in habitat extent can be somewhat subjective. However, it is expected that with marked increase or decrease in acreage of a particular type that it can be reasonably assumed that certain spatially expressed landscape metrics such as patch size, number of patches, nearest neighbor of similar habitat and associated connectivity in the landscape matrix will show corresponding trends for the species utilizing those habitat types. Marked increase of acreage of large trees with well-developed canopies should correspond to an increase in patch size, number of patches and improvement in connectivity of that type. In other words, the degree of forest development within the landscape matrix in which the patches of potential late seral habitat are positioned is expected to become increasingly similar to those patches of late seral forest, facilitating species dispersal. Large tree patch connectivity is subsequently increased, habitat fragmentation is decreased, and nearest neighbor values decreased for these more advanced stages of forest development.

Conversely, for early stages of forest development, patch size and number, nearest neighbor, and connectivity of early seral habitats can be expected to decline over the planning period. In this case, if modeling results are realized, habitat fragmentation of early seral forest increases and then declines to zero since patches of early seral forest in this condition are not expected to persist to 2060 and hence show by default no measurable levels of fragmentation.

The California Wildlife Habitat Relationships System was used to examine change in habitat capability for terrestrial vertebrates over the planning period. Habitat types exceeding 1% of the acreage of the assessment area outside JDSF were used as inputs to complete this non-spatial evaluation for the current to mid (2030) and mid to late (2030-2060) periods. The results of this analysis were then used as a point of comparison to habitat capability trends for each of the alternatives within JDSF. Marked change in habitat capability for a particular species over the planning period could be indicative of cumulative negative or positive effects requiring identification of other habitat considerations or the development of mitigation measures.

Examination of change in habitat capability for each alternative will reveal one or more species with declines of 100% in either the Current to 2030 or 2030-2060 period or conversely, a large percent increase in habitat capability. These generally common to abundant or locally abundant species and their apparent local extirpation or otherwise highly variable response to modeled habitat conditions is explained by one or more of the following:

- The species occupies a transitory early seral habitat type or stage that is found in very limited extent on JDSF (e.g. open shrub or early seral open canopied forest types).
- The species occupies a early seral habitat type rated as low or none in habitat capability for breeding, feeding and/or cover functions that over time is not represented at the scale at which vegetation modeling was conducted.
- The species occurs in low numbers in several early seral habitat types or stages but exhibit a preference for riparian areas that remain relatively stable in acreage

and so are not included in vegetation and habitat capability modeling. These species remain nonetheless a well represented but unassessed part of the JDSF fauna.

- Species presence is potentially an artifact of vegetation modeling methodology that utilized the Coastal Scrub CWHR habitat type to represent the earliest transitory stages of forest development after harvest activities.

Limitations of the Modeling Approach

Vegetation typing for forest management often includes a more detailed classification scheme than is found in CWHR. In order to utilize CWHR as a habitat evaluation and planning tool, forest vegetation typing systems must be converted to CWHR habitat types. The conversion process to CWHR tends to simplify the vegetation typing into the three criteria of forest type, average tree diameter, and average canopy cover. The amount of information lost in this process is largely unknown.

The CWHR habitat classification system was designed primarily for single-storied stands, i.e. stands that had one dominant canopy layer. The vast majority of forest types are categorized as single stored stands with all tree canopy contributing to a single level of canopy density. The CWHR habitat classification system includes only limited consideration of stands with multiple canopy layers, i.e., forest stands composed of large sized trees with small or pole sized trees in the understory (CWHR 6).

Projections of CWHR habitat classes over time are based on rule-based algorithms that tier off projections from growth and yield models. These CWHR projections have not been validated against independent data in the same way as the underlying growth models. While projections of CWHR habitat class distribution and changes over time is a widely accepted tool for scientific and applied analysis, it is important to temper interpretations of results with a recognition of the appropriate level of accuracy (landscape level, not stand level) and context (comparisons of trends for different management alternatives, not absolute magnitude, point-in-time estimates). Making projections for the complex structures of CWHR 6 are particularly difficult.

Assessment Area Excluding JDSF

CDF modeled change in habitat conditions for a 6-decade period (Current to 2060) in the assessment area outside of JDSF. A best estimate of projected CWHR acres for the lands outside of Jackson Demonstration State Forest (JDSF) but within the EIR assessment area was needed for wildlife analysis. The inputs to the analysis were the best available information on habitat starting conditions and estimated future behavior of landowners. This was, by its nature, somewhat speculative due to the future uncertainties of behavior as influenced by timber markets, regulatory conditions, and environmental factors. Table VII 6.6.14 shows the ownership by acres of the assessment area. Not including JDSF, non-industrial private forests make up 27.5%, state parks 6.6%, and industrial forests 65.9% of the assessment area.

Each large industrial ownership and ownership class was addressed separately and then summed at the end to produce the CWHR habitat types over time table. Medium sized ownerships were combined with NIPFs.

Table VII.6.6.14. Ownership of Assessment Area.

Ownership	Acres	Percentage Including JDSF	Percentage Excluding JDSF
JDSF	48,773	22.8%	
MRC	54,222	25.4%	32.8%
HTC	29,058	13.6%	17.6%
Medium sized	25,571	12.0%	15.5%
Parks	10,852	5.1%	6.6%
NIPF	45,381	21.2%	27.5%
Total	213,857		
Excluding JDSF	**165,084**		

MRC

Mendocino Redwood Company has an Option A planning document on file with CDF. They also provided a summary of current and 20-yr projections of CWHR habitat types to JDSF for their lands in the assessment area. The CWHR types and acreages are included in VII.6.6.15. The first twenty years were covered by MRC's estimates of CWHR and the next three decades were estimated based on growth and harvest projections. The CWHR types totaling 93% of the MRC lands in the assessment area were modeled. The remaining 7% were estimated based on the modeled CWHR classes.

Table VII 6.6.15. Current (2004) and Projected (2010-2060) CWHR Acres by Decade for the Assessment Area Outside of JDSF.

CWHR TYPE	2004	2010	2020	2030	2040	2050	2060
AGS0	8,408	8,391	8,391	8,391	8,391	8,391	8,391
BAR0	283	280	280	280	280	280	280
COW4D	67	67	67	67	67	67	67
CPC1S	14	28	0	0	0	0	0
CPC2D	848	842	164	0	0	0	0
CPC2M	197	196	0	0	0	0	0
CPC2P	385	389	0	0	0	0	0
CPC2S	90	94	28	0	0	0	0
CPC3D	848	844	994	258	0	0	0
CPC3M	152	152	183	495	428	23	0
CPC3P	129	129	422	28	0	0	0
CPC4D	1,503	1,451	2,327	1,891	2,329	1,920	925
CPC4M	139	180	263	305	199	154	149
CPC4P	116	115	62	17	6	0	0

Table VII 6.6.15. Current (2004) and Projected (2010-2060) CWHR Acres by Decade for the Assessment Area Outside of JDSF.

CWHR TYPE	2004	2010	2020	2030	2040	2050	2060
CPC4S	45	42	0	0	0	0	0
CPC5D	502	478	478	1,929	1,961	2,826	3,849
CRC0	19	19	19	19	19	19	19
CSC0	2,438	2,434	2,434	2,434	2,434	2,434	2,434
DFR1S	36	35	121	42	42	42	42
DFR2P	14	0	7	0	0	0	0
DFR2S	215	323	0	0	0	0	0
DFR3D	318	317	92	507	556	413	83
DFR3M	23	0	323	7	0	0	0
DFR4D	5,399	5,188	5,096	1,043	28	212	584
DFR4M	253	309	839	0	514	514	514
DFR4P	263	263	0	0	0	0	0
DFR5D	2,888	2,816	2,549	7,094	7,553	7,512	7,470
DFR5M	45	45	270	604	604	604	604
MCH0	978	975	975	975	975	975	975
MHC1S	49	81	0	0	0	0	0
MHC2D	0	0	0	0	0	0	0
MHC2P	378	305	391	0	0	0	0
MHC2S	78	126	0	0	0	0	0
MHC3D	182	169	0	0	0	0	0
MHC3M	1,072	289	204	102	289	207	0
MHC3P	0	0	82	391	185	0	0
MHC4D	3,504	4,528	4,296	2,362	19	287	493
MHC4M	17,713	14,764	3,001	3,335	334	185	185
MHC4P	585	149	149	0	0	0	0
MHC5D	223	203	203	2,137	7,501	7,649	7,649
MHW1S	98	148	0	0	0	0	0
MHW2D	222	195	195	0	0	0	0
MHW2P	1,016	1,423	1,088	0	0	0	0
MHW2S	421	808	956	148	0	0	0
MHW3D	1,428	1,269	1,269	200	195	0	0
MHW3M	438	438	503	65	1,088	426	0
MHW3P	96	82	0	1,088	808	956	148
MHW3S	0	0	0	808	148	0	0
MHW4D	8,067	7,317	7,317	8,582	1,707	1,967	265
MHW4M	3,103	3,319	3,459	4,183	491	891	1,088
MHW4P	152	124	286	0	0	0	808
MHW4S	298	286	0	0	0	0	0
MHW5D	417	413	413	413	11,050	11,247	13,178
MRI2D	12	12	11	0	0	0	0
MRI2P	20	11	0	0	0	0	0
MRI3D	39	24	36	35	24	24	24
MRI3M	35	30	30	30	30	30	30
MRI4D	130	88	88	101	112	112	112
MRI4M	23	17	17	17	17	17	17
RDW1S	2,040	2,804	1,511	898	862	821	821

Table VII 6.6.15. Current (2004) and Projected (2010-2060) CWHR Acres by Decade for the Assessment Area Outside of JDSF.

CWHR TYPE	2004	2010	2020	2030	2040	2050	2060
RDW2D	1,306	1,300	0	0	0	0	0
RDW2M	147	137	0	0	0	0	0
RDW2P	2,477	4,164	8,456	0	0	0	0
RDW2S	1,456	2,632	0	0	0	0	0
RDW3D	5,944	4,661	4,283	5,394	8,858	7,756	1,683
RDW3M	3,321	3,182	4,368	8,593	0	0	0
RDW3P	76	70	16	0	0	0	0
RDW4D	44,705	45,188	57,999	50,851	46,936	15,556	22,515
RDW4M	12,767	14,975	15,270	2,705	6,108	5,955	5,890
RDW4P	1,802	2,001	1,169	16	63	0	0
RDW4S	94	143	63	63	0	0	0
RDW5D	19,881	16,634	15,264	33,236	32,407	65,066	64,245
RDW5M	522	894	3,081	9,777	16,917	16,975	16,975
RDW5P	461	775	801	748	128	150	150
RDW5S	54	82	0	0	0	0	0
RDW6D	51	52	52	52	52	52	52
URB0	847	847	847	847	847	847	847
WAT0	279	271	271	271	271	271	271
WTM0	47	47	47	47	47	47	47
Total	164,688	163,877	163,877	163,877	163,878	163,878	163,878

The year 21-50 projections were based on the MRC projected CWHR condition at year 20 and an estimate of the silvicultural prescriptions applied in years 21-50. This was done using GENR (Krumland and Wensel 1988) to generate the tree lists for each CWHR class and CRYPTOS (Wensel and Krumland 1987) to implement the harvests, growth and mortality. No ingrowth was simulated. Simulations were grown for one 5-year period to make them mid-period. They were then evaluated for meeting the 120 sq. ft per acre conifer basal area criteria specified in the option A plan. If meeting this minimum criterion then the stand was harvested to approximately 100 sq. ft. per acre conifer basal area. A lag of 1 year was used. The harvest option was r1 with minimum dbh of 12.0, maximum of 99.0 and equal proportions on the minimum and maximum to bring the basal area down to the target. This was to simulate a crown thin or single tree selection. Background mortality was left on and site was set at 110 redwood, 50-year basis.

HTC

Hawthorne Timber Company, LLC, has an Option A plan on file with CDF. There is no information in the public record regarding proportion of even versus uneven-aged management so we assumed a 50-50 mix for the assessment area. After screening for available stands even-aged applications resulted on 30% of the acreage. The prescriptions for uneven-aged management were defined the same as for MRC since they were similar as defined in the plan. The even-aged prescriptions were applied as 65-year clearcut rotations (50-80 given in plan). This equated to harvesting 15.4% of the even-aged ground every decade. Crown ratios were assumed at 40% and heights were predicted from diameter by species using Henry (1997). Stands in the conifer 1-3” size class were based on the regenerated stand. Redwood site index of 110 with a 50-year base age was assumed.

NIPF

The non-industrial private forests are a mix of ownerships with varying objectives. For purposes of this analysis it is assumed that 20% will follow an industrial model and will follow yield streams from MRC and HTC, 20% will follow a parks model and just grow with no harvest, and the remaining 60% will follow a high retained volume, light selection system with a basal area retention of 250 sq. ft. per acre with a harvest minimum of 280 sq. ft. per acre. This category includes every timberland ownership except Jackson, MRC, HTC, and State Parks. The same modeling assumptions were made as for HTC and MRC regarding site, ingrowth, etc.

Parks and Other Ownerships

The remainder of the ownerships in forestland was assumed to be allowed to grow with no harvest. These included park lands. The same modeling assumptions were made as for HTC and MRC regarding site, ingrowth, etc.

In general, model outputs for the assessment area outside JDSF indicate a marked increase in acreage of large size (CWHR 5) and dense canopied (CWHR D) conifers, conifer hardwood mix, and hardwood (redwood RDW, Douglas-fir DFR, Montane Hardwood Conifer MHC, and Montane Hardwood MHW). For example, Redwood 5D increased in extent by 67% from current conditions to 2030 and by 223% to 2060. Similarly, Douglas-fir 5D, and Montane Hardwood Conifer 5D increased by 146% and 858% to 2030 and by 159% and 3330% to 2060 respectively. Montane Hardwood 5D acreage remained stable to 2030 but increased by 3060% to 2060 (Table VII.6.6.15).

As expected, other habitat types exhibit a concurrent decrease in extent. Earlier stages of forest development with smaller trees and less well developed canopies are recruited to like forest types of larger tree size and denser canopy closure through growth and active management. Small to mid-sized conifers (CWHR size class 3 and 4) with all levels of canopy development show marked levels of decrease in extent. Redwood 3D and 4D acreage remains stable or increases slightly in extent by 2030 but declines by 72% and 50% respectively by 2060. Mixed Hardwood Conifer (MHC) and hardwood dominated stands (MHW) of small tree size and moderate to dense canopy show marked reductions in extent over the planning period. Montane Hardwood Conifer (4D) decreased by 33% from Current to 2030 and by an additional 79% from 2030 to 2060. Montane Hardwood (MHW4D) remained stable to 2030 but declined by 97% from 2030 to 2060.

The earliest stages of conifer forest development [sapling CWHR size class 2 and pole CWHR size class 3 size trees of sparse (S), open (P) or moderate canopy closure (M)] while represented with at least 1 percent of the total acreage under current conditions grow into other stages of forest development by 2030 and certainly by 2060. Redwood (2S and 2P) is no longer present by 2030. Redwood (RDW 3M) increases in extent by 159% at 2030 but is absent by 2060. Redwood seedling (CWHR size Class 1) acreage declined by 56% by 2030 but then remains stable to 2060.

Each of these changes in extent of habitat conditions (either increase or decrease) has implications for the species potentially occupying the habitat type of interest. Habitat types that represented at least 1% of the assessment area at either current (2004), midpoint (2030) or endpoint (2060) of the planning period were analyzed to identify marked change in habitat capability for species predicted to occur in the assessment area (Table VII 6.6.16 and Figure VII 6.6.9). The 2030and 2060 planning periods were selected as mid- and end-points for analysis because 60 years from Current conditions was judged a reasonable time span in which to detect change in direction of wildlife habitat capability. Modeled vegetation conditions for planning periods in excess of 60 years were judged to be too speculative while those closest to current conditions would likely not be of sufficient duration to differentiate between alternatives and trends in habitat capability.

Table VII 6.6.16. CWHR Habitat Types (acres) for Assessment Area outside of JDSF, by Planning Period.

CWHR	2004	2030	2060		CWHR	2004	2030	2060
CPC4D	1,503	1,891	925		MHW5D	417	413	13,178
CPC5D	502	1,929	3,849		RDW1S	2,040	898	821
CSC0	2,438	2,434	2,434		RDW2P	2,477	0	0
DFR4D	5,399	1,043	584		RDW3D	5,944	5,394	1,683
DFR5D	2,888	7,094	7,470		RDW3M	3,321	8,593	0
MHC4D	3,504	2,362	493		RDW4D	44,705	50,851	22,515
MHC4M	17,713	3,335	185		RDW4M	12,767	2,705	5,890
MHC5D	223	2,137	7,649		RDW4P	1,802	16	0
MHW4D	8,067	8,582	265		RDW5D	19,881	33,236	64,245
MHW4M	3,103	4,183	1,088		RDW5M	522	9,777	16,975

Assessment Area Outside JDSF

Initial CWHR queries resulted in the identification of 250 terrestrial vertebrate species potentially occurring outside JDSF. This list was refined to 205 species for the assessment area outside JDSF by examining species range maps and ancillary information such as species occurrence databases and Kitchen (1992).

For the Current to 2030 period in the assessment area outside of JDSF, 133 species exhibited declines in habitat capability (2 amphibian, 13 reptile, 73 bird and 45 mammal species). Three bird species exhibited no change and 69 species showed positive trends in habitat capability (14 amphibian, 3 reptile, 38 bird and 14 mammal species).

For the 2030-2060 period, 56 species showed declines in habitat capability (0 amphibians, 8 reptile, 25 bird and 23 mammal species). Habitat for one species (Broad-footed mole) is not expected to occur based on model results. Twenty species exhibited no change (0 amphibian, 3 reptile, 12 bird and 5 mammal species). Habitat capability increased for 128 species (16 amphibians, 5 reptiles, 77 bird and 30 mammal species).

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8--Approach.

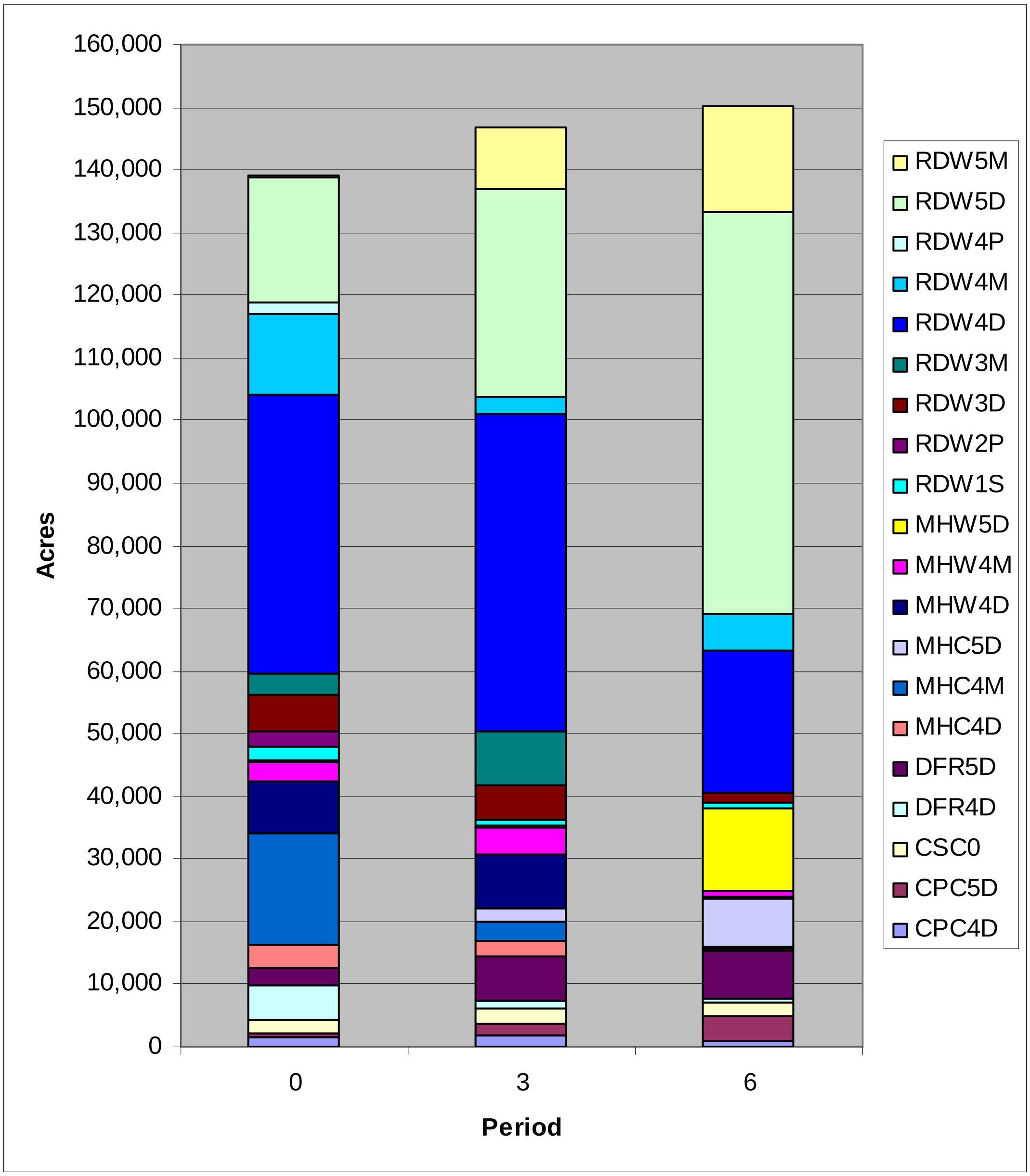


Figure VII 6.6.9. Change in CWHR Types over Time for Assessment Area *Outside* of JDSF (Acreage totals vary by planning period given requirement that type extent be at least 1% of assessment area before representation).

Habitat capability changes for bat, amphibian, and reptile species known or expected to occur within the area outside JDSF are reported in Table VII 6.6.17. However, change in habitat capability for these species based on change in acreage of habitat types utilized must be interpreted cautiously. Relatively little is known and/or scale of habitat measurement is not consistent with habitat requirements (small home ranges) for most of these species. Similarly, extents of key habitat types (e.g. riparian) or presence/absence of essential habitat elements like snags or talus slopes are not generally mappable or are generally underestimated given vegetation mapping limitations. A general trend toward larger trees and higher levels of canopy closure over the planning period increases the likelihood that habitat conditions for bats and amphibians will be stable or improve. Conversely, reduction in early seral stage and open forest conditions increases the likelihood that habitat capability for reptiles will be reduced. (Table VII 6.6.17). It is assumed that increases/decreases in acreage of a particular forest stage will equate to improvement/decline in those habitat conditions or habitat elements utilized by the species of interest (e.g. presence of large snags, down logs, riparian canopy cover and influence on water quality).

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.

	Current to 2030	2030-2060
Neotropical Migrants		
Fox Sparrow	-52	-26
Yellow Warbler	-43	1
Bullock's Oriole	-43	-19
N. Rough-winged Swallow	-42	-1
Tree Swallow	-41	6
Golden-crowned Sparrow	-37	0
Warbling Vireo	-27	-4
Nashville Warbler	-24	-15
MacGillivray's Warbler	-21	-53
Yellow-rumped Warbler	-20	1
Allen's Hummingbird	-18	-49
Chipping Sparrow	-18	-10
Western Tanager	-16	-1
Western Wood Pewee	-13	5
Black-headed Grosbeak	-11	1
Orange-crowned Warbler	-10	-26
Black-throated Gray Warbler	-10	-2
Violet-green Swallow	-8	3
Rufous Hummingbird	-8	0
Lazuli Bunting	-2	-15
Cedar Waxwing	2	4
Wilson's Warbler	3	2
Hermit Thrush	4	11
Swainson's Thrush	5	12
White-crowned Sparrow	6	3
Olive-sided Flycatcher	7	17
Hermit Warbler	9	5
Purple Martin	9	21

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.		
	Current to 2030	2030-2060
Townsend's Warbler	9	2
Chestnut-backed Chickadee	11	6
Vaux's Swift	17	12
Carnivore and Furbearer		
Marten	-52	7
Ermine	-29	6
Ringtail	-28	-56
Striped Skunk	-23	-32
Bobcat	-19	-31
Mountain Lion	-18	-4
Long-tailed Weasel	-8	-3
Coyote	-1	-8
Raccoon	4	18
Fisher	9	13
Game Species		
Blue Grouse	-44	0
Wild Turkey	-42	1
Wild Pig	-36	-15
Band-Tailed Pigeon	-13	9
Mourning Dove	-11	-5
Mule Deer	-7	-8
Gray Squirrel	-5	8
Black Bear	-3	-8
California Quail	0	2
Small Mammals		
Brush Rabbit	-84	0
Botta's Pocket Gopher	-73	0
Long-tailed Vole	-71	6
Western Harvest Mouse	-68	-48
Creeping Vole	-51	-40
Pinon Mouse	-35	31
Pacific Jumping Mouse	-30	-2
Sonoma Chipmunk	-27	-50
California Ground Squirrel	-23	-16
Vagrant Shrew	-22	3
Douglas Squirrel	-18	-2
Yellow-cheeked Chipmunk	-11	1
Black Rat	-9	-49
Dusky-footed Woodrat	-7	-23
Fog Shrew	3	5
Trowbridges Shrew	3	5
California Vole	3	-3
Coast Mole	4	-78
Red Tree Vole	12	6

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.

	Current to 2030	2030-2060
Northern Flying Squirrel	17	8
Western Red-backed Vole	21	26
Shrew Mole	27	23
Raptors		
White-tailed Kite	-90	0
Short-eared Owl	-86	0
Barn Owl	-67	-74
Northern Harrier	-67	0
Golden Eagle	-49	-1
Red-shouldered Hawk	-40	42
Merlin	-31	-41
Northern Goshawk	-23	3
Peregrine Falcon	-15	5
Coopers Hawk	-12	4
Northern Pygmy Owl	-11	2
American Kestrel	-7	11
Great-horned Owl	-6	10
Bald Eagle	-2	24
Western Screech Owl	-2	1
Red-tailed Hawk	1	5
Turkey Vulture	2	3
Northern Saw-whet Owl	3	5
Sharp-shinned Hawk	5	2
Osprey	8	5
Spotted Owl	18	14
Primary Cavity Excavators		
Northern Flicker	-9	6
Acorn Woodpecker	-8	-1
Downy Woodpecker	-6	-2
Pileated Woodpecker	-5	22
Red-Breasted Sapsucker	-4	4
Hairy Woodpecker	-4	4
Reptiles		
Gopher Snake	-57	-24
Ringneck Snake	-49	-41
Western Rattlesnake	-33	0
Western Skink	-33	-4
Racer	-31	-14
Common Kingsnake	-29	9
Western Fence Lizard	-29	6
Western Pond Turtle	-27	-20
Northern Alligator Lizard	-27	-35
Sharp-tailed snake	-15	-35
Western Terrestrial Garter Snake	-11	0

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.

	Current to 2030	2030-2060
Sagebrush Lizard	-4	0
Rubber Boa	-1	3
Southern alligator Lizard	1	4
Common Garter Snake	2	2
Amphibians		
Western Toad	-7	1
Pacific Chorus Frog	-4	3
Bullfrog	2	2
Foothill Yellow-legged Frog	2	2
Red-bellied Newt	4	1
Rough-skinned Newt	5	3
Tailed Frog	7	6
Pacific Giant Salamander	7	1
Ensatina	8	2
Black Salamander	8	5
Red-legged Frog	9	2
Arboreal Salamander	10	3
Southern Torrent salamander	12	4
Clouded Salamander	13	17
Northwestern Salamander	13	7
California Slender Salamander	19	2
Bats		
Long-eared Myotis	-14	0
Big Brown Bat	-12	3
Long-legged Myotis	-11	1
California Myotis	-7	0
Fringed Myotis	-7	3
Yuma Myotis	-7	3
Hoary Bat	-5	1
Western Red Bat	-5	1
Little Brown Myotis	-2	1
Pallid Bat	2	2
Townsends Big-eared Bat	2	2
Silver-haired Bat	3	1
Resident and other species not assigned to species groups: percent change in habitat capability.		
Birds	Current to 2030	2030-2060
Pygmy Nuthatch	-69	42
Lincoln's Sparrow	-67	0
Common Nighthawk	-51	4
Belted Kingfisher	-50	0
House Wren	-42	-14
Bushtit	-41	10
Oak Titmouse	-41	16

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.

	Current to 2030	2030-2060
Western Scrub-Jay	-41	14
Black Phoebe	-39	3
Western Meadowlark	-38	0
Western Bluebird	-38	18
Red Crossbill	-36	22
White-Breasted Nuthatch	-35	6
House Finch	-17	-2
Spotted Towhee	-17	-42
Hutton's Vireo	-15	7
Purple Finch	-13	7
American Robin	-10	2
Wrentit	-7	-3
Barn Swallow	-7	0
Mountain Quail	-6	2
Ruby-Crowned Kinglet	-5	1
Bewick's Wren	-5	-44
Dark-Eyed Junco	-5	1
Anna's Hummingbird	-5	-12
Brown-Headed Cowbird	-2	3
Red-Breasted Nuthatch	-1	4
Song Sparrow	-1	3
Great Egret	0	15
Common Raven	0	9
Evening Grosbeak	1	5
White-Throated Sparrow	2	3
Steller's Jay	3	4
Brewer's Blackbird	3	2
Golden-Crowned Kinglet	3	4
Pine Siskin	4	6
European Starling	4	2
Pacific-Slope Flycatcher	4	3
Green Heron	5	3
Wood Duck	7	31
Winter Wren	11	4
Varied Thrush	12	1
Lesser Goldfinch	14	11
Brown Creeper	14	18
American Goldfinch	16	-13
California Towhee	18	0
Lark Sparrow	18	0
Great Blue Heron	19	41
Gray Jay	24	14
American Crow	24	3
Marbled Murrelet	30	26

Table VII 6.6.17. Percent change in habitat capability for species occurring in the assessment area outside of Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060.

	Current to 2030	2030-2060
Mammals		
Broad-Footed Mole	-100	
American Beaver	-72	29
House Mouse	-71	6
American Badger	-70	0
Black-Tailed Jackrabbit	-54	-85
Common Porcupine	-40	-15
Deer Mouse	-16	-19
Gray Fox	-5	2
Virginia Opossum	-1	1
Western Spotted Skunk	-1	-14
Norway Rat	16	1
Reptiles		
Pacific Coast Aquatic Garter Snake	2	-7

Species with a preference for early seral stages of forest development to fulfill breeding, feeding or cover requirements showed the largest percentage decline in habitat capability. Conversely, species associated with larger tree DBH classes and denser canopy conditions showed increases in habitat capability, particularly in the 2030-2060 time period.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability increases in both time periods (+30% and +26%) with projected large increases in the extent of large tree and closed canopy forest conditions in the Redwood (Redwood 5M, 5D) and Douglas-fir (Douglas-fir 5D) forest types. Northern Spotted Owl habitat capability also increases over both periods due to marked increase in extent of large tree/dense canopy conditions (principally Redwood 5M and 5D).

Small Mammals

Small mammal species exhibiting a preference for early stages of forest development or significant herbaceous understory/brush component as a consequence of a more open tree canopy layer showed the largest net reduction in habitat capability in either time period (western harvest mouse, creeping vole, brush rabbit, Sonoma chipmunk, dusky-footed woodrat, coast mole). The brush rabbit, creeping vole and coast mole find no additional habitat capability beyond the 4P, 4M, and 3D stages of forest development respectively for the forest types examined. Habitat capability for the broad-footed mole is not expected to occur in the second period based on model results. Reversal of the marked habitat capability decline over the first 30 years for the long-tailed vole and pinion mouse may be explained by marked increases in acreage of Montane Hardwood Conifer and Montane Hardwood in the 2030-2060 period.

Small mammal species with a preference for later stages of forest development with well developed canopies and larger trees showed increases in habitat capability values for the habitat types examined. Northern flying squirrels benefit from large trees with cavities for cover and reproduction. Marked increase in Douglas-fir 5D in the first period is the principal contribution to habitat capability improvement for the red tree vole. Late stages of forest development with dense canopies in the Redwood and Douglas-fir type benefited the shrew mole. Forest floor debris and lichen requirements of the western red-backed vole are met in the later stages of Redwood, Douglas-fir and Montane Hardwood Conifer forest development.

Raptors

Forest dwelling raptors that regularly occur in the assessment area outside of JDSF exhibit stable to increasing levels of habitat capability within the habitat types examined for the modeled period. Species exhibiting large decreases in habitat capability for both Current to 2030 and 2030-2060 time periods are for the most part species that find highly suitable habitat conditions in the most open canopies and earliest stages of forest development, showing a preference for grassland/shrub dominated habitats. These species include Northern Harrier, Short-eared Owl, and White-tailed Kite. Merlin, a rare winter visitor, does not breed in the assessment area, and frequents open forest conditions, grasslands and coastlines. Accipiters (Northern Goshawk, Cooper’s Hawk and Sharp-shinned Hawk) as a group varied in their response to changing habitat conditions over the planning period. Northern Goshawk (virtually no sightings) and Cooper’s Hawk exhibited marked decline in habitat capability during the first period but remained stable during the 2030-2060 period. Reduction in extent of suitable foraging habitat in the first period was likely responsible followed by a marked compensatory increase in suitability of high habitat capability breeding, feeding and cover conditions (Montane Hardwood Conifer and Montane Hardwood 5D) in the 2030-2060 period. Sharp-shinned Hawk habitat capability showed a slight positive trend during the planning period for the habitat types examined due to increases in acreage of Montane Hardwood, Montane Hardwood Conifer, and Redwood in moderate and dense canopy conditions in the pole to large tree stages. Reduction in early stages of Redwood (2S, 2P) and Montane Hardwood Conifer (4M) during the first period influenced Red-shouldered Hawk habitat capability negatively but was compensated for in the second period by increases in hardwood and conifer/hardwood woodland habitat considered moderate for reproduction, cover and feeding requirements.

Neotropical Migrants

Neotropical migrants are migratory bird species that nest in the United States and Canada but migrate south to the tropical regions of Mexico, Central and South America and the Caribbean for the non-breeding season (generally south of the Tropic of Cancer). Hayes (1995) has suggested a more refined definition in which the former describes a Nearctic migrant reserving the term Neotropical migrant for species breeding in South America that migrate northward during the non-breeding season. This analysis examines passerine birds found in the assessment area that exhibit both migratory patterns.

The largest decreases in habitat capability for the Current to 2030 and 2030-2060 period are noted for Neotropical migrants preferring forest structure less than a 4D for Redwood, Douglas-fir, Closed Cone Pine Cypress, Montane hardwood and Montane Hardwood

Conifer. Species such as the MacGillivray's Warbler, Orange-crowned Warbler, Fox Sparrow, and Allen's Hummingbird show marked declines in capability for the habitat types modeled for both the Current to 2030 and 2030-2060 periods. The Bullock's Oriole shows reduction in breeding habitat capability given reduction in open or sparse canopy conditions in large tree stages. Open or sparse canopied forest conditions are also sought out by Northern Rough-winged Swallows for foraging and change in extent of these conditions also reduced overall habitat capability ratings for this species. General reduction in extent of early seral stages of forest development in the Montane Hardwood and Montane Hardwood Conifer types resulted in marked reduction in breeding, feeding, and covers requirements for the Chipping Sparrow. Although generally found in riparian habitats, Yellow Warblers also exhibit a breeding preference for forest habitats with significant amounts of brush. Reduction in early stages of forest development in the Montane Hardwood Conifer type is a negative influence on breeding habitat conditions and influenced habitat capability values. Large increases in acreage of Montane Hardwood and Montane Hardwood Conifer 5D at the end of the second period slowed the decline or resulted in slight increase in habitat capability for the Western Wood Pewee, Tree Swallow, and Black-headed Grosbeak.

All species showing an increase in habitat capability in the Current to 2030 period continue to exhibit habitat capability increases in the 2030-2060 period. Greatest increases were for species exhibiting a preference for large tree stages of forest development or increasing levels of canopy closure. Purple Martin, Chestnut-backed Chickadee, and Vaux's Swift showed a marked increase in habitat capability during the Current to 2030 period. Increase in Montane Hardwood Conifer and Redwood in large trees with well developed canopy closure (5D) benefited the Vaux's Swift (Redwood 5D increases). Purple Martin habitat capability was benefited by increase in large trees with moderate levels (40-59%) of canopy closure development (Montane Hardwood and Redwood 5M increases). The Olive-sided Flycatcher benefited from a marked increase in extent of large tree stages in the Redwood and Montane Hardwood Conifer types in the Current to 2030 and 2030-2060 periods. Swainson's Thrush and Hermit Thrush exhibited marked increase in habitat capability in latter half of the planning period. Increase in extent of Redwood 5D benefited Swainson's Thrush. Increases in extent of large tree stages of forest development (5M and 5D) in the Redwood, Montane Hardwood and Montane Hardwood Conifer types was primarily responsible for increases in habitat capability for the Hermit Thrush

Game Species
In general, many game species exhibit a preference for the early stages of forest development, edge habitats and/or a mosaic of forest structural conditions at a relatively "fine" grain. Late seral forest interior conditions are not typically sought out as a principal source of resources to meet breeding, feeding or cover requirements. Reduction in extent or loss of early stages of Redwood Forest (1S, 2S, 2P, 3M, 3D) and Montane Hardwood Conifer (4M) reduced mule deer reproduction and feeding habitat capability in both the Current to 2030 and 2030-2060 periods. Relatively large reductions in habitat capability during the first and second period for wild pig and first period for Wild Turkey are closely associated with changes in Montane Hardwood Conifer and Montane Hardwood of all stages of forest development in these important mast producing types.

For Blue Grouse, marked reduction in Douglas-fir 4D and Montane Hardwood Conifer 4M in the first period and reduction in open coniferous forest stands and associated brush component resulted in marked reduction in habitat capability. This trend in habitat capability stabilized in the second period with increases of Montane Hardwood Conifer 5D.

Carnivore and Furbearer
Forest dwelling carnivores and furbearers that regularly occur in the assessment area outside of JDSF exhibit decreasing levels of habitat capability within the habitat types examined for the modeled period (except Pacific fisher and raccoon). Species exhibiting large decreases in habitat capability for both Current to 2030 and 2030-2060 time periods are for the most part species that find highly suitable habitat conditions in open canopies and earliest stages of forest development. Reduction or elimination of expected acreage of early stages of forest development in Redwood and Montane Hardwood Conifer during the first and second periods reduced habitat capability for bobcat, ringtail, mountain lion, long-tailed weasel and striped skunk. Ermine habitat capability stabilizes and increases slightly in the second period with increase in acreage of later stages of forest development (Douglas-fir 5D, Montane Hardwood 5D, and Montane Hardwood Conifer 5D).

Potential marten habitat (populations of the Humboldt marten and Pacific fisher are not currently known to exist in the assessment area) exhibited marked reduction in capability with decreases in Montane Hardwood Conifer (4D) and Douglas-fir (4D) in the first period but increased slightly with recruitment of Montane Hardwood Conifer (5D) in the second period. Potential Pacific fisher habitat shows increases in habitat capability over both time periods due to increases in extent of intermediate to large tree stages with well developed levels of canopy closure. Increase in Redwood (4D, 5D, 5M) and Montane Hardwood Conifer (5D) acreage contributed most to increase in habitat capability over the Current to 2030 and 2030-2060 time periods and for the habitat types examined.

Bats
In general, bats as a group exhibit small declines in habitat capability during the Current to 2030 period. The greatest percent decline occurs for long-legged myotis, big brown bat, and the long-eared myotis. Reduction in acreage of Montane Hardwood Conifer 4M and 4D and Douglas-fir 4D (small tree and moderate to dense canopies) are largely responsible for the expected decline. This trend in habitat capability stabilizes or improves slightly during the 2030-2060 period. Large increases in extent of Montane Hardwood Conifer (MHC 5D), Montane Hardwood (MHW 5D) and Redwood (RDW 5D) (5D is medium to large trees with dense canopy cover) were likely responsible for that effect.

Alternative Comparison within JDSF

Alternative A—Inside JDSF

In general, model outputs for alternative A within JDSF indicate that this alternative increases the acreage of CWHR size class 5 (large tree size) throughout the projection interval. This is to be expected for an alternative simulating no timber harvest throughout the Forest. Young and mid-seral forest types decrease significantly over time as the majority of the Forest acreage is consolidated into late seral forest types (Table VII.6.6.18, Figure 6.6.10).

The general shift toward late seral forest types later in the planning period is largely responsible for change in the habitat capability of species potentially occurring on JDSF under alternative A. The decline in the earliest stages of forest development, shrub associations, and open canopy conditions minimize the occurrence of shrub or understory components utilized by certain Neotropical migrant birds, small mammals and reptiles.

The largest increases in habitat capability are exhibited by those species finding high levels of habitat suitability in stands dominated by large trees and a closed canopy condition. In general, species under alternative A with a preference for small to medium sized trees and open forest canopy conditions showed the largest percentage decline in habitat capability. Reduction in early- and mid-seral habitat stages had a marked negative influence on habitat capability for species adapted to these forest types.

For the Current to 2030 period within JDSF, 122 species exhibited declines in habitat capability. Seven (7) species exhibited no change and 72 species showed positive trends in habitat capability (Table VII.6.6.19).

Table VII.6.6.18. Estimated CWHR acres on Jackson Demonstration State Forest. Alternative A.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1M	423	228	116	MHC6	2683	2683	2683
CPC2P	608			RDW2D	647		
DFR2D		608		RDW3D		843	
DFR3M			608	RDW4S			112
DFR4P	1725			RDW4P	847	15	
DFR4D	1854	771	195	RDW4M	437	437	
DFR5P		1725	1725	RDW4D	1686	1384	647
DFR5D		1083	1854	RDW5P		832	847
MHC4M	7928	7703		RDW5M			437
MHC4D	3940	3911		RDW5D		302	1686
MHC5M		224	7928	RDW6	25873	25873	25873
MHC5D		28	3940				

For the 2030-2060 period, 54 species showed declines in habitat capability.   Eleven (11) species exhibited no change. Habitat capability increased for 130 species. Six species are not projected to occur on JDSF given habitat modeling results (Lazuli Bunting, White-tailed Kite, Northern Harrier, Lark Sparrow, California Towhee, and American Badger) (Table VII.6.6.19).

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

Listed Terrestrial Species

Potential habitat capability for Marbled Murrelets remained essentially stable in the first period (+1%) or showed a slight increase in the second period (+4%) with slight increase in extent of large tree and closed canopy conditions in the forest types examined. Northern Spotted Owl habitat capability increases in the Current to 2030 period (+3%) and again in the 2030 to 2060 period (+17%) as a result of the increase in Douglas-fir 5D followed by Redwood 5D and Montane Hardwood Conifer 5M and 5D in the second period.

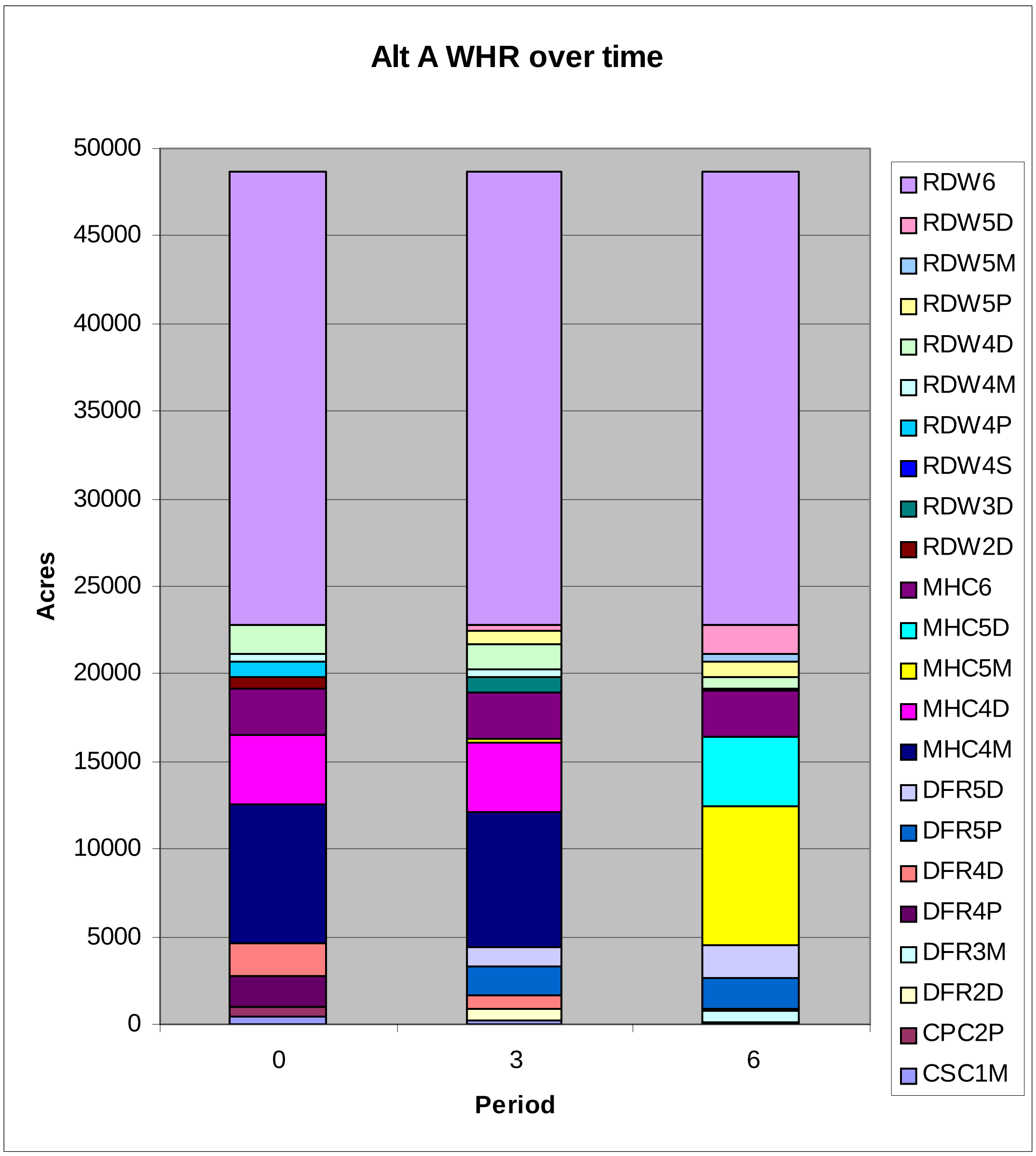


Figure VII.6.6.10. Estimated CWHR Acres on JDSF in 2004, 2030, and 2060. Alternative A.

Table VII.6.6.19. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative A

	Current To 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-100.0	
White-Crowned Sparrow	-23.1	10.0
Allen's Hummingbird	-18.6	-12.7
Fox Sparrow	-12.4	8.7
Chipping Sparrow	-8.8	-66.7
Bullock's Oriole	-6.7	7.1
Macgillivray's Warbler	-5.6	-13.3
Yellow Warbler	-4.9	-14.4
Orange-Crowned Warbler	-4.8	-20.3
Northern Rough-Winged Swallow	-4.2	4.4
Tree Swallow	-3.6	3.8
Nashville Warbler	-3.1	-38.6
Rufous Hummingbird	-2.8	2.1
Warbling Vireo	-1.8	3.4
Black-Throated Gray Warbler	-1.5	1.5
Black-Headed Grosbeak	-1.2	2.8
Yellow-Rumped Warbler	-1.0	1.9
Violet-Green Swallow	-0.9	1.4
Western Tanager	-0.7	1.6
Western Wood-Pewee	-0.7	1.4
Cedar Waxwing	-0.4	2.1
Golden Crowned Sparrow	0.0	0.0
Wilson's Warbler	0.2	0.3
Hermit Thrush	0.5	1.1
Chestnut-Backed Chickadee	0.6	0.7
Hermit Warbler	0.7	1.1
Swainson's Thrush	0.7	0.2
Townsend's Warbler	0.8	0.8
Purple Martin	2.6	55.4
Olive-Sided Flycatcher	3.4	8.2
Vaux's Swift	6.4	9.8
Carnivore And Furbearer		
Ringtail	-18.8	-71.2
Gray Fox	-8.1	-22.3
Mountain Lion	-7.1	-7.9
Bobcat	-3.5	-23.0
Striped Skunk	-3.5	-19.7
American Marten	-2.4	3.3
Long-Tailed Weasel	-1.2	-0.5
Coyote	-0.8	-5.4
Ermine	-0.7	1.8
Raccoon	-0.3	9.3

Table VII.6.6.19. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative A

	Current To 2030	2030-2060
Fisher	0.0	5.2
Game Species		
Wild Turkey	-3.3	3.4
Mourning Dove	-2.9	4.1
Wild Pig	-2.4	2.4
Mule Deer	-1.5	-8.4
California Quail	-0.3	0.3
Black Bear	0.2	12.6
Band-Tailed Pigeon	0.4	2.3
Western Gray Squirrel	2.7	12.5
Blue Grouse	2.8	2.0
Small Mammals		
Brush Rabbit	-76.9	-100.0
Creeping Vole	-74.1	-57.1
California Vole	-16.4	-15.7
Botta's Pocket Gopher	-13.0	0.0
Pinon Mouse	-12.2	19.9
Western Harvest Mouse	-10.4	-34.9
Black Rat	-6.0	-31.9
Dusky-Footed Woodrat	-4.9	-7.3
California Ground Squirrel	-2.8	1.6
Pacific Jumping Mouse	-2.6	8.9
Sonoma Chipmunk	-2.6	-52.4
Vagrant Shrew	-2.5	5.0
Yellow-Cheeked Chipmunk	-1.8	-0.5
Shrew-Mole	0.2	2.6
Fog Shrew	0.3	1.1
Trowbridge's Shrew	0.3	1.1
Long-Tailed Vole	0.8	-0.8
California Red Tree Vole	4.6	2.3
Northern Flying Squirrel	4.6	10.7
Western Red-Backed Vole	6.3	17.7
Douglas' Squirrel	9.3	17.6
Coast Mole	233.3	-70.0
Raptors		
White-Tailed Kite	-100.0	
Northern Harrier	-100.0	
Barn Owl	-6.0	6.4
Red-Shouldered Hawk	-4.5	57.1
Golden Eagle	-2.7	0.3
Merlin	-2.4	-63.8
Peregrine Falcon	-1.4	1.5
Red-Tailed Hawk	-1.0	2.3
Great Horned Owl	-0.9	1.5
American Kestrel	-0.8	22.8

Table VII.6.6.19. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative A

	Current To 2030	2030-2060
Cooper's Hawk	-0.7	0.9
Northern Pygmy Owl	-0.3	1.2
Northern Saw-Whet Owl	-0.1	1.1
Turkey Vulture	-0.1	0.0
Western Screech Owl	-0.1	0.4
Short-Eared Owl	0.0	0.0
Northern Goshawk	0.2	3.1
Sharp-Shinned Hawk	0.4	0.4
Osprey	2.4	4.8
Spotted Owl	2.5	16.8
Bald Eagle	3.4	23.1
Primary Cavity Excavators		
Red-Breasted Sapsucker	-0.6	3.5
Downy Woodpecker	-0.4	1.1
Acorn Woodpecker	-0.2	0.7
Hairy Woodpecker	0.0	14.7
Northern Flicker	0.7	1.9
Pileated Woodpecker	3.1	22.1
Reptiles		
Common Kingsnake	-11.3	-0.8
Western Pond Turtle	-10.2	3.8
Gopher Snake	-8.0	-1.0
Ringneck Snake	-6.7	2.4
Western Skink	-5.6	2.5
Sharp-Tailed Snake	-2.4	-2.4
Western Rattlesnake	-2.3	-1.0
Western Terrestrial Garter Snake	-1.8	-1.8
Western Fence Lizard	-1.5	-3.4
Southern Alligator Lizard	-0.6	0.6
Northern Alligator Lizard	-0.3	-21.4
Rubber Boa	0.5	0.9
Racer	0.9	-4.3
Common Garter Snake	1.1	-1.1
Sagebrush Lizard	10.3	-2.3
Amphibians		
Western Toad	-1.0	0.3
Bullfrog	-0.3	-0.2
Pacific Chorus Frog	-0.3	0.3
Arboreal Salamander	0.0	7.7
Foothill Yellow-Legged Frog	0.6	-0.6
Red-Bellied Newt	0.7	0.0
Ensatina	0.9	-0.5
Pacific Giant Salamander	1.3	-0.5
Red-Legged Frog	1.3	-0.5
Rough-Skinned Newt	1.3	1.2

Table VII.6.6.19. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative A

	Current To 2030	2030-2060
Tailed Frog	1.7	2.8
Black Salamander	2.5	0.8
Northwestern Salamander	3.1	8.1
Southern Seep Salamander	3.5	5.9
California Slender Salamander	3.6	-0.4
Clouded Salamander	3.6	10.4
Bats		
Long-Eared Myotis	-1.1	-12.7
Long-Legged Myotis	-0.8	0.8
Fringed Myotis	-0.7	0.7
Yuma Myotis	-0.7	0.7
Big Brown Bat	-0.4	1.2
Little Brown Myotis	-0.4	1.7
Hoary Bat	0.0	1.8
Western Red Bat	0.4	6.6
California Myotis	0.5	0.3
Silver-Haired Bat	0.7	1.2
Pallid Bat	0.9	0.0
Townsend's Big-Eared Bat	0.9	0.0
Resident And Other Species Not Assigned To Species Groups: Percent Change In Habitat Capability		
Birds		
Lark Sparrow	-100.0	
California Towhee	-100.0	
Song Sparrow	-17.5	-23.4
House Finch	-15.8	0.0
Western Meadowlark	-15.4	0.0
Lesser Goldfinch	-9.1	10.0
Anna's Hummingbird	-6.5	5.7
Western Bluebird	-5.9	33.9
Pygmy Nuthatch	-5.7	4.5
Wrentit	-4.9	-3.3
Western Scrub-Jay	-4.3	3.0
Bushtit	-3.9	3.0
American Goldfinch	-3.8	-12.0
Spotted Towhee	-3.7	-7.6
Oak Titmouse	-3.4	3.0
House Wren	-3.1	-26.5
Black Phoebe	-2.9	3.0
American Robin	-2.6	2.7
Barn Swallow	-1.7	1.3
Hutton's Vireo	-1.6	1.4
Dark-Eyed Junco	-1.4	0.4
Great Egret	-1.4	2.3
Common Raven	-1.3	1.3

Table VII.6.6.19. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative A

	Current To 2030	2030-2060
White-Breasted Nuthatch	-1.1	3.1
Purple Finch	-1.0	1.5
Brown-Headed Cowbird	-0.8	0.4
Evening Grosbeak	-0.6	1.7
European Starling	-0.2	0.4
Ruby-Crowned Kinglet	-0.2	0.9
Mountain Quail	0.2	0.5
Pine Siskin	0.2	0.7
Pacific-Slope Flycatcher	0.3	0.6
Brewer's Blackbird	0.5	0.5
Green Heron	0.5	1.4
White-Throated Sparrow	0.5	0.5
Steller's Jay	0.7	0.2
Golden-Crowned Kinglet	0.8	1.2
Common Nighthawk	0.8	1.5
Marbled Murrelet	1.0	3.9
Wood Duck	1.3	37.5
Brown Creeper	2.1	12.5
Bewick's Wren	2.2	-44.7
Winter Wren	2.7	6.8
American Crow	2.8	13.5
Gray Jay	3.1	1.7
Varied Thrush	3.1	-0.4
Great Blue Heron	4.6	19.2
Red-Breasted Nuthatch	4.6	3.8
Red Crossbill	14.7	5.5
Mammals		
American Badger	-100.0	
Black-Tailed Jackrabbit	-28.3	-96.7
Common Porcupine	-4.9	0.0
Deer Mouse	-3.1	-19.4
American Beaver	-2.9	2.9
House Mouse	-2.8	-3.8
Broad-Footed Mole	0.0	0.0
Virginia Opossum	1.4	-0.6
Norway Rat	3.6	-2.2

Small Mammals

Botta’s pocket gopher, Western harvest mouse and the brush rabbit exhibited marked declines in percent habitat capability in the Current to 2030 planning period, principally as a result of reduction in the extent of open canopied forest types and Redwood 2D.

Northern flying squirrel and Douglas squirrel experienced increases in habitat capability in both planning periods. This trend mirrors the emergence and development of late seral forest types such as Montane Hardwood Conifer 5M, 5D and Douglas-fir 5D over the projection interval. Creeping vole exhibited marked reduction in habitat capability over both periods with declines in Douglas-fir 4P, and Redwood 4P (Current to 2030) and Douglas-fir 2D (2030-2060) forest types which are not well represented on JDSF. California red-tree vole exhibited a slight increase in habitat capability over both periods with increase in extent of Douglas-fir 5P and 5D and in the second period Montane Hardwood Conifer 5M and 5D and Douglas-fir 5D. Dusky-footed woodrat experience a slight to modest decline in habitat capability in the Current-2030 (-5%) and 2030-2060 period (-7%) with reduction in extent of Douglas-fir 4P and Redwood 4P followed by Montane Hardwood Conifer 4M in the second period.

Raptors

Species exhibiting large percent decrease in habitat capability in the Current to 2030 period were Northern Harrier, Merlin and Short-eared Owl. Reduction in extent of early seral stages of forest development Closed-cone Pine Conifer 2P, Douglas-fir 4P and Redwood 4P negatively affected habitat capability for these species. Northern Goshawk, Cooper 's Hawk, and Sharp-shinned Hawk habitat capability remains stable or increases slightly over both planning periods. Red-shouldered hawk habitat capability declines slightly (-5%) in the first period with a decrease in extent of Montane Hardwood Conifer 4M but increases markedly (+57%) in the second period with an increase in acreage of Montane Hardwood Conifer 5M and 5D.

Neotropical Migrants

Large decreases in habitat capability occur for those Neotropical migrants exhibiting a preference for Montane Hardwood Conifer 4M and early stages of forest development with open canopy and/or a shrub understory in the Current to 2030 and 2030-2060 periods. These species include Lazuli Bunting, Chipping Sparrow, Allen's Hummingbird, MacGillivray's Warbler, Yellow Warbler, Nashville Warbler and Song Sparrow.

Species showing an increase in habitat capability during the Current to 2030 period are generally typical of mid- to late stages of Redwood, Montane Hardwood Conifer and Douglas-fir forest development. Purple Martin and Vaux's Swift both exhibit increases in habitat capability with increase in Douglas-fir 5P and 5D and Redwood 5P in the Current to 2030 period. Habitat capability for Purple Martin and Vaux's Swift increases markedly during the 2030-2060 period with an increase in extent of Montane Hardwood Conifer 5M and 5D. Swainson's Thrush habitat capability remains stable over both time periods. Western Bluebird habitat capability declines slightly in the Current to 2030 period (-6%) but increases markedly (+34%) in the 2030-2060 period with increase in Montane Hardwood Conifer 5M. Olive-sided Flycatcher habitat capability increases in both periods (+3%, +8%) with increase in acreage of Douglas-fir 5P and Redwood 5P followed by increase in extent of Montane Hardwood Conifer 5M and 5D.

Game Species

The preference of most game species for early to mid stages of mast (acorns, berries) producing forest conditions (Montane Hardwood Conifer 4M and 4D) is well established. Mourning Dove, Band-tailed Pigeon, Blue Grouse, California Quail, Wild Turkey and wild pig Habitat capability remains stable when considering both the Current to 2030 and 2030-2060 periods. Mule deer exhibit a small decrease (-1.5%) in the first period and larger decrease (-8%) in the second period. Black bear habitat capability is stable during the first period and exhibits a marked increase (+13%) in the second with increase in Montane Hardwood Conifer 5M and 5D.

Carnivore and Furbearer
Species typically associated with early stages of forest development (ringtail cat, bobcat, mountain lion, gray fox and striped skunk) all exhibit habitat capability declines in the Current to 2030 period with reduction in extent of Redwood 2D, 4P, Montane Hardwood Conifer 4M and Douglas-fir 4P. These trends continue into the second period with a generally marked reduction in habitat capability. Change in extent of Montane Hardwood Conifer 4m and 4D was principally responsible for the trends in 2030-2060. Potential Pacific fisher habitat capability is stable in the Current to 2030 period and increases slightly (+5%) in the second period with increase in extent of Montane Hardwood Conifer 5M and 5D. Potential marten habitat capability remains stable when considering the 60-year projection interval (-2% in the Current to 2030 period and +3% in the 2030-2060 period).

Bats
Habitat capability for all bat species, with the exception of the long-eared myotis (-1% and -13%) and Western red bat (0% and +7%) was stable over both time periods. Long-eared myotis exhibited a decline in the second period with a reduction in extent of Montane Hardwood Conifer 4M and 4D. The Western red bat exhibited an increase in habitat capability with increase in acreage of Montane Hardwood Conifer 5M and 5D.

Alternative B—Inside JDSF

In general, model outputs for alternative B within JDSF indicate an increase in early seral acreage representation and a moderate shift towards higher size classes, notably between size classes 3 and 4. (Table VII.6.6.20; Figure VII.6.6.11).

Other forest types and stages show a large increase in extent. The Redwood and Douglas-fir small tree with dense canopy closure (RDW 4D and DFR 4D) show a large increase in extent. Redwood 6 shows a decrease in extent from current conditions to 2060. The most pronounced changes in forest extent over the planning period are found in the large decrease in Montane Hardwood Conifer 4M, 4D and Redwood 3D and increase later in the planning period in Redwood 4D and Montane Hardwood Conifer 6.

Under alternative B species with a preference for Redwood large tree and dense canopied forest conditions (later stages of forest development) showed the largest percentage decline in habitat capability (Redwood 6). Similarly, species associated with stages of forest development composed of small trees, moderate to dense canopies, and a well developed shrub understory component also decline (Montane Hardwood Conifer 4M, 4D). The largest increases in habitat capability are exhibited by those species finding high levels of habitat suitability in small tree (CWHR size class 4) and dense levels of canopy closure particularly Redwood 4D and Douglas-fir 4D as well as more advanced stages of forest development (Montane Hardwood Conifer 6) later in the planning period.

Table VII.6.6.20. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative B.							
CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1	423	274	639	MHC6	2683	3572	6816
CPC2P	608			RDW2M		2643	141
DFR2D		608		RDW2D	647		446
DFR3M		378	859	RDW3M		447	96
DFR3D			14	RDW3D		5521	118
DFR4P	1725			RDW3S		985	
DFR4M			11	RDW3P		74	
DFR4D	1854	1576	4446	RDW4M	437	875	710
DFR5P		26	26	RDW4D	1686	276	8874
DFR5D		0	3	RDW4S			42
DFR6		1822	2234	RDW4P	847	15	
MHC4M	7928	3959		RDW5P		566	572
MHC4D	3940	1885	45	RDW5D		1	65
MHC5M		3	790	RDW6	25873	23116	21424
MHC5D		28	280				

For the Current to 2030 period, 144 species exhibited declines in habitat capability (Table VII.6.6.21). Fifty-four (54) species exhibited increases in habitat capability and 3 species remained unchanged. For the 2030 to 2060 period, 108 species exhibited declines in habitat capability. Habitat is not expected to occur for 2 species given upland habitat modeling results (Northern Harrier and California Towhee). Five species experienced no change in habitat capability and 86 species improved.

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to decline in the first period (-7%) given reduction in extent of Redwood 6. Although modeling results project an increase in habitat capability for this species in the second period (+24%), the increase is based on a marked improvement in the representation of Redwood 4D and Douglas-fir 4D acreage. Neither of these types represents forest conditions likely to be used by murrelets for nesting and therefore habitat capability likely continues to decline for this species under Alternative B in the second period. Northern Spotted Owl habitat capability declines slightly in the first period (-2%) but increases markedly in the 2030-2060 period (+19%) with increase in representation of Redwood 4D, Montane Hardwood Conifer 5M and 6 and Douglas-fir 4D and 6.

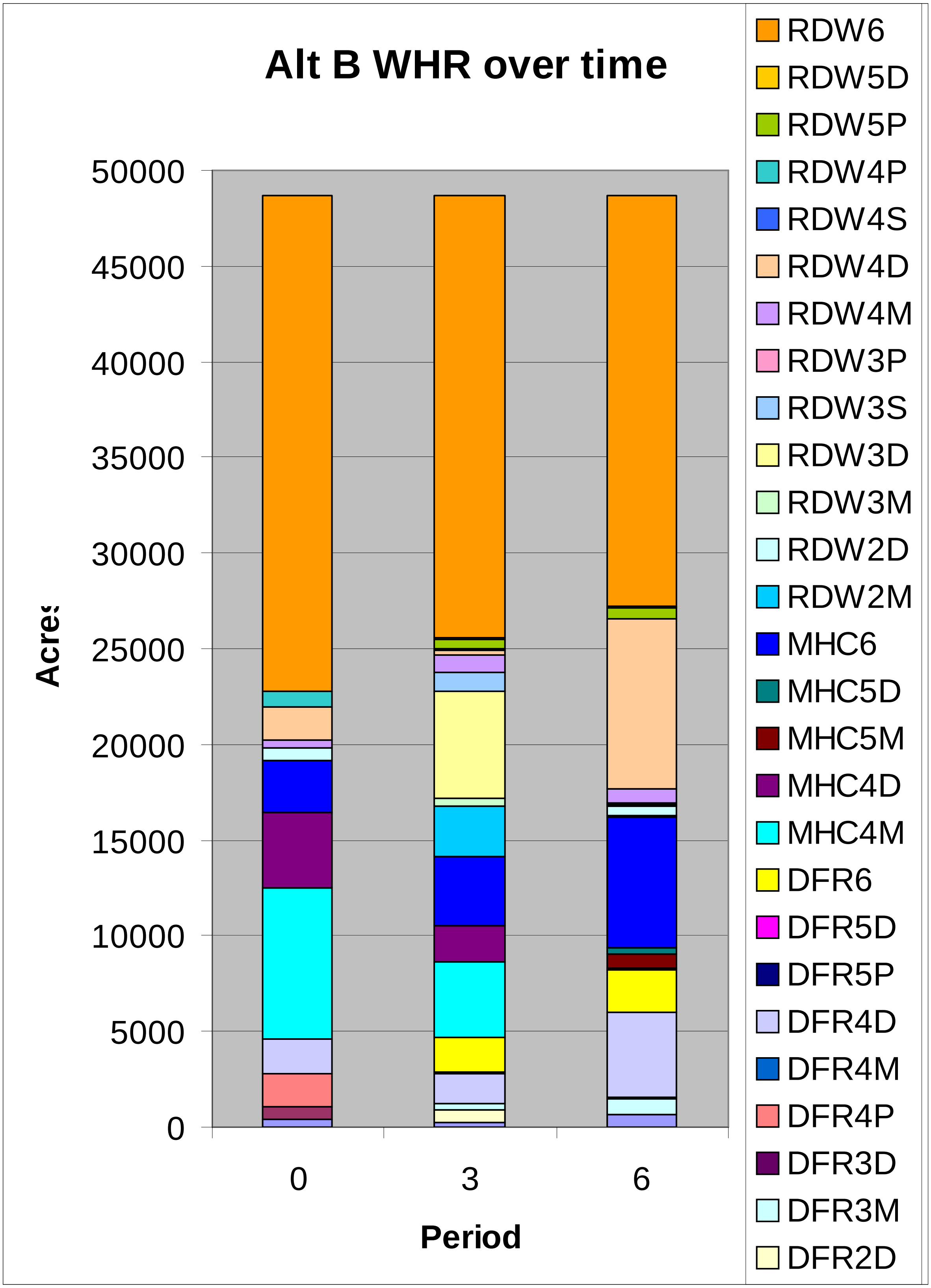


Figure VII 6.6.11. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative B.

Table VII.6.6.21. Percent Change In Habitat Capability For Species Occurring In Jackson Demonstration State Forest For Two Time Periods: Current To 2030 And 2030-2060. Alternative B.		
	Current To 2030	**2030-2060**
Neotropical Migrants		
Bullock's Oriole	-53.3	-74.3
Tree Swallow	-52.1	-83.5
Northern Rough-Winged Swallow	-52.1	-73.5
Chipping Sparrow	-37.6	1.8
Nashville Warbler	-37.0	-22.4
Yellow Warbler	-33.3	-23.5
Warbling Vireo	-18.9	-3.9
Fox Sparrow	-17.1	-66.7
Black-Headed Grosbeak	-17.0	3.4
Western Tanager	-15.4	0.4
Violet-Green Swallow	-14.4	-0.4
Yellow-Rumped Warbler	-14.4	2.8
Western Wood-Pewee	-13.0	-4.3
Black-Throated Gray Warbler	-9.8	0.0
Rufous Hummingbird	-6.9	-10.8
Hermit Warbler	-5.8	15.7
Olive-Sided Flycatcher	-5.1	6.2
Chestnut-Backed Chickadee	-2.3	12.7
Hermit Thrush	-1.5	-2.3
Townsend's Warbler	-0.3	6.8
Vaux's Swift	0.1	17.9
Wilson's Warbler	0.8	-1.8
Purple Martin	1.3	16.9
Orange-Crowned Warbler	2.4	-11.0
Cedar Waxwing	7.5	-8.9
Swainson's Thrush	8.5	-6.2
Allen's Hummingbird	14.4	9.0
White-Crowned Sparrow	26.9	51.5
MacGillivray's Warbler	35.3	-52.2
Golden-Crowned Sparrow	115.4	-78.6
Lazuli Bunting	133.3	-85.7
Carnivore and Furbearer		
American Marten	-27.9	13.3
Ermine	-27.0	17.2
Fisher	-11.3	20.1
Mountain Lion	-9.0	-18.0
Striped Skunk	-8.8	-8.0
Raccoon	-5.7	4.2
Coyote	7.5	-12.5
Long-Tailed Weasel	11.1	-10.4
Ringtail	14.1	-17.8
Gray Fox	16.8	-36.2
Bobcat	31.7	-21.1

Table VII.6.6.21. Percent Change In Habitat Capability For Species Occurring In Jackson Demonstration State Forest For Two Time Periods: Current To 2030 And 2030-2060. Alternative B.

	Current To 2030	2030-2060
Game Species		
Wild Turkey	-34.9	-17.9
Blue Grouse	-25.6	23.1
Mourning Dove	-23.0	-7.0
Wild Pig	-19.3	-5.2
Band-Tailed Pigeon	-19.0	11.9
Western Gray Squirrel	-9.9	1.6
Mule Deer	-1.9	-6.0
California Quail	-0.7	-1.9
Black Bear	7.2	5.9
Small Mammals		
Botta's Pocket Gopher	-56.5	30.0
Vagrant Shrew	-22.1	-18.9
California Ground Squirrel	-10.3	-3.8
Fog Shrew	-6.9	9.4
Trowbridge's Shrew	-6.9	9.4
California Red Tree Vole	-5.2	18.6
Western Harvest Mouse	-3.1	-81.7
Douglas' Squirrel	-2.7	15.4
Western Red-Backed Vole	-2.5	8.1
Sonoma Chipmunk	-2.1	-34.9
Yellow-Cheeked Chipmunk	-2.1	-17.7
Shrew-Mole	-0.5	15.7
Northern Flying Squirrel	0.0	10.3
Long-Tailed Vole	0.8	-49.6
Dusky-Footed Woodrat	5.3	-4.3
Pacific Jumping Mouse	8.7	-31.2
Pinon Mouse	12.2	-22.6
California Vole	37.7	22.0
Black Rat	114.0	0.0
Creeping Vole	148.1	-79.1
Brush Rabbit	153.8	-87.9
Coast Mole	2233.3	-90.0
Raptors		
Northern Harrier	-100.0	
Short-Eared Owl	-53.8	0.0
Barn Owl	-41.4	-67.9
Red-Shouldered Hawk	-33.6	-79.5
Merlin	-30.5	-77.2
Northern Goshawk	-21.8	7.3
Peregrine Falcon	-16.6	8.6
American Kestrel	-16.2	4.1
Red-Tailed Hawk	-14.4	21.3
Great Horned Owl	-13.9	1.6
Cooper's Hawk	-13.2	-5.8

Table VII.6.6.21. Percent Change In Habitat Capability For Species Occurring In Jackson Demonstration State Forest For Two Time Periods: Current To 2030 And 2030-2060. Alternative B.

	Current To 2030	2030-2060
Golden Eagle	-11.0	-26.4
Northern Pygmy Owl	-8.6	-0.6
Bald Eagle	-8.5	-0.5
Northern Saw-Whet Owl	-8.1	9.6
Osprey	-5.8	11.5
Western Screech Owl	-3.3	-6.4
Sharp-Shinned Hawk	-2.1	-0.3
Spotted Owl	-1.5	18.9
Turkey Vulture	-0.2	-0.9
White-Tailed Kite	1100	-92.5
Primary Cavity Excavators		
Red-Breasted Sapsucker	-14.7	13.8
Pileated Woodpecker	-14.5	27.4
Northern Flicker	-12.2	-1.2
Acorn Woodpecker	-9.3	-0.5
Downy Woodpecker	-6.6	-1.8
Hairy Woodpecker	-3.2	2.7
Reptiles		
Ringneck Snake	-41.6	30.8
Gopher Snake	-38.4	-27.5
Western Pond Turtle	-25.0	-84.8
Western Skink	-21.5	-13.1
Common Kingsnake	-21.1	-1.8
Western Rattlesnake	-18.2	-16.6
Racer	-7.8	-22.6
Rubber Boa	-7.5	5.0
Western Terrestrial Garter Snake	-5.6	-6.4
Sagebrush Lizard	0.0	79.5
Southern Alligator Lizard	4.0	-3.8
Sharp-Tailed Snake	4.7	-11.8
Western Fence Lizard	8.9	-14.3
Northern Alligator Lizard	13.2	-26.9
Common Garter Snake	27.0	-2.7
Amphibians		
Arboreal Salamander	-46.2	14.3
Western Toad	-7.9	-3.8
Tailed Frog	-6.0	7.8
Rough-Skinned Newt	-3.3	2.5
Red-Bellied Newt	-2.7	-1.8
Pacific Chorus Frog	-2.3	-4.9
Northwestern Salamander	-1.0	8.6
Clouded Salamander	-0.4	3.0
Foothill Yellow-Legged Frog	0.3	0.3
Bullfrog	2.0	-7.0
Southern Seep Salamander	2.4	2.7

Table VII.6.6.21. Percent Change In Habitat Capability For Species Occurring In Jackson Demonstration State Forest For Two Time Periods: Current To 2030 And 2030-2060. Alternative B.

	Current To 2030	2030-2060
Black Salamander	3.8	1.7
Pacific Giant Salamander	4.3	-1.8
Ensatina	4.9	-1.7
Red-Legged Frog	7.2	2.2
California Slender Salamander	18.1	1.1
Bats		
Big Brown Bat	-23.3	-16.8
Long-Eared Myotis	-15.1	0.8
Hoary Bat	-14.1	4.9
Western Red Bat	-12.5	14.8
Long-Legged Myotis	-11.9	-5.8
California Myotis	-10.5	-12.9
Little Brown Myotis	-8.3	1.4
Silver-Haired Bat	-7.8	3.7
Yuma Myotis	-7.0	-1.5
Fringed Myotis	-7.0	-3.0
Townsend's Big-Eared Bat	-3.5	1.8
Pallid Bat	0.9	6.4
Resident And Other Species Not Assigned To Species Groups: Percent Change In Habitat Capability		
Birds		
California Towhee	-100.0	
American Crow	-72.2	900.0
Pygmy Nuthatch	-52.9	-83.3
Western Bluebird	-50.4	-52.2
House Wren	-40.3	-36.8
Anna's Hummingbird	-36.6	-15.3
Western Scrub-Jay	-36.5	-18.2
Black Phoebe	-36.3	-15.4
Bushtit	-36.2	-18.9
Oak Titmouse	-35.9	-20.5
Western Meadowlark	-33.3	-50.0
Common Nighthawk	-31.6	17.6
White-Breasted Nuthatch	-30.6	4.8
Lesser Goldfinch	-30.3	226.1
Red Crossbill	-20.0	22.4
Great Egret	-19.0	21.7
House Finch	-15.8	-62.5
Purple Finch	-13.1	4.3
Hutton's Vireo	-12.2	-5.2
Common Raven	-12.1	12.1
American Robin	-11.7	-8.0
Wood Duck	-11.7	33.8
Great Blue Heron	-10.6	16.1
Red-Breasted Nuthatch	-9.6	14.4

Table VII.6.6.21. Percent Change In Habitat Capability For Species Occurring In Jackson Demonstration State Forest For Two Time Periods: Current To 2030 And 2030-2060. Alternative B.		
	Current To 2030	**2030-2060**
Evening Grosbeak	-7.5	12.9
Golden-Crowned Kinglet	-7.0	8.8
Green Heron	-6.9	8.0
Marbled Murrelet	-6.7	24.3
Mountain Quail	-6.7	-3.7
Ruby-Crowned Kinglet	-6.3	-1.8
Barn Swallow	-6.0	-9.5
Dark-Eyed Junco	-5.9	-5.2
Pine Siskin	-4.6	2.2
Brown Creeper	-4.4	8.0
Brown-Headed Cowbird	-3.3	-4.3
Steller's Jay	-1.6	2.6
Brewer's Blackbird	-0.9	-8.0
European Starling	-0.9	-2.5
Pacific-Slope Flycatcher	-0.7	3.1
Lark Sparrow	0	0
Wrentit	0.4	-27.0
White-Throated Sparrow	0.9	-0.5
Winter Wren	2.2	5.8
Gray Jay	4.9	11.8
Varied Thrush	6.7	5.4
Spotted Towhee	26.8	-24.0
Bewick's Wren	37.0	63.5
Song Sparrow	78.9	20.6
American Goldfinch	134.6	49.2
Mammals		
Broad-Footed Mole	-50.0	-40.0
Black-Tailed Jackrabbit	-40.2	-77.6
American Beaver	-37.1	-22.7
Common Porcupine	-4.9	-11.3
Deer Mouse	-3.5	-11.4
Virginia Opossum	4.3	-6.4
House Mouse	9.2	-55.5
Norway Rat	12.5	2.8
American Badger	100.0	0.0

Small Mammals
Western harvest mouse, Sonoma chipmunk and California ground squirrel exhibited declines in habitat capability in both planning periods. The decline in the Current to 2030 period was principally due to decrease in acreage of Montane Hardwood Conifer 4M and 4D. Larger declines in habitat capability in the 2030-2060 period occur for the Western harvest mouse (-82%) and Sonoma chipmunk (-35%). Habitat capability decline for these species is related to reduction in extent of Redwood 2M, 3D, 3S, and Montane Hardwood Conifer 4M, 4D. Botta’s pocket gopher habitat capability declines markedly in the first

period (-57%) with decrease in extent of Douglas-fir 4P and Redwood 4P. Creation of early seral stages of forest development and open canopies in the 2030-2060 period result in a marked increase in habitat capability for this species (+30%).

The red-tree vole exhibited a 5% decline in habitat capability in the Current to 2030 period but a 19% increase in the 2030 to 2060 period. Decline in extent of Douglas-fir 4D, Redwood 6 , Redwood 4D, and Montane Hardwood Conifer 4M in the Current to 2030 period and increase in extent of Redwood 4D and Douglas-fir 4D and 6 and Montane Hardwood Conifer 6 in the 2030 to 2060 period is principally responsible for these changes.

Northern flying squirrel habitat capability remained stable in the Current to 2030 period and increased (+10%) in the 2030-2060 period. Habitat capability increase in the second period was principally due to increase in the extent of Douglas-fir 4D and 6, Redwood 4D and Montane Hardwood Conifer 6.

Habitat capability for the dusky-footed woodrat increase slightly (+5%) in the first period and declined by a similar amount (-4%) in the second period.

Raptors
Species exhibiting large percent decrease in habitat capability in the Current to 2030 period were Barn Owl, Red-shouldered Hawk, and Short-eared Owl. Reduction in extent of Montane Hardwood Conifer 4M negativity affected Barn Owl and Red-shouldered Hawk habitat capability. Short-eared Owl habitat capability declined with reduction in the Douglas-fir 4P stage of forest development. Habitat capability continued to decline in the second period for the Barn Owl and Red-shouldered Hawk with continued reduction in extent of Montane Hardwood Conifer 4M and 4D. Accipiter species (Goshawk, Cooper's Hawk, and Sharp-shinned Hawk) exhibited declines with reduction in Montane Hardwood Conifer 4M and 4D and Redwood 4D during the first period. Sharp-shinned Hawk habitat capability is stable in the 2030-2060 period. Goshawk habitat capability increases (+7%) in the 2030-2060 period with increase in acreage of Montane Hardwood Conifer 5M, 6 and Douglas-fir 4D. Cooper's Hawk habitat capability continues to decline in the 2030-2060 period with reduction in extent of Montane Hardwood Conifer 4M and 4D and Redwood 2M and 3D.

Neotropical Migrants
Large decreases in habitat capability occur for those Neotropical migrants exhibiting a preference for Montane Hardwood Conifer 4M and 4D in the Current to 2030 and 2030-2060 period. These species include Bullock's Oriole, Tree Swallow, Northern Rough-winged Swallow, Yellow Warbler, and Nashville Warbler. Olive-sided Flycather habitat capability declines slightly in the Current to 2030 period but increases by a similar amount in the 2030-2060 period.

Vaux's Swift and Purple Martin habitat capability is stable in the Current to 2030 period. Increase in representation of Montane Hardwood Conifer 5M and 6 and Douglas-fir 6 is principally responsible for a marked increase in habitat capability in the 2030-2060 period (+18% and +17% respectively).

Species showing an increase in habitat capability during the Current to 2030 period are generally typical of early to mid-stages of Redwood forest development. Orange-crowned Warbler, Swainson's Thrush and MacGillivray's Warbler all exhibit increases in habitat capability with increase in Redwood 2M and 3D in the Current to 2030 period. These species exhibit declines in habitat capability with growth of these forest types into later stages of forest development and reduction in extent of Montane Hardwood Conifer 4M. Marked decline in Warbling Vireo habitat capability (-19%) in the Current to 2030 period is principally due to a reduction in extent of Montane Hardwood Conifer 4M. This species continues to exhibit a slight decline in habitat capability during the 2030-2060 period (-4%) with further reduction in Montane Hardwood Conifer 4M and 4D.

Game Species

The preference of most game species for early to mid stages of mast producing forest conditions (Montane Hardwood Conifer 4M and 4D) is clear. Wild Turkey (an introduced exotic species), wild pig (an introduced exotic species), Band-tailed Pigeon, Mourning Dove, and gray squirrel all exhibit marked decline in habitat capability during the Current to 2030 period principally as a result of decline in extent of Montane Hardwood Conifer 4M, 4D and Douglas-fir 4P. The negative trend in habitat capability for Wild Turkey, wild pig and Mourning Dove continues into the 2030-2060 period with additional decline in extent of Montane Hardwood Conifer 4M, 4D and Redwood 3D. Band-tailed pigeon, gray squirrel and Blue Grouse habitat capability increases in the 2030-2060 period with increase in representation of Montane Hardwood Conifer 6, Redwood 3D, 4D and Douglas-fir 4D, 6. California Quail habitat capability remains stable over the two time periods. Black bear exhibit a modest increase in habitat capability with increase in extent of Redwood 2M, 3D and 4M and Montane Hardwood Conifer 6 in the Current to 2030 period and Redwood 4D, Douglas-fir 4D and Montane Hardwood Conifer 6 in the 2030 to 2060 period. Mule deer habitat capability shows a slight decline in both time periods with decrease in acreage of Montane Hardwood Conifer 4M, Douglas-fir 4P and Redwood 3M, 3S.

Carnivore and Furbearer

Reduction in acreage of Montane Hardwood Conifer 4M, 4D and Douglas-fir 4P in the Current to 2030 period is largely responsible for loss of habitat capability for the ermine (-27%) and mountain lion (-9%). Ermine habitat capability improves in the 2030-2060 period (+17%) with increase in extent of Montane Hardwood Conifer 5M, 6 and Douglas-fir 4D. Mountain lion habitat capability continues to decline (-18%) with reduction in extent of Montane Hardwood Conifer 4M and Redwood 2M, 3D. in the second period.

Ringtail cat and bobcat exhibit marked increases in habitat capability over the Current to 2030 period (+14% and +32% respectively). Increase in acreage of early stages of Redwood forest development (Redwood 2M, 3D, 3S) benefited these species. However, this trend reverses in the second period (-18% and -21% respectively) as these early stages of forest development mature, combined with a reduction in extent of Montane Hardwood Conifer 4M.

Potential marten habitat capability declines (-28%) in the first period with a reduction in acreage of Montane Hardwood Conifer 4M, 4D and Douglas-fir 4P. However, habitat capability improves in the second period (+13%) with increase in extent of Montane

Hardwood Conifer 5M, 6 and Douglas-fir 4D and 6. Potential fisher habitat also declines in the first period (-11%) with reduction in acreage of Redwood 4D, 6 and Montane Hardwood Conifer 4M, 4D. However, like the marten, habitat capability improves (+20%) in the second period with increase in representation of Redwood 4D, Montane Hardwood Conifer 6, 5M and Douglas-fir 4D.

Bats

All bat species, with the exception of the pallid bat (no change) exhibited declines in habitat capability during the Current to 2030 period. Reduction in Montane Hardwood Conifer 4M, 4D and Redwood 4D, 6 and Douglas-fir 4P acreage during this period reduced bat habitat capability.

Habitat capability stabilizes or improves for most species in the second period. Habitat capability continues to decline however for the California myotis (-12%) and big brown bat (-17%) with reduction in Montane Hardwood Conifer 4M, 4D and Redwood 2M, 3S.

Alternative C1 Project Alternative—Inside JDSF

In general, model outputs for alternative C1 within JDSF indicate a decrease in acreage of large size and multistoried canopy condition in Redwood (RDW6) and a roughly equivalent increase in acreage of Montane Hardwood-Conifer (MHC6).

Other marked decreases in forest type and stage occur in the small tree size and moderate to dense canopy closure classes of the Montane Hardwood Conifer type, including Montane Hardwood Conifer MHC (4M,4D) and Redwood 3D.

Other forest types and stages show a large increase in extent. The redwood small tree with dense canopy closure (RDW 4D) shows a large increase in extent over the projection interval. The Montane Hardwood Conifer large tree and multistoried stage (MHC6) increases substantially over the projection interval (Table VII.6.6.22; Figure VII.6.6.12).

The most pronounced changes in forest extent over the planning period are found in the decrease in Redwood 6 and Montane Hardwood Conifer 4M, 4D and increase in Redwood 4D and Montane Hardwood Conifer 5M and 6. Loss or gain in extent of these stages of forest development is largely responsible for change in the habitat capability of species potentially occurring on JDSF under alternative C1. General lack or short-term presence of the earliest stages of forest development, shrub associations, and open canopy conditions minimize the occurrence of a shrub or an understory component utilized by certain Neotropical migrant birds, small mammals and reptiles.

In general, species under alternative C1 with a preference for small sized trees (size class 4) and moderate to dense forest canopy conditions (early to mid stages of forest development) and in the Montane Hardwood Conifer type showed the largest percentage decline in habitat capability. Reduction in extent of Redwood 6 also had a negative influence on habitat capability.

Table VII.6.6.22. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative C1.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1M	423	507	2057	MHC6	2683	2470	7641
CPC2P	608			RDW2P			1
DFR2D		608		RDW2M		556	614
DFR3M		67	608	RDW2D	647	791	316
DFR3D		51		RDW3P		28	
DFR4P	1725			RDW3M		842	49
DFR4M		573	109	RDW3D		3985	832
DFR4D	1854	2981	1737	RDW4P	847	6	
DFR5P		155	155	RDW4M	437	684	135
DFR5D		34	71	RDW4D	1686	3696	8760
DFR6		1022	1835	RDW4S			62
MHC3D		6		RDW5P		483	489
MHC4M	7928	3504	120	RDW5M			81
MHC4D	3940	4034	254	RDW5D		21	83
MHC5M		42	1077	RDW6	25873	21476	21068
MHC5D		28	496				

The largest increases in habitat capability are exhibited by those species finding high levels of habitat suitability in small tree (CWHR size class 4) and dense levels of canopy closure, particularly Redwood 4D. Increase in acreage of Montane Hardwood Conifer 6 and to a lesser extent Douglas-fir 6 (large tree, multi-storied and dense canopy) improved habitat capability for species preferring this level of forest development.

For the Current to 2030 period, 148 species exhibited declines in habitat capability. Five species exhibited no change and 48 species showed positive trends in habitat capability.

For the 2030 to 2060 period, 134 species exhibited declines in habitat capability. One species (California Towhee) is not expected to occur in the 2030-2060 period given modeling results. Four species exhibited no change and habitat capability increased for 62 species (Table VII.6.6.23).

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

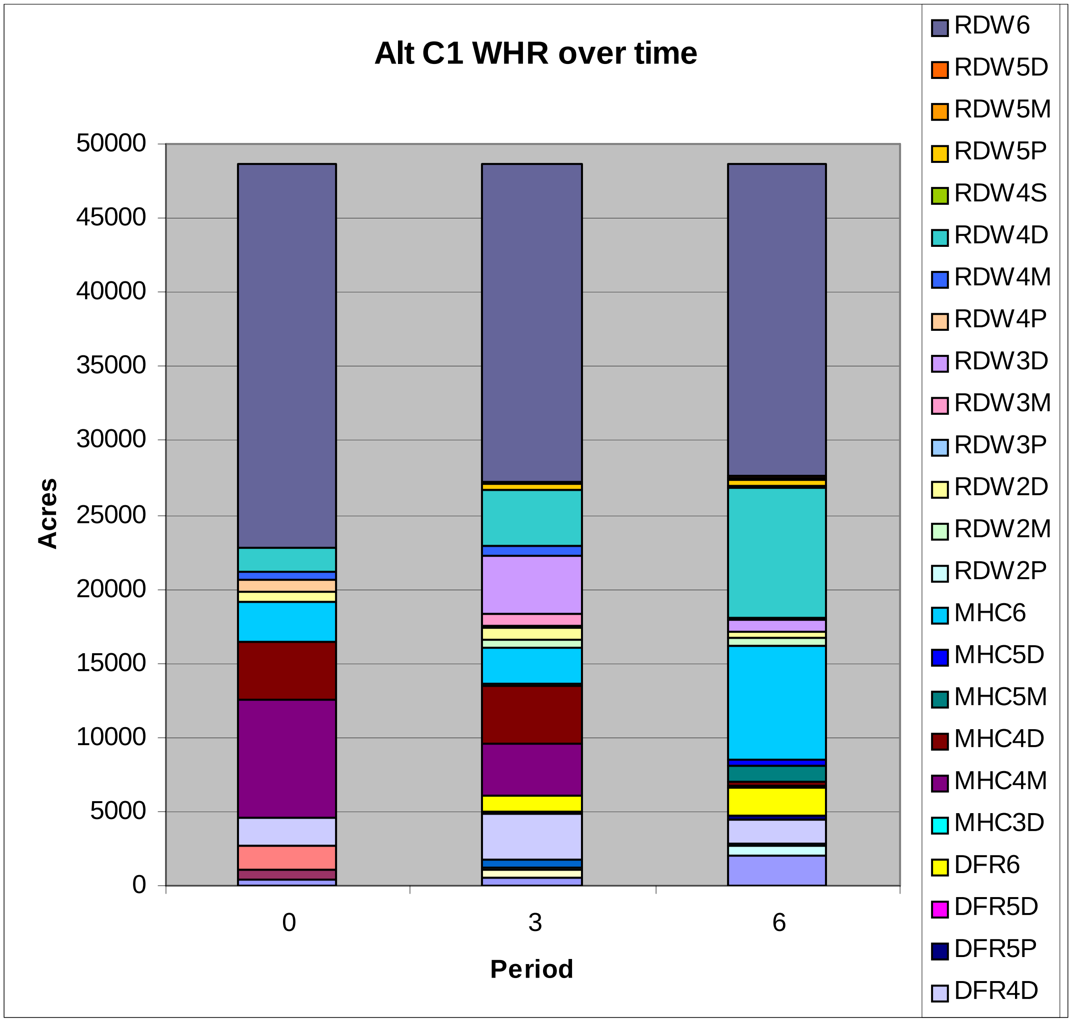


Figure VII 6.6.12. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative C1.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to decline in the first period (-7%) given reduction in extent of Redwood 6. Although modeling results project an increase in habitat capability for this species in the second period (+13%), the increase is based on a marked improvement in the representation of Redwood 4D acreage. This forest type does not represent forest conditions likely to be used by murrelets for nesting and therefore habitat capability is unlikely to improve as markedly as modeling results suggest. Improvement in the extent of Douglas-fir 6 however indicates some improvement in habitat capability for this species under Alternative C1. Northern Spotted Owl habitat capability in the Current to 2030 period remained stable and increased by 13% in the 2030 to 2060 period primarily as a result of increases in extent of Montane Hardwood Conifer 6 and Redwood 4D.

Table VII.6.6.23. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C1.

	Current to 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-66.7	500.0
Golden-Crowned Sparrow	-53.8	333.3
Bullock's Oriole	-53.3	-100.0
Fox Sparrow	-47.6	-80.0
Yellow Warbler	-40.2	-18.0
Chipping Sparrow	-34.3	-20.2
Tree Swallow	-32.1	-93.8
Northern Rough-Winged Swallow	-29.6	-64.7
Nashville Warbler	-25.1	-41.8
Warbling Vireo	-22.5	-4.6
Purple Martin	-19.2	36.5
Yellow-Rumped Warbler	-16.4	-3.8
Black-Headed Grosbeak	-14.6	-3.6
Western Wood-Pewee	-14.6	-7.3
Rufous Hummingbird	-14.2	-7.3
Black-Throated Gray Warbler	-13.7	1.0
Western Tanager	-13.1	-8.1
Violet-Green Swallow	-12.6	-7.5
Olive-Sided Flycatcher	-7.4	4.5
Hermit Warbler	-4.3	5.9
Vaux's Swift	-2.6	14.2
Cedar Waxwing	-1.7	-8.5
Chestnut-Backed Chickadee	-1.2	1.9
Hermit Thrush	-1.2	-8.6
White-Crowned Sparrow	0.0	184.6
Townsend's Warbler	1.0	-2.7
Wilson's Warbler	1.2	-6.1
Orange-Crowned Warbler	8.6	-17.8
Swainson's Thrush	10.4	-12.9
Allen's Hummingbird	28.9	-12.0
MacGillivray's Warbler	45.6	-56.2
Carnivore and Furbearer		
American Marten	-19.9	-15.9
Ermine	-17.6	-13.5
Mountain Lion	-15.9	-12.6
Raccoon	-9.2	3.1
Striped Skunk	-7.9	-5.4
Fisher	-7.3	7.5
Coyote	3.8	-7.0
Long-Tailed Weasel	4.2	-6.4
Gray Fox	5.6	-28.2
Ringtail	9.4	-12.9
Bobcat	14.3	-6.8
Game Species		

Table VII.6.6.23. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C1.

	Current to 2030	2030-2060
Wild Turkey	-29.9	-17.1
Wild Pig	-26.1	1.4
Blue Grouse	-18.6	-12.5
Mourning Dove	-16.2	-25.3
Band-Tailed Pigeon	-13.4	-6.5
Western Gray Squirrel	-7.4	-5.0
Mule Deer	-2.3	-9.7
California Quail	-1.0	-2.6
Black Bear	4.1	1.5
Small Mammals		
Botta's Pocket Gopher	-56.5	430.0
Pacific Jumping Mouse	-33.0	-3.9
Vagrant Shrew	-21.3	2.1
Long-Tailed Vole	-17.8	-32.0
California Ground Squirrel	-15.3	5.5
Pinon Mouse	-14.8	24.2
Yellow-Cheeked Chipmunk	-10.0	-18.0
Western Red-Backed Vole	-6.9	7.6
Fog Shrew	-3.8	-1.6
Trowbridge's Shrew	-3.8	-1.6
California Red Tree Vole	-3.5	5.7
Western Harvest Mouse	-3.1	-38.7
Northern Flying Squirrel	-1.0	7.0
Sonoma Chipmunk	-0.5	-47.1
Shrew-Mole	-0.2	7.8
Douglas' Squirrel	6.0	-11.0
Dusky-Footed Woodrat	18.4	-16.6
Brush Rabbit	30.8	41.2
Creeping Vole	48.1	-75.0
California Vole	73.0	-1.9
Black Rat	124.0	-17.0
Coast Mole	1566.7	-74.0
Raptors		
Short-Eared Owl	-69.2	500.0
Barn Owl	-46.6	-36.6
Merlin	-40.2	-71.4
Red-Shouldered Hawk	-28.2	-74.7
Golden Eagle	-26.5	10.0
Great Horned Owl	-15.1	-0.4
Northern Goshawk	-15.1	-13.2
Bald Eagle	-13.7	0.5
Northern Pygmy Owl	-12.7	-2.5
American Kestrel	-11.3	2.1
Cooper's Hawk	-11.2	-9.5
Peregrine Falcon	-11.1	-2.3
Western Screech Owl	-7.5	-4.1

Table VII.6.6.23. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C1.		
	Current to 2030	**2030-2060**
Northern Saw-Whet Owl	-5.6	-1.0
Osprey	-4.8	3.3
Turkey Vulture	-1.9	-0.6
Spotted Owl	-1.1	13.4
Sharp-Shinned Hawk	-0.1	-5.4
White-Tailed Kite	0	140.0
Red-Tailed Hawk	1.3	-4.3
Northern Harrier	300.0	450.0
Primary Cavity Excavators		
Northern Flicker	-16.7	1.4
Pileated Woodpecker	-12.9	13.1
Downy Woodpecker	-12.5	1.2
Hairy Woodpecker	-11.5	6.2
Acorn Woodpecker	-10.2	-0.3
Red-Breasted Sapsucker	-8.0	-5.0
Reptiles		
Gopher Snake	-44.6	11.3
Ringneck Snake	-30.3	0.0
Racer	-28.7	-12.2
Western Skink	-28.5	-10.5
Western Rattlesnake	-25.2	-14.4
Sagebrush Lizard	-23.1	40.0
Common Kingsnake	-16.2	7.6
Western Pond Turtle	-13.6	-69.7
Western Terrestrial Garter Snake	-8.1	-6.1
Rubber Boa	-5.0	-6.4
Southern Alligator Lizard	-1.1	0.9
Western Fence Lizard	2.1	-6.0
Sharp-Tailed Snake	3.3	-14.7
Northern Alligator Lizard	4.1	-31.3
Common Garter Snake	19.0	-1.9
Amphibians		
Arboreal Salamander	-59.0	68.8
Western Toad	-6.9	-6.1
Pacific Chorus Frog	-6.6	-4.6
Clouded Salamander	-3.2	0.5
Tailed Frog	-2.8	0.2
Rough Skinned Newt	-1.3	-4.9
Red-Bellied Newt	-0.2	-8.9
Foothill Yellow-Legged Frog	0.0	-3.6
Bullfrog	0.2	-3.9
Northwestern Salamander	0.3	2.0
Black Salamander	2.5	-2.1
Southern Seep Salamander	2.7	0.1
Pacific Giant Salamander	3.6	-8.8

Table VII.6.6.23. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C1.

	Current to 2030	2030-2060
Ensatina	4.2	-3.7
Red-Legged Frog	6.5	-0.7
California Slender Salamander	11.7	-0.1
Bats		
Hoary Bat	-11.4	-6.8
Long-Legged Myotis	-10.7	-10.6
Long-Eared Myotis	-10.2	-15.2
Big Brown Bat	-9.3	-34.9
Little Brown Myotis	-7.5	-5.8
Silver-Haired Bat	-6.2	-5.0
Fringed Myotis	-4.9	-7.4
California Myotis	-4.2	-20.6
Yuma Myotis	-3.5	-0.7
Western Red Bat	-2.4	-7.2
Townsend's Big-Eared Bat	-0.9	0.0
Pallid Bat	8.3	14.5
Resident and other species not assigned to species groups: percent change in habitat capability		
Birds		
California Towhee	-100.0	
House Finch	-84.2	566.7
Western Meadowlark	-82.1	457.1
Western Bluebird	-60.7	-75.5
Anna's Hummingbird	-34.4	-37.7
Pygmy Nuthatch	-32.9	-93.6
Oak Titmouse	-29.6	-22.1
House Wren	-29.3	-40.7
Bushtit	-29.0	-15.6
Western Scrub-Jay	-28.8	-12.2
Black Phoebe	-26.5	-10.7
Common Nighthawk	-23.3	-16.7
White-Breasted Nuthatch	-22.8	-18.4
American Robin	-20.8	-6.7
Red Crossbill	-16.8	-26.6
Hutton's Vireo	-16.4	-4.7
Purple Finch	-16.1	-0.7
Great Blue Heron	-14.7	14.8
Great Egret	-14.4	5.9
Wood Duck	-13.3	29.6
Pine Siskin	-11.7	0.2
Common Raven	-10.2	2.5
Brown-Headed Cowbird	-9.1	0.0
Barn Swallow	-8.5	-6.0
Red-Breasted Nuthatch	-7.7	-3.4
Mountain Quail	-7.4	-4.7
Marbled Murrelet	-6.9	12.7

Table VII.6.6.23. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C1.

	Current to 2030	2030-2060
Lesser Goldfinch	-6.1	148.4
Ruby-Crowned Kinglet	-6.1	-8.9
European Starling	-5.8	2.1
Brown Creeper	-5.2	3.0
Golden–Crowned Kinglet	-4.2	-1.9
Evening Grosbeak	-3.6	-3.4
Green Heron	-3.2	-3.3
Dark-Eyed Junco	-1.7	-20.6
Steller's Jay	-0.3	-5.2
Lark Sparrow	0	400.0
White-Throated Sparrow	0.5	-1.8
Pacific-Slope Flycatcher	1.1	-4.7
Gray Jay	2.0	4.9
Winter Wren	4.7	-1.7
Varied Thrush	6.8	-2.7
Spotted Towhee	13.4	-29.0
Wrentit	18.2	-39.1
Brewer's Blackbird	26.2	-34.4
American Crow	36.1	61.2
Bewick's Wren	93.5	0.0
Song Sparrow	103.5	7.8
American Goldfinch	257.7	-8.6
Mammals		
Broad-Footed Mole	-85.0	566.7
Black-Tailed Jackrabbit	-41.7	-24.3
American Beaver	-28.6	-24.0
House Mouse	-8.3	-37.0
Common Porcupine	-4.1	-29.6
Virginia Opossum	-2.9	0.3
American Badger	0	371.4
Deer Mouse	0.8	-17.7
Norway Rat	12.1	-5.6

Small Mammals

Botta's pocket gopher, Western harvest mouse and California ground squirrel exhibited declines in percent habitat capability in the Current to 2030 planning period. This decline was due to decrease in acreage of Douglas-fir 4P, Redwood 4P, 6, and Montane Hardwood Conifer 4M. Percent change in habitat capability for the Western harvest mouse continues to decline into the 2030 to 2060 period given reduction in extent of Montane Hardwood Conifer 4M 4D, and Redwood 2D. Botta's pocket gopher exhibits a marked increase in habitat capability during the 2030-2060 period from early seral conditions resulting from modeled harvest activities.

The red-tree vole exhibited a 3.5% decline in habitat capability in the Current to 2030 period but a 5.7% increase in the 2030 to 2060 period. Decline in extent of Redwood 6 and Douglas-fir 4P and Montane Hardwood Conifer 4M in the Current to 2030 period and increase in extent of Redwood 4D, Montane Hardwood Conifer 6 and Douglas-fir 6 in the 2030 to 2060 period is principally responsible for these changes.

Northern flying squirrel habitat capability for the Current to 2030 period remained stable. In the 2030-2060 period habitat capability increases by 7% given increase in extent of Montane Hardwood Conifer 6, Redwood 4D and Douglas-fir 6.

Other small mammals show a marked increase in habitat capability over the Current to 2030 period. Increase in extent of Redwood 3D and 4D in the Current to 2030 period benefited the Dusky-footed woodrat, coast mole, and other small mammals. Habitat capability decreased by nearly an equal amount for the dusky-footed woodrat in the second period but only slightly for the coast mole.

Raptors

Species exhibiting large percent decrease in habitat capability in the Current to 2030 period were Barn Owl, Red-shouldered Hawk, and Short-eared Owl. Reduction in extent of Montane Hardwood Conifer 4M negativity affected Barn Owl and Red-shouldered Hawk capability. Short-eared Owl habitat capability declined with reduction in the Douglas-fir 4P stage of forest development. Accipiter species (Goshawk, Cooper’s Hawk,) exhibited declines with reduction in Montane Hardwood Conifer 4M (Sharp-shinned Hawk remained stable). Continued decline in extent of the Montane Hardwood Conifer 4M and 4D reduced habitat capability for these species in the 2030-2060 period also.

Primary Cavity Excavators

Modest to small declines in habitat capability for the 6 species of woodpeckers on JDSF occurs in the Current to 2030 period. Reduction in extent of Montane Hardwood Conifer 4M was the principal contributor to the reduction in habitat capability. Habitat capability generally stabilized or increased slightly in the 2030-2060 period. Pileated Woodpecker habitat capability was essentially stable when considered over both planning periods. Increase in the extent of Montane Hardwood Conifer 6 and Douglas-fir 6 compensated for decreases in the extent of Montane Hardwood Conifer 4M, 4D in the 2030-2060 period.

Neotropical Migrants

Largest decreases in percent change in habitat suitability occur for those Neotropical migrants exhibiting a preference for Montane Hardwood Conifer 4M in the Current to 2030 period. These species include Bullock’s Oriole, Tree Swallow, Northern Rough-winged Swallow, Yellow Warbler, and Nashville Warbler. These species continue to exhibit decline in habitat capability in the 2030 to 2060 period with decrease in Montane Hardwood Conifer 4M. Reduction in extent of Douglas-fir 4P, Redwood 6 and Montane Hardwood Conifer 4M in the Current to 2030 period negatively influences habitat capability (down 7%) for the Olive-sided Flycatcher. This trend improves in the 2030 to 2060 period (up 4.5%) with increase in Douglas-fir 6 Redwood 4D and Montane Hardwood Conifer 6 acreage. Warbling vireo habitat capability decreases in the Current to 2030 period with reduction in extent of Montane Hardwood Conifer 4M and Douglas-fir

4M. This trend is slightly downward (given increase in Montane Hardwood Conifer 6 acreage) in the 2030-2060 period with further decrease in acreage of Montane Hardwood Conifer 4M and 4D.

The Vaux's Swift and Purple Martin show a decrease in capability (3% and 19% respectively) in the Current to 2030 period given reduction in Redwood 6. Trend in habitat capability for both species is positive in the 2030 to 2060 period (14% and 36% respectively) with increase in extent of Montane Hardwood Conifer 6, and Douglas-fir 6. . Increase in Redwood 4D may also have had a positive influence on habitat capability of the Vaux's Swift in the 2030-2060 period. Reproductive habitat capability for these species is dependent on the availability of large snags or tree hollows as a source of nesting cavities.

Species showing an increase in habitat capability during the Current to 2030 period are generally typical of early to mid-stages of Redwood forest development. Orange-crowned Warbler, Swainson's Thrush (foraging and cover requirements) and MacGillivray's Warbler all exhibit increases in habitat capability with increase in Redwood 3D and 4D. Decline in extent of Redwood 3D and Montane Hardwood Conifer 4M, 4D largely contribute to decline in habitat capability for these species during the 2030-2060 period.

Game Species

The preference of most game species for early to mid stages of mast (acorns, berries) producing forest conditions (Montane Hardwood Conifer 4M and 4D) is clear. Wild Turkey (an introduced exotic species), wild pig (an introduced exotic species), Band-tailed Pigeon, Mourning Dove, and gray squirrel all exhibit decline in percent change of habitat capability during the Current to 2030 period. The modest negative trend exhibited by Blue Grouse in the Current to 2030 period with reduction in extent of Montane Hardwood Conifer 4M and Douglas-fir 4P continues although at a lower rate in the 2030 to 2060 period with decrease in acreage of Montane Hardwood Conifer 4D and 4M and Douglas-fir 4D and 4M. Black bear exhibit slight net increases in habitat capability when considering the Current to 2030 and 2030 to 2060 periods. Increase in Redwood 3D and 4M and Douglas-fir 6 in the Current to 2030 period and Redwood 4D and Montane Hardwood Conifer 6 in the 2030 to 2060 period benefited black bear. Mule deer and California Quail habitat capability remains essentially stable or exhibit slight decreases (10% decrease for mule deer in the 2030-2060 period in part due to change in Montane Hardwood Conifer 4M) in both planning periods.

Carnivore and Furbearer

Half of the carnivores and furbearer species potentially occurring on JDSF exhibit decreasing levels of habitat capability in the Current to 2030 period. Reduction in acreage of Montane Hardwood Conifer 4M, and Douglas-fir 4P in the Current to 2030 period is largely responsible for loss of habitat capability for the ermine and mountain lion. Reduction in acreage of these types and Redwood 6 also has a negative influence on potentially occupied habitat of marten and Pacific fisher. Habitat capability for marten, mountain lion, and ermine decreases in the 2030 to 2060 period principally as a result of reduction in extent of Montane Hardwood Conifer 4D. Potential Pacific fisher habitat capability exhibits a slight compensatory increase (+8%) with marked increase in acreage of Redwood 4D and Montane Hardwood Conifer 6 in the 2030-2060 period.

Ringtail cat and bobcat exhibit increases in habitat capability over the Current to 2030 period. Increase in acreage of early stages of Redwood forest development (RDW 3D) benefited these species in the Current to 2030 period reducing the effect of acreage decline in Montane Hardwood Conifer 4M. Habitat capability for these species shows a decrease in the 2030-2060 period rougly similar to the increase of the prior planning period with reduction in extent of Redwood 3D and Montane Hardwood Conifer 4M, 4D.

Bats

All bat species, with the exception of the pallid bat exhibited declines in habitat capability during the Current to 2030 period. Reduction in Montane Hardwood Conifer 4M, Douglas-fir 4P, and Redwood 6 acreage during this period reduced bat habitat capability.

Continued reduction in Montane Hardwood Conifer 4M, 4D and Redwood 3D acreage in the 2030 to 2060 period also negatively affects those bat species showing negative habitat capability trends in this period. Increase in Redwood 4D and Montane Hardwood Conifer 6 was responsible for the slowing or slightly positive trend in habitat capability for those bat species exhibiting this trend. Habitat capability increased for the pallid bat and stabilized for the Yuma myotis and Townsend's big-eared bat in the second period.

Alternative C2—Inside JDSF

In general, representation and extent of forest type and stage of development under alternative C2 are similar to those of alternative C1. Within JDSF there is a decrease in acreage of large size and multistoried canopy condition in Redwood (RDW6), but an increase in MHC6 and to a lesser degree DFR6 (Table VII.6.6.24; Figure VII.6.6.13).

Table VII.6.6.24. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative C2.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1M	423	539	3272	MHC6	2683	3639	8688
CPC2P	608			RDW2M		727	367
DFR2D		608		RDW2D	647	1691	375
DFR3D		88		RDW3M		139	165
DFR3M			608	RDW3D		4257	1567
DFR4P	1725			RDW4S			66
DFR4M		845	129	RDW4P	847	6	
DFR4D	1854	3100	1126	RDW4M	437	780	336
DFR5P		140	140	RDW4D	1686	3144	10444
DFR5D		48	65	RDW5P		496	502
DFR6		575	1366	RDW5M			65
MHC4M	7928	2878		RDW5D		21	83
MHC4D	3940	5243	334	RDW6	25873	19635	17332
MHC5M		25	1104				
MHC5D		28	521				

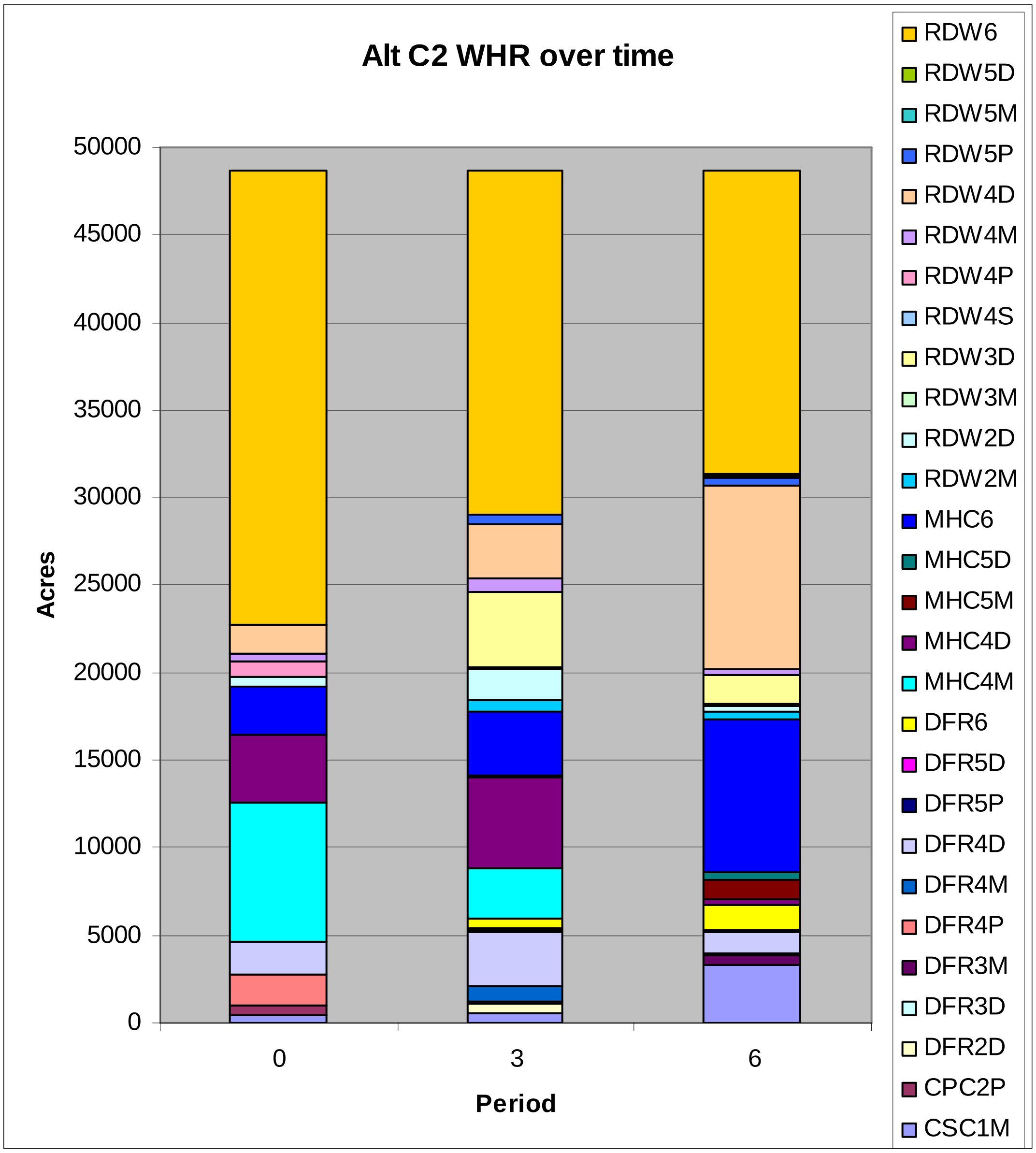


Figure VII. 6.6.13. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative C2.

Other marked decreases in forest type and stage occur in the small tree size and moderate to dense canopy closure classes of the Montane Hardwood Conifer type (MHC 4M and 4D). The Redwood small tree with dense canopy closure (RDW 4D), in part as a product of the decrease in RDW6, shows a large increase in extent. The Montane Hardwood Conifer large tree and multistoried stage (MHC6) and Douglas-fir (DFR 6) also increase.

The most pronounced changes in forest extent over the planning period are found in the decrease in RDW6 and MHC 4M, 4D and increase in RDW 4D, Montane Hardwood Conifer (MHC 6) and Douglas-fir (DFR 6). Like alternative C1 loss or gain in extent of these stages of forest development is largely responsible for change in the habitat capability of species potentially occurring on JDSF under alternative C2 (Table VII.6.6.25.). General lack or short-term presence of the earliest stages of forest development, shrub associations, and open canopy conditions minimize the occurrence of a shrub or an understory component utilized by certain Neotropical migrant birds, small mammals and reptiles.

In general, species under alternative C2 with a preference for small sized trees and moderate to dense forest canopy conditions (early to mid stages of forest development) and in the Montane Hardwood Conifer type (MHC 4M, 4D) showed the largest percentage decline in habitat capability. Reduction in extent of Redwood 6 also had a marked negative influence on habitat capability.

The largest increases in habitat capability are exhibited by those species finding high levels of habitat suitability in small tree (CWHR size class 4, 11-24" dbh) and dense levels of canopy closure in the Redwood type (RDW 4D). Increase in acreage of Montane Hardwood Conifer 6 and to a lesser extent Douglas-fir 6 (large tree, multi-storied and dense canopy) improved habitat capability for species preferring this level of forest development.

For the Current to 2030 period, 142 species exhibited declines in habitat capability. Six species exhibited no change and 53 species showed positive trends in habitat capability.

For the 2030 to 2060 period, 109 species exhibited declines in habitat capability. One species (California Towhee) is not expected to occur in the 2030-2060 period given habitat modeling results. One species exhibited no change. Habitat capability increased for 90 species.

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to decline in the first period (-13%) given reduction in extent of Redwood 6. Although modeling results project an increase in habitat capability for this species in the second period (+9%), the increase is based on a marked improvement in the representation of Redwood 4D acreage. This forest type does not represent forest conditions likely to be used by murrelets for nesting and therefore habitat capability is unlikely to improve as markedly as modeling results suggest. Habitat capability is likely stable or exhibiting a slight decline in the second period commensurate with increase in extent of Douglas-fir 6 and reduction in extent of the Redwood 6 type. Northern Spotted Owl habitat capability is stable to slightly negative in the Current to 2030 period (-4%%) but increases markedly in the 2030 to 2060 period (+18%) in spite of declines in Redwood 6 but as a result of additional acreage in the

Redwood 4D, Montane Hardwood Conifer 6 and Douglas-fir 6 stages of forest development.

Table VII.6.6.25. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C2.

	Current to 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-66.7	700.0
Bullock's Oriole	-65.3	-65.4
Fox Sparrow	-52.4	-68.0
Chipping Sparrow	-38.7	-6.3
Golden-Crowned Sparrow	-38.5	312.5
Yellow Warbler	-33.3	-13.2
Tree Swallow	-31.5	-82.3
Northern Rough-Winged Swallow	-30.5	-40.5
Nashville Warbler	-24.2	-32.0
Warbling Vireo	-18.9	-0.6
Purple Martin	-16.7	34.9
Yellow-Rumped Warbler	-14.4	-3.6
Rufous Hummingbird	-13.8	-3.6
Violet-Green Swallow	-11.8	-4.1
Black-Throated Gray Warbler	-11.0	6.7
Western Wood-Pewee	-10.7	-5.4
Western Tanager	-10.5	-4.5
Olive-Sided Flycatcher	-8.2	5.3
Black-Headed Grosbeak	-7.7	9.4
Vaux's Swift	-6.1	15.5
Hermit Warbler	-5.5	7.1
Chestnut-Backed Chickadee	-4.3	2.2
White-Crowned Sparrow	-3.8	268.0
Hermit Thrush	-2.7	-7.8
Townsend's Warbler	-2.0	-0.7
Cedar Waxwing	-0.8	-10.5
Wilson's Warbler	1.7	-5.7
Orange-Crowned Warbler	10.2	-11.4
Swainson's Thrush	10.6	-12.0
Allen's Hummingbird	25.8	4.9
MacGillivray's Warbler	47.4	-47.9
Carnivore and Furbearer		
Mountain Lion	-15.90	-7.67
American Marten	-11.97	-14.50
Raccoon	-10.19	4.39
Fisher	-8.55	8.33
Striped Skunk	-8.48	2.56
Ermine	-7.91	-14.84
Coyote	2.95	-3.39
Long-Tailed Weasel	6.48	-5.22

Table VII.6.6.25. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C2.

	Current to 2030	2030-2060
Ringtail	10.16	-2.84
Gray Fox	14.3	-25.5
Bobcat	22.17	-0.71
Game Species		
Wild Pig	-27.2	6.5
Wild Turkey	-20.6	-5.0
Mourning Dove	-16.9	-6.5
Blue Grouse	-10.2	-16.0
Band-Tailed Pigeon	-9.0	-6.2
Mule Deer	-3.0	-6.2
Western Gray Squirrel	-1.9	-2.8
California Quail	-1.4	0.9
Black Bear	5.4	6.2
Small Mammals		
Botta's Pocket Gopher	-43.5	461.5
Pacific Jumping Mouse	-25.2	-2.3
California Ground Squirrel	-16.6	9.0
Vagrant Shrew	-10.7	14.7
Western Red-Backed Vole	-8.4	8.0
California Red Tree Vole	-7.6	7.4
Yellow-Cheeked Chipmunk	-7.5	-20.2
Fog Shrew	-4.9	-0.1
Trowbridge's Shrew	-4.9	-0.1
Shrew-Mole	-4.8	5.5
Long-Tailed Vole	-1.7	-34.5
Northern Flying Squirrel	-1.7	6.5
Sonoma Chipmunk	1.6	-41.5
Pinon Mouse	5.8	16.5
Western Harvest Mouse	10.4	-27.4
Douglas' Squirrel	16.6	-8.5
Dusky-Footed Woodrat	22.5	-1.7
Brush Rabbit	73.1	20.0
California Vole	76.2	15.3
Creeping Vole	100.0	-94.4
Black Rat	146.0	-19.5
Coast Mole	1533.3	-73.5
Raptors		
Barn Owl	-57.9	39.3
Short-Eared Owl	-53.8	450.0
Merlin	-36.6	-73.1
Red-Shouldered Hawk	-29.1	-55.1
Great Horned Owl	-15.5	0.1
Bald Eagle	-13.7	4.0
Golden Eagle	-13.4	11.6
Northern Pygmy Owl	-12.9	-1.3

Table VII.6.6.25. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C2.

	Current to 2030	2030-2060
Northern Goshawk	-9.6	-10.1
Western Screech Owl	-8.7	-2.2
Cooper's Hawk	-7.5	-5.4
Peregrine Falcon	-7.2	2.0
Osprey	-6.7	5.6
Northern Saw-Whet Owl	-6.0	-0.3
Spotted Owl	-4.3	18.2
Turkey Vulture	-2.2	0.7
Sharp-Shinned Hawk	-1.9	-2.1
White-Tailed Kite	0	130.0
American Kestrel	0.4	12.4
Red-Tailed Hawk	11.8	4.1
Northern Harrier	300.0	675.0
Primary Cavity Excavators		
Northern Flicker	-16.7	3.8
Downy Woodpecker	-12.5	3.6
Hairy Woodpecker	-11.8	8.0
Pileated Woodpecker	-9.4	14.5
Acorn Woodpecker	-8.0	5.9
Red-Breasted Sapsucker	1.7	2.5
Reptiles		
Gopher Snake	-47.3	52.5
Sagebrush Lizard	-41.0	43.5
Ringneck Snake	-36.0	33.3
Racer	-29.6	2.5
Western Skink	-29.0	5.9
Western Rattlesnake	-25.7	1.3
Western Pond Turtle	-14.8	-56.0
Western Terrestrial Garter Snake	-8.8	-0.5
Common Kingsnake	-7.0	20.5
Rubber Boa	-4.6	-4.8
Southern Alligator Lizard	-1.4	4.0
Sharp-Tailed Snake	3.3	0.0
Northern Alligator Lizard	4.4	-23.4
Western Fence Lizard	14.1	-4.3
Common Garter Snake	25.3	3.7
Amphibians		
Arboreal Salamander	-38.5	37.5
Western Toad	-7.4	0.3
Pacific Chorus Frog	-7.0	-4.8
Tailed Frog	-6.5	5.5
Clouded Salamander	-3.2	-0.1
Rough-Skinned Newt	-2.3	-2.6
Foothill Yellow-Legged Frog	-0.3	-1.8
Bullfrog	0.0	-1.3

Table VII.6.6.25. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C2.

	Current to 2030	2030-2060
Northwestern Salamander	0.0	2.6
Red-Bellied Newt	0.4	-8.5
Pacific Giant Salamander	1.3	-9.8
Black Salamander	1.4	-2.3
Southern Seep Salamander	2.0	2.4
Ensatina	2.7	-2.7
Red-Legged Frog	4.3	0.9
California Slender Salamander	6.6	-1.8
Bats		
Hoary Bat	-11.6	-3.0
Big Brown Bat	-10.3	-30.4
Little Brown Myotis	-8.7	-1.4
Long-Eared Myotis	-8.6	-15.5
Long-Legged Myotis	-8.4	-6.7
Silver-Haired Bat	-8.1	-0.9
California Myotis	-7.4	-15.1
Fringed Myotis	-3.5	-2.9
Yuma Myotis	-2.1	6.5
Townsend's Big-Eared Bat	-1.8	4.5
Western Red Bat	2.7	3.1
Pallid Bat	7.4	26.7
Resident and other species not assigned to species groups: percent change in habitat capability		
Birds		
California Towhee	-100.0	
House Finch	-68.4	333.3
Western Meadowlark	-66.7	300.0
Western Bluebird	-56.3	-49.2
Anna's Hummingbird	-40.9	-16.4
Pygmy Nuthatch	-32.9	-81.9
Red Crossbill	-22.1	-35.1
House Wren	-22.0	-29.5
Oak Titmouse	-19.4	-12.7
American Robin	-19.1	-3.6
Bushtit	-18.8	-4.8
Western Scrub-Jay	-18.8	-0.6
Pine Siskin	-17.7	-1.1
Black Phoebe	-17.6	4.8
Great Blue Heron	-16.1	14.7
Common Nighthawk	-15.8	-14.3
Purple Finch	-15.6	-0.8
Great Egret	-15.3	7.1
Hutton's Vireo	-14.8	-4.2
White-Breasted Nuthatch	-14.8	-13.7
Marbled Murrelet	-13.3	9.1

Table VII.6.6.25. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative C2.

	Current to 2030	2030-2060
Wood Duck	-10.7	32.0
Common Raven	-10.3	3.0
Red-Breasted Nuthatch	-8.7	-1.4
Barn Swallow	-8.2	-0.8
Brown-Headed Cowbird	-7.9	0.9
Brown Creeper	-6.3	3.5
European Starling	-6.3	2.7
Green Heron	-6.0	1.0
Ruby-Crowned Kinglet	-5.2	-7.5
Mountain Quail	-4.9	-3.4
Golden-Crowned Kinglet	-4.7	-1.0
Evening Grosbeak	-4.2	-1.4
Gray Jay	-3.6	1.8
Steller's Jay	-1.0	-4.1
Lark Sparrow	0	600.0
White-Throated Sparrow	0	0.9
Pacific-Slope Flycatcher	0.1	-3.2
Spotted Towhee	2.4	-8.3
Varied Thrush	3.3	-2.2
Winter Wren	3.4	0.7
Dark-Eyed Junco	5.9	-14.2
Lesser Goldfinch	6.1	168.6
Wrentit	16.9	-23.6
Brewer's Blackbird	30.4	-24.4
American Crow	38.9	78.0
Bewick's Wren	115.2	3.0
Song Sparrow	124.6	15.6
American Goldfinch	234.6	16.1
Mammals		
Broad-Footed Mole	-70.0	333.3
Black-Tailed Jackrabbit	-51.2	17.7
American Beaver	-20.0	-14.3
Virginia Opossum	-2.0	1.2
Deer Mouse	-0.4	-11.4
American Badger	0	371.4
Common Porcupine	3.7	-29.0
Norway Rat	8.9	-5.6
House Mouse	11.9	-40.2

Small Mammals

Botta’s pocket gopher (-44%) and California ground squirrel (-17%) exhibited marked declines in percent habitat capability in the Current to 2030 planning period. This decline was due to decrease in acreage of Douglas-fir 4P (Botta’s pocket gopher), Montane Hardwood Conifer 4M and Redwood 6. Percent change in habitat capability for the

Western harvest mouse and California ground squirrel increases into the 2030 to 2060 period given short term increase in extent of acreage recently harvested. Botta's pocket gopher also exhibits a marked increase in habitat capability during the 2030-2060 period from modeled early seral conditions resulting from harvest activities.

The red-tree vole exhibited a slight decline in habitat capability in the Current to 2030 period (-8%) but increase (7%) in the 2030 to 2060 period. Decline in extent of Redwood 6 and Douglas-fir 4P and Montane Hardwood Conifer 4M in the Current to 2030 period and increase in extent of Redwood 4D, Douglas-fir 6 and Montane Hardwood Conifer 6 in the 2030 to 2060 period is principally responsible for these changes.

Northern flying squirrel habitat capability for the Current to 2030 period remained stable (-2%). Loss of Redwood 6 was potentially reduced in effect with increase in acreage of Redwood 3D and 4D. Increase in extent of Douglas-fir 6 and Redwood 4D contributed to the increase in habitat capability in the 2030-2060 period (+7%).

Other small mammals show a marked increase in habitat capability over the Current to 2030 period. Increase in extent of Redwood 3D and 4D benefited dusky-footed woodrat habitat capability (+23%),and the coast mole and other small mammals. California vole habitat capability increased (+76%) in the Current to 2030 period with increase in extent of Redwood 3D and 4D. In the 2030-2060 period California vole capability increases with additional acreage of Redwood 4D. Dusky-footed woodrat habitat capability stabilized in the 2030-2060 period (-3%) with continued increase in the extent of Redwood 4D but decreases in Montane Hardwood Conifer 4M and 4D.

Raptors
Species exhibiting a decrease in habitat capability in the Current to 2030 period were Barn Owl (-58%), Red-shouldered Hawk (-29%), and Short-eared Owl (-54%). Reduction in extent of Montane Hardwood Conifer 4M negativity affected Barn Owl and Red-shouldered Hawk capability. Short-eared Owl habitat capability declined with reduction in the Douglas-fir 4P and Redwood 4P stages of forest development (foraging and cover requirements). Accipiter species (Goshawk -10% , Cooper's Hawk -8%, and Sharp-shinned Hawk -2%) exhibited declines in habitat capability with reduction in Montane Hardwood Conifer 4M and to a lesser degree with Redwood 6. Continued decline in extent of the Montane Hardwood Conifer 4M and 4D resulted in net negative trends in habitat capability for these species in the 2030-2060 period also (-10%, -5%, and -2% respectively). Increase in extent of Montane Hardwood Conifer 6 in this period benefited these species.

Neotropical Migrants
Largest decreases in percent change in habitat suitability occur for those Neotropical migrants exhibiting a preference for Montane Hardwood Conifer 4M in the Current to 2030 period. These species include Bullock's Oriole (-65%), Tree Swallow (-32%), Northern Rough-winged Swallow (-31%), Yellow Warbler (-33%), Western Wood Pewee (-11%), and Nashville Warbler (-24%). These species continue to exhibit decline in habitat capability in the 2030 to 2060 period with decrease in Montane Hardwood Conifer 4M and 4D. Reduction in extent of Redwood 6 and Montane Hardwood Conifer 4M in the Current to 2030 period negatively influences habitat capability for the Olive-sided

Flycatcher (-8%). This trend apparently stabilizes or improves slightly in the 2030 to 2060 period (+5%) with increase in Redwood 4D and Montane Hardwood Conifer 6 acreage. Warbling vireo habitat capability decreases (-19%) in the Current to 2030 period with reduction in extent of Montane Hardwood Conifer 4M, Douglas-fir 4P and Redwood 6. This trend stablizes in the 2030-2060 period (-1%) with further decrease in acreage of Montane Hardwood Conifer 4M and 4D but increase in extent of Montane Hardwood Conifer 6.

The Vaux's Swift and Purple Martin show a decrease in capability (-6% and -17% respectively) in the Current to 2030 period given reduction in representation of Douglas-fir 4P and Redwood 6. Trend in habitat capability for both species is positive in the 2030 to 2060 period (Vaux's Swift +16%, Purple Martin +35%) with increase in extent of Montane Hardwood Conifer 6, Douglas-fir 6, and Redwood 4D (Vaux's Swift).

Species showing an increase in habitat capability during the Current to 2030 period are generally typical of early to mid-stages of forest development. Orange-crowned Warbler (+10%) Swainson's Thrush (foraging and cover requirements) (+11%) and MacGillivray's Warbler (+47%,) all exhibit increases in habitat capability with increase in Redwood 3D and 4D and Montane Hardwood Conifer 6. Decline in extent of Montane Hardwood Conifer 4M, 4D and and Redwood 2D, 3D largely contribute to decline in capability for these three species during the 2030-2060 period (-11%, -12%, and -48% respectively).

Game Species

The preference of most game species for early to mid stages of mast (acorns, berries) producing forest conditions (Montane Hardwood Conifer 4M) is clear. Wild Turkey (an introduced exotic species) (-21%), wild pig (an introduced exotic species) (-27%), Band-tailed Pigeon (-9%), Mourning Dove (-17%), and gray squirrel (-2%) all exhibit a decline in percent change of habitat capability during the Current to 2030 period. Gray squirrel exhibited a slight net decrease (-3%) in habitat capability during the 2030-2060 period with reduction of Montane Hardwood Conifer 4M and 4D as did Mourning Dove (-7%) and Band-tailed Pigeon (-6%) Wild pig were benefited (+7%) with an increase in Montane Hardwood Conifer 6 in the second period. The negative trend exhibited by Blue Grouse in the Current to 2030 period (-10%) and 2030-2060 period (-16%) is due to decrease in extent of Douglas-fir 4P and Montane Hardwood Conifer 4M, and in the second period Montane Hardwood Conifer 4M, 4D and Douglas-fir 4M, 4D. Mule deer exhibit a slight decrease in habitat capability (-3%) with reduction in Montane Hardwood Conifer 4M during the Current to 2030 period and Montane Hardwood Conifer 4M and 4D in the 2030 to 2060 period (-6%). Increase in Redwood 3D and Montane Hardwood Conifer 6 in the Current to 2030 period and Montane Hardwood Conifer 6 and Redwood 4D in the 2030 to 2060 period benefited black bear (+5%, and +6% increase in habitat capability respectively).

Carnivore and Furbearer

Six of the 10 carnivores and furbearers potentially occurring on JDSF exhibit decreasing levels of habitat capability in the Current to 2030 period. Reduction in acreage of Montane Hardwood Conifer 4M and Douglas-fir 4P in the Current to 2030 period is largely responsible for loss of habitat capability for mountain lion (-16%). Reduction in acreage of Montane Hardwood Conifer 4M and Redwood 6 has a negative influence on potentially occupied habitat of Pacific fisher (-9%). Potential marten habitat capability declined in the Current to 2030 period (-12%) given decrease in acreage of Montane Hardwood Conifer 4M. Habitat capability for marten and ermine decreases in the 2030 to 2060 period (-15% both species) principally as a result of reduction in extent of Montane Hardwood Conifer 4M and 4D and Douglas-fir 4M and 4D. Potential Pacific fisher habitat capability increases in the 2030-2060 period (+8%) with increase in extent of Montane Hardwood Conifer 6 and Redwood 4D.

Ringtail cat and bobcat exhibit marked increases in habitat capability over the Current to 2030 period (+10%, +22% respectively). Increase in acreage of early stages of Redwood forest development (RDW 3D in particular) benefited these species. The slightly negative level of habitat capability (-3% ringtail) or stable (bobcat) in the 2030-2060 period was due to decline in extent of Redwood 3D and Montane Hardwood Conifer 4M (ringtail).

Bats

All bat species, with the exception of the pallid bat (+7%) and western red bat (+3%), exhibited declines in habitat capability during the Current to 2030 period. Reduction in Montane Hardwood Conifer 4M and Redwood 6 acreage during this period reduced bat habitat capability. Increase in Montane Hardwood Conifer 6 and Redwood 4D were mostly responsible for positive habitat capability trend for western red bat and pallid bat.

Continued reduction in Montane Hardwood Conifer 4M and 4D and to a lesser extent Redwod 6 acreage in the 2030 to 2060 period also contributes to negative bat habitat capability trend. Increase in Redwood 4D and Montane Hardwood Conifer 6 was principally responsible for the positive trend in habitat capability for those bat species exhibiting this trend during the 2030-2060 period (Yuma myotis +7%, western red bat +3%, Townsend’s big-eared +5% and pallid bat +27%).

Alternative D—Inside JDSF

In general, model outputs for alternative D within JDSF indicate increasing acreages in large size and multistoried canopy conditions in Redwood, Douglas-fir, and Montane Hardwood Conifer (RDW 6, DFR 6 and MHC 6).

Other marked changes in forest type and stage occur in the small tree size and moderate to dense canopy closure classes of the Montane Hardwood Conifer type (MHC 4M, 4D). The Montane Hardwood Conifer large tree stage MHC (5M, 5D) increased substantially in later decades commensurate with a decrease in small tree stages in the early decades of the planning period. The Douglas-fir type exhibited a similar transition (Table VII.6.6.26; Figure VII.6.6.14).

Loss or gain in extent of these stages of forest development is largely responsible for change in the habitat capability of species potentially occurring on JDSF under alternative D. General lack or short-term presence of the earliest stages of forest development, shrub associations, and open canopy conditions minimize the occurrence of a shrub or an understory component utilized by certain Neotropical migrant birds, small mammals and reptiles.

TABLE VII.6.6.26. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative D.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1M	423	228	116	MHC5D		28	2929
DFR2D		608		MHC6	2683	2730	6988
CPC2P	608			RDW2D	647		
DFR3M			608	RDW3M		158	
DFR4P	1725			RDW3D		684	
DFR4M			3	RDW4S			112
DFR4D	1854	1213	231	RDW4P	847	15	
DFR5P		60	60	RDW4M	437	446	158
DFR5D		76	93	RDW4D	1686	1384	460
DFR6		2229	3425	RDW5P		649	656
MHC4M	7928	7703		RDW5M			360
MHC4D	3940	3911		RDW5D		205	1173
MHC5M		178	4633	RDW6	25873	26144	26645

In general, species under alternative D with a preference for small to medium sized trees and moderate to dense forest canopy conditions (early to mid stages of forest development) and in the Montane Hardwood Conifer type showed the largest percentage decline in habitat capability early in the planning period as these types transition into later stages of forest development.

Increase in acreage of Montane Hardwood Conifer 5M, 5D and 6 and to a lesser extent Douglas-fir 6 (large tree, multi-storied and dense canopy) improved habitat capability for species preferring this level of forest development (Table VII.6.6.26).

Under Alternative D and for the Current to 2030 period, 126 species exhibit a decline in habitat capability. A total of 71 species improve and 4 species remain unchanged (Table VII.6.6.27)

For the 2030-2060 period, 86 species experience a decline in habitat capability. A total of 100 species improve and 12 remain unchanged. Three species are not projected to occur given vegetation modeling results (Lazuli Bunting, Northern Harrier and California Towhee)(Table VII.6.6.27).

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

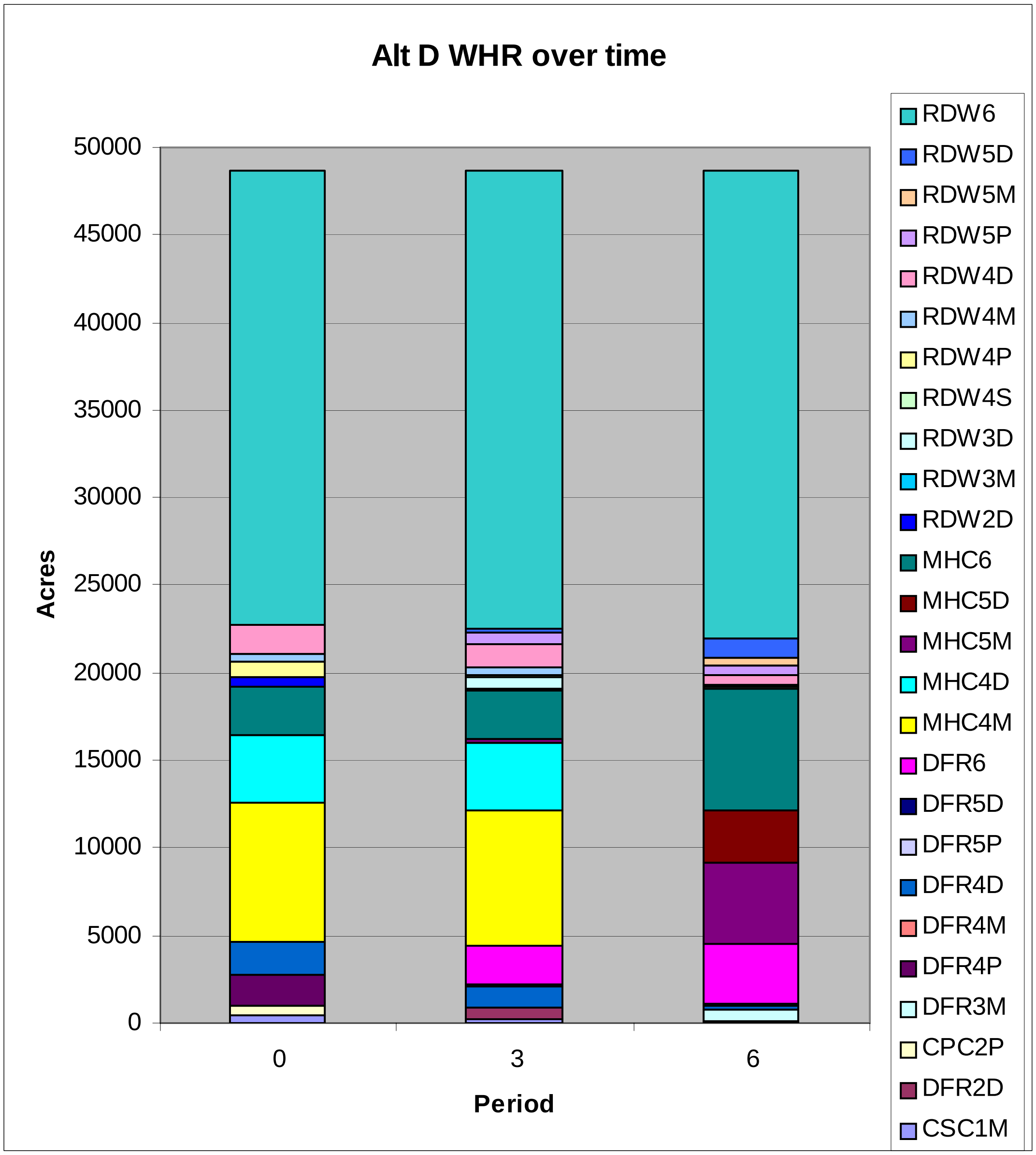


Figure VII 6.6.14. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative D

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to increase in the first period (+6%) given increase in extent of Redwood 6 and Douglas-fir 6. Modeling results project a slight increase in habitat capability for this species in the second period as well (+5%) with an increase in representation of Redwood 6 and Douglas-fir 6. Northern Spotted Owl habitat capability increases in both periods (+6% and +18%) with increase in Douglas-fir 6 followed by increase in Montane Hardwood Conifer 5M, 5D and 6.

Table VII.6.6.27. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative D.

	Current to 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-100.0	
Golden-Crowned Sparrow	-84.6	0.0
White-Crowned Sparrow	-65.4	0.0
Allen's Hummingbird	-33.0	-63.1
Fox Sparrow	-29.5	-31.1
Chipping Sparrow	-24.9	-85.3
Rufous Hummingbird	-10.0	-4.2
Bullock's Oriole	-6.7	-37.1
Cedar Waxwing	-6.7	1.8
Nashville Warbler	-6.6	-40.6
Yellow Warbler	-4.9	-7.2
MacGillivray's Warbler	-4.2	-45.1
Northern Rough-Winged Swallow	-4.2	-33.3
Orange-Crowned Warbler	-4.0	-22.1
Tree Swallow	-3.6	-33.3
Warbling Vireo	-1.6	7.1
Black-Headed Grosbeak	-1.5	4.4
Black-Throated Gray Warbler	-1.2	6.6
Violet-Green Swallow	-1.2	-1.4
Yellow-Rumped Warbler	-0.6	3.9
Western Wood-Pewee	-0.5	3.9
Western Tanager	-0.4	2.9
Chestnut-Backed Chickadee	0.6	0.7
Wilson's Warbler	0.6	-1.7
Hermit Warbler	0.7	4.5
Townsend's Warbler	1.2	1.5
Swainson's Thrush	3.1	-1.2
Hermit Thrush	3.7	1.1
Olive-Sided Flycatcher	4.0	10.7
Purple Martin	5.1	59.8
Vaux's Swift	5.4	10.8
Carnivore and Furbearer		
Ringtail	-29.7	-88.9
Gray Fox	-19.3	-33.1
Mountain Lion	-6.5	-5.4
Striped Skunk	-6.4	-20.6
Bobcat	-4.8	-11.9
Coyote	-4.6	-5.3
Raccoon	0.4	9.7
Ermine	0.7	5.4
Long-Tailed Weasel	0.9	2.3
American Marten	1.3	3.1

Table VII.6.6.27. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative D.

	Current to 2030	2030-2060
Fisher	3.7	7.0
Game Species		
Mourning Dove	-9.0	-15.0
Wild Turkey	-3.3	4.1
Mule Deer	-3.2	-11.1
Wild Pig	-1.3	7.5
California Quail	-0.9	-1.2
Western Gray Squirrel	0.0	12.8
Band-Tailed Pigeon	0.4	2.1
Blue Grouse	1.4	2.1
Black Bear	1.8	12.2
Small Mammals		
Botta's Pocket Gopher	-87.0	0.0
Brush Rabbit	-76.9	-100.0
Creeping Vole	-74.1	-57.1
Black Rat	-40.0	-90.0
Pacific Jumping Mouse	-30.4	21.3
Vagrant Shrew	-16.4	6.9
Dusky-Footed Woodrat	-16.0	-23.9
Pinon Mouse	-12.2	48.2
Sonoma Chipmunk	-11.1	-74.6
California Vole	-10.7	-48.6
Western Harvest Mouse	-10.4	-61.6
Long-Tailed Vole	-10.2	0.0
Yellow-Cheeked Chipmunk	-9.3	-6.0
California Ground Squirrel	-2.8	2.9
Fog Shrew	2.2	1.1
Trowbridge's Shrew	2.2	1.1
California Red Tree Vole	4.2	3.0
Western Red-Backed Vole	6.0	19.2
Northern Flying Squirrel	6.6	14.1
Shrew-Mole	7.4	6.8
Douglas' Squirrel	12.6	16.8
Coast Mole	233.3	-70.0
Raptors		
Northern Harrier	-100.0	
Short-Eared Owl	-84.6	0.0
Merlin	-30.5	-89.5
Red-Tailed Hawk	-16.2	-5.2
American Kestrel	-13.2	18.3
Barn Owl	-6.0	-37.6
Red-Shouldered Hawk	-4.5	1.0
Golden Eagle	-2.7	11.6
Peregrine Falcon	-1.4	1.5

Table VII.6.6.27. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative D.

	Current to 2030	2030-2060
Great Horned Owl	-1.1	3.1
Cooper's Hawk	-0.7	0.9
Turkey Vulture	-0.7	0.5
Western Screech Owl	-0.1	1.2
White-Tailed Kite	0	140.0
Northern Pygmy Owl	0.4	4.1
Northern Saw-Whet Owl	1.1	1.1
Sharp-Shinned Hawk	1.4	-0.5
Osprey	2.1	4.8
Bald Eagle	2.6	18.3
Northern Goshawk	2.9	2.8
Spotted Owl	5.5	17.8
Primary Cavity Excavators		
Red-Breasted Sapsucker	-16.1	-1.0
Downy Woodpecker	-0.8	3.8
Acorn Woodpecker	-0.5	4.6
Hairy Woodpecker	0.6	18.1
Northern Flicker	1.3	5.0
Pileated Woodpecker	5.9	22.2
Reptiles		
Gopher Snake	-38.4	-47.8
Common Kingsnake	-21.1	-2.7
Racer	-15.7	-28.9
Western Pond Turtle	-10.2	-32.9
Western Terrestrial Garter Snake	-8.3	-8.3
Ringneck Snake	-6.7	-25.3
Northern Alligator Lizard	-6.3	-31.1
Western Skink	-6.1	-3.0
Southern Alligator Lizard	-4.8	0.9
Sharp-Tailed Snake	-4.3	-14.9
Western Rattlesnake	-2.8	-6.3
Common Garter Snake	-0.6	4.0
Rubber Boa	0.6	0.9
Western Fence Lizard	4.0	8.8
Sagebrush Lizard	17.9	21.7
Amphibians		
Arboreal Salamander	-82.1	42.9
Red-Bellied Newt	-3.0	-3.2
Western Toad	-1.0	-3.5
Pacific Chorus Frog	-0.6	0.9
Foothill Yellow-Legged Frog	0.6	-0.3
Rough-Skinned Newt	1.2	0.5
Pacific Giant Salamander	1.3	-3.8
Ensatina	1.5	-0.5

Table VII.6.6.27. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative D.

	Current to 2030	2030-2060
Bullfrog	1.5	-0.3
Red-Legged Frog	1.6	-0.4
California Slender Salamander	3.1	0.0
Black Salamander	3.8	1.1
Clouded Salamander	4.1	11.8
Northwestern Salamander	4.6	8.1
Southern Seep Salamander	6.3	8.1
Tailed Frog	6.8	3.0
Bats		
Big Brown Bat	-6.8	-22.2
Hoary Bat	-3.8	0.0
Western Red Bat	-2.4	1.6
Silver-Haired Bat	-2.2	-0.4
Townsend's Big-Eared Bat	-1.8	0.0
Little Brown Myotis	-1.7	-2.1
Long-Eared Myotis	-1.1	-12.7
Long-Legged Myotis	-0.8	-0.6
California Myotis	0.5	-14.7
Yuma Myotis	0.7	0.7
Fringed Myotis	0.7	0.7
Pallid Bat	2.8	0.0
Resident and other species not assigned to species groups: percent change in habitat capability		
Birds		
California Towhee	-100.0	
Western Meadowlark	-84.6	0.0
House Finch	-84.2	0.0
Lesser Goldfinch	-60.6	0.0
American Crow	-44.4	-35.0
Song Sparrow	-42.1	-51.5
Western Bluebird	-29.6	-11.6
Spotted Towhee	-29.3	-53.4
Anna's Hummingbird	-29.0	-40.9
Bewick's Wren	-28.3	-81.8
Dark-Eyed Junco	-21.0	-16.8
American Robin	-13.8	1.4
Brewer's Blackbird	-12.6	-38.5
Barn Swallow	-11.7	-5.4
Wrentit	-9.3	-37.3
American Goldfinch	-7.7	-58.3
Brown-Headed Cowbird	-7.1	0.0
Pygmy Nuthatch	-5.7	-33.3
Western Scrub-Jay	-4.3	3.0
Bushtit	-3.9	3.0

Table VII.6.6.27. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative D.

	Current to 2030	2030-2060
Oak Titmouse	-3.4	3.0
House Wren	-3.1	-26.5
Common Nighthawk	-3.0	2.3
Black Phoebe	-2.9	4.0
Mountain Quail	-1.8	0.6
Common Raven	-1.3	1.3
Hutton's Vireo	-1.2	3.8
Pine Siskin	-1.2	-1.1
Great Egret	-0.9	1.9
White-Breasted Nuthatch	-0.8	3.1
Ruby-Crowned Kinglet	-0.2	-0.7
Lark Sparrow	0	400.0
European Starling	0.5	5.4
Green Heron	0.9	0.9
White-Throated Sparrow	0.9	0.0
Purple Finch	1.0	4.4
Golden-Crowned Kinglet	1.3	1.2
Wood Duck	1.3	37.5
Steller's Jay	1.8	0.2
Pacific-Slope Flycatcher	2.7	0.6
Great Blue Heron	3.7	20.2
Red-Breasted Nuthatch	3.7	4.8
Brown Creeper	3.8	13.0
Varied Thrush	3.8	-0.4
Evening Grosbeak	3.9	1.3
Gray Jay	4.7	2.2
Winter Wren	5.9	6.9
Marbled Murrelet	6.2	4.6
Red Crossbill	16.8	-2.7
Mammals		
Broad-Footed Mole	-85.0	0.0
Black-Tailed Jackrabbit	-28.3	-96.7
Common Porcupine	-7.4	-1.3
Deer Mouse	-4.8	-25.9
Norway Rat	-4.0	-6.5
American Beaver	-2.9	2.9
Virginia Opossum	-2.9	-0.3
House Mouse	-2.8	-2.8
American Badger	0	371.4

Small Mammals

Under Alternative D, Botta’s pocket gopher, brush rabbit, and western harvest mouse exhibit declines in habitat capability. Brush rabbit and western harvest mouse are most influenced by decreases in Redwood 2D and Douglas-fir 4P. The pocket gopher is most influenced by transitory early seral habitat conditions developed through harvest activities.

In the Current to 2030 period, habitat suitability declines for the Sonoma chipmunk due to a reduction in Montane Hardwood Conifer 4M and Redwood 4M and continues to decline in the 2030-2060 period with reduction in extent of Montane Hardwood Conifer 4M and 4D. The creeping vole experiences a marked reduction in habitat capability during both periods as well with a decrease in Douglas-fir 4P and Redwood 4P and in the second period Douglas-fir 2D.

Several small mammals show overall positive response to habitat changes in Alternative D over the Current to 2030 and 2030-2060 periods. These include the Douglas squirrel, and western red-backed vole. Douglas squirrel are benefited by large tree multi-storied canopy conditions of Douglas-fir 6 in the first period. The dusky-footed woodrat benefits from increases in early stages of forest development. After initially losing habitat capability in the Current to 2030 period, the Pacific jumping mouse and vagrant shrew exhibit an increase in habitat capability with increases in extent of Montane Hardwood Conifer 5M, 5D, and 6.

Raptors
Nineteen species of raptors were examined for changes in their habitat suitability on JDSF. Of these, five species of raptor experience diminishing habitat capability over the Current to 2030 and 2030-2060 period. These include Northern Harrier, White-tailed Kite, Short-eared Owl, which are influenced by relatively small acreage changes in early seral and sparse to open canopy conditions that are uncommon on JDSF. The Barn Owl and Red-shouldered Hawk exhibit a reduction in habitat capability due to decline in extent of Montane Hardwood Conifer 4M. The Merlin shows a decline in habitat capability in the Current to 2030 period with reduction in Douglas-fir 4P and Redwood 4P and a subsequent large decrease in habitat capability with reduction in extent of Montane Hardwood Conifer 4M in the 2030-2060 period. American Kestrel exhibit a decline in habitat capability (-13%) in the first period with reduction in extent of Douglas-fir 4P and Redwood 4P but an increase of 18% in the second period with increase in Montane Hardwood Conifer 5M, 5D and 6.

Neotropical Migrants
Lazuli Bunting, Golden-crowned Sparrow, White-crowned Sparrow, Meadowlark and other species utilizing early seral grass or brush dominated habitat conditions are not expected to occur based on upland habitat modeling results. The Bullock's Oriole (-7% and -37%), Northern Rough-winged Swallow (-4%, -33%)and Tree Swallow (-4 and -33%) exhibit declines in habitat capability due to decrease in acreage of Montane Hardwood Conifer 4M, 4D over the Current to 2030 and 2030-2060 periods. The Nashville Warbler (-7% and -41%) and Yellow Warbler (-5% and -7%) show declines in suitable habitat in both periods with decreases in extent of Redwood 4P and Douglas-fir 4P in the first period and Montane Hardwood Conifer 4M and 4D in the second period.

Other species experiencing a decline in habitat capability over both planning periods include Fox Sparrow, Chipping Sparrow, Rufous Hummingbird, Allen's Hummingbird, and

MacGillivray's Warbler. In all cases, the decline is principally due to reduction in Douglas-fir 4P and Redwood 4P in the first period and Montane Hardwood Conifer 4M in the second period. Purple Martin increases in the first period (+5%) with increase in Douglas-fir 6 representation as well as the second period (+60%) with an increase in extent of Montane Hardwood Conifer 5M and 6. Vaux's Swift habitat capability also increases over both periods (+5% and +11%) with increase in Douglas-fir 6 and Montane Hardwood Conifer 5M, 5D and 6. Warbling Vireo exhibits a decline in habitat capability (-2%) in the first period given reduction in extent of Douglas-fir 4P and an increase of 7% in the second period with additional acreage in Douglas-fir 6 and Montane Hardwood Conifer 5M, 5D and 6. Similar habitat changes benefited the Olive-sided Flycatcher.

Game Species

Mourning Dove habitat capability declines (-9%) in the Current to 2030 period with decrease in extent of Douglas-fir 4P and Montane Hardwood Conifer 4M. Decreases continue in the 2030-2060 period (-15%) with reduction in Montane Hardwood Conifer 4M and 4D. Black bear habitat capability remains stable in the first period but increases in the second period (+12%) with increases in Montane Hardwood Conifer 5M, 5D and 6. Band-tailed Pigeon, California Quail, Blue Grouse, and Wild Turkey habitat capability remains stable over both time periods. Gray squirrel habitat capability remains stable in the first period but increases in the 2030-2060 period (+13%) with increase in representation of Montane Hardwood Conifer 5M, 5D and 6. Mule deer habitat capability decreases in both time periods (-3% and -11% respectively) principally as a result of reduction in Douglas-fir 4P and Redwood 4P in the first period and Montane Hardwood Conifer 4M and 4D in the second. Wild pig habitat capability is stable during the first period and exhibits an 8% increase in the second with increased acreage of Montane Hardwood Conifer 5M, 5D and 6.

Carnivore and Furbearer

Ringtail cat habitat capability declined in the first period (-30%) with decrease in acreage of Redwood 4P and Douglas-fir 4P and in the second period (-89%) with reduction principally in extent of Montane Hardwood Conifer 4M. Bobcat habitat capability decreased over both time periods (-5% and -12%) given decrease in Douglas-fir 4P and Redwood 4P followed by Montane Hardwood Conifer 4M, 4D in the second period. Potential Pacific fisher (+4% and +7%) and marten (+1% and +3%) habitat capability increased or remained relatively stable over both periods.

Bats

The big brown bat, California myotis and long-eared myotis exhibit the largest decreases in habitat capability primarily due to reduction in the acreage of Montane Hardwood Conifer 4M, Redwood 4P and Douglas-fir 4P in the first period and Montane Hardwood Conifer 4M and 4D in the second period. Other bat species exhibited a generally stable habitat capability value over both planning periods.

Alternative E—Inside JDSF

In general, alternative E model outputs for JDSF indicate a increase in acreage of multi-storied and large size Douglas-fir, Redwood and Montane Hardwood Conifer forest (CWHR 5M, 5D and 6) in the later decades of the planning period. This increase follows an expected reduction in mid-sized Redwood, Douglas-fir and Montane Hardwood Conifer forest (size class 4). Redwood 6 remains fairly stable throughout the planning period at approximately 50% of the JDSF acreage.

Most forest types consisting of smaller tree sizes or open to moderate canopy density exhibit a decrease over time, due to continued forest growth and the absence of management practices characteristic of moderate to high levels of timber production (Table VII.6.6.28; Figure VII 6.6.15).

Species with a preference for early seral stages of forest development to fulfill breeding, feeding or cover requirements showed the largest percentage decline in habitat capability. Conversely, species associated with larger tree DBH classes and denser canopy conditions showed increases in habitat capability, particularly in the 2030-2060 period.

For the Current to 2030 period within JDSF (Table VII.6.6.29) 126 species exhibit declines in habitat capability. A total of eight species experience no change in habitat capability and 67 are positively influenced.

For the 2030-2060 period, 76 species show declines in habitat capability. A total of 107 are positively influenced and 13 show no change. Five species are not projected to occur based on vegetation modeling results (Northern Harrier, Lazuli Bunting, White-tailed Kite, California Towhee and American badger)(Table VII.6.6.29).

TABLE VII.6.6.28. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative E.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1	423	228	116	MHC6	2683	2712	3845
CPC2P	608			RDW2D	647		
DFR2D		608		RDW3M		4	
DFR3M			608	RDW3D		839	
DFR4P	1725			RDW4M	437	442	21
DFR4D	1854	1213	191	RDW4D	1686	1384	636
DFR5P		1217	1217	RDW4S			112
DFR5D		243	311	RDW4P	847	15	
DFR6		906	2051	RDW5P		716	731
MHC4M	7928	7703		RDW5M			92
MHC4D	3940	3911		RDW5D		227	490
MHC5M		195	7328	RDW6	25873	26059	27524
MHC5D		28	3377				

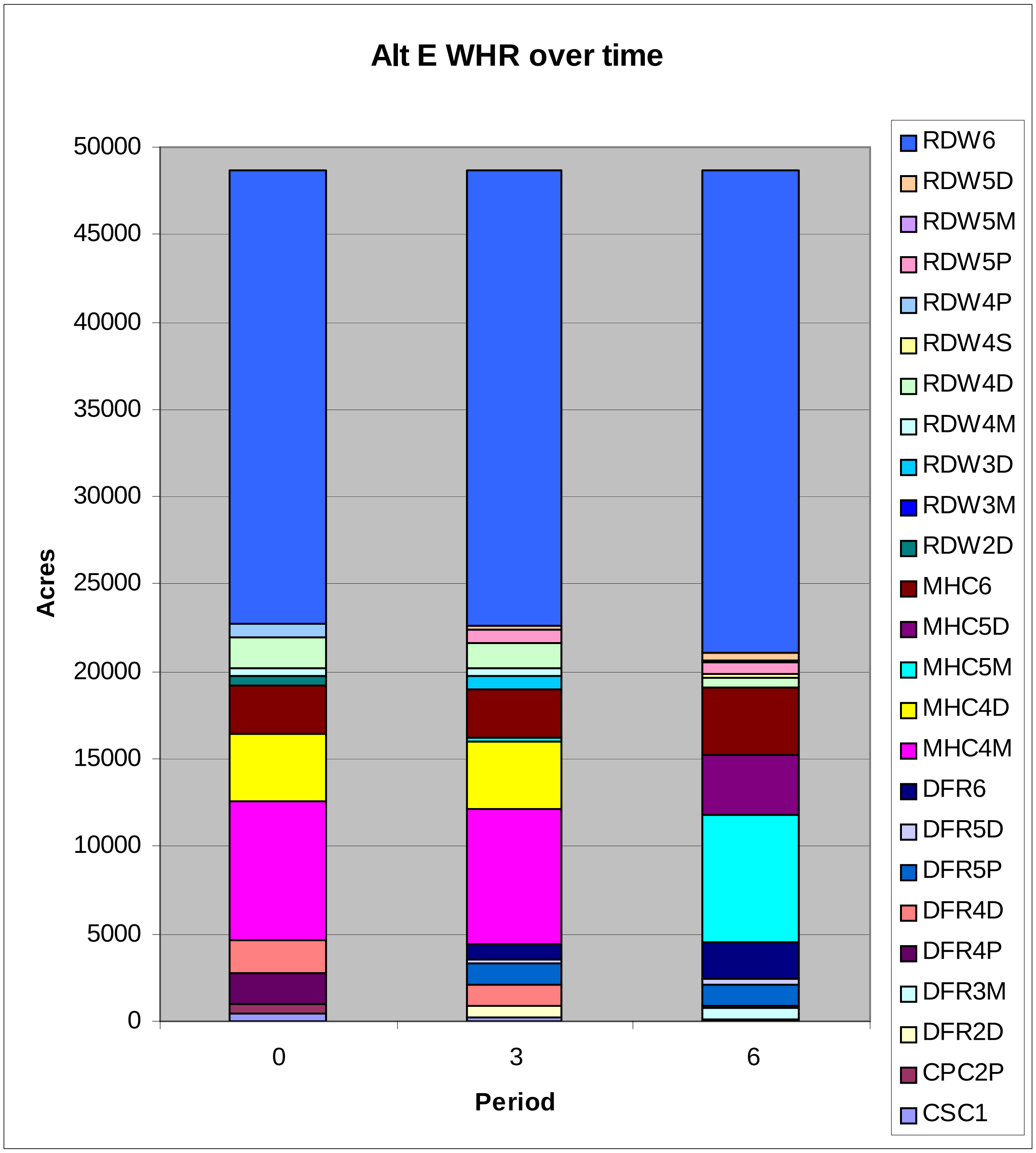


Figure VII 6.6.15. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative E.

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to increase slightly in the first period (+3%) and second period (+3%) given increase in extent of Redwood 6 and Douglas-fir 6. Northern Spotted Owl habitat capability increases slightly (+3%) in the first period with increase in Douglas-fir 6 and 5P. Habitat capability increases markedly (+17%) in the second period with increase in extent of Douglas-fir 6, Redwood 6, and Montane Hardwood Conifer 5M, 5D, and 6.

Table VII.6.6.29. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative E.

	Current to 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-100.0	
White-Crowned Sparrow	-38.5	-6.3
Golden-Crowned Sparrow	-30.8	22.2
Allen's Hummingbird	-25.8	-34.7
Fox Sparrow	-20.0	9.5
Chipping Sparrow	-13.8	-73.1
Bullock's Oriole	-6.7	0.0
Rufous Hummingbird	-5.5	2.2
Yellow Warbler	-4.9	-9.3
Orange-Crowned Warbler	-4.3	-20.2
MacGillivray's Warbler	-4.2	-20.9
Northern Rough-Winged Swallow	-4.2	-3.4
Nashville Warbler	-4.0	-42.2
Tree Swallow	-3.6	-4.4
Cedar Waxwing	-2.5	3.0
Black-Headed Grosbeak	-1.5	1.3
Black-Throated Gray Warbler	-1.2	3.3
Violet-Green Swallow	-1.2	1.1
Warbling Vireo	-0.9	5.2
Western Wood-Pewee	-0.7	2.9
Yellow-Rumped Warbler	-0.6	2.1
Western Tanager	-0.4	2.0
Wilson's Warbler	-0.3	-0.9
Chestnut-Backed Chickadee	0.6	0.7
Hermit Warbler	0.7	1.9
Townsend's Warbler	1.0	0.7
Swainson's Thrush	1.4	-2.1
Hermit Thrush	1.9	0.5
Olive-Sided Flycatcher	4.0	10.4
Purple Martin	5.1	63.0
Vaux's Swift	5.4	10.8
Carnivore and Furbearer		
Ringtail	-21.9	-73.0
Gray Fox	-13.0	-31.4
Mountain Lion	-6.5	-6.4
Striped Skunk	-4.7	-18.1
Coyote	-1.9	-5.2
American Marten	-1.3	-2.2
Long-Tailed Weasel	-0.7	-0.7
Ermine	-0.4	-2.9
Raccoon	0.0	9.1
Black Bear	1.1	11.8
Fisher	1.4	4.8

Table VII.6.6.29. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative E.		
	Current to 2030	**2030-2060**
Game Species		
Mourning Dove	-5.4	-1.9
Wild Turkey	-3.3	3.8
Mule Deer	-1.9	-9.0
Wild Pig	-1.3	7.8
California Quail	-0.3	0.3
Band-Tailed Pigeon	0.4	0.2
Black Bear	1.1	11.8
Blue Grouse	1.4	-3.5
Western Gray Squirrel	2.1	12.6
Small Mammals		
Brush Rabbit	-76.9	-100.0
Creeping Vole	-74.1	-57.1
Botta's Pocket Gopher	-43.5	30.8
Black Rat	-20.0	-60.0
Pacific Jumping Mouse	-13.0	19.0
Pinon Mouse	-12.2	24.1
California Vole	-10.7	-35.8
Western Harvest Mouse	-10.4	-38.4
Vagrant Shrew	-8.2	8.9
Dusky-Footed Woodrat	-7.8	-11.6
Sonoma Chipmunk	-5.8	-54.2
Yellow-Cheeked Chipmunk	-4.8	0.2
California Ground Squirrel	-2.8	3.9
Long-Tailed Vole	-1.7	-0.9
Fog Shrew	1.1	0.7
Trowbridge's Shrew	1.1	0.7
Shrew-Mole	2.8	2.0
California Red Tree Vole	4.2	1.6
Northern Flying Squirrel	5.3	11.8
Western Red-Backed Vole	6.0	18.5
Douglas' Squirrel	9.3	12.8
Coast Mole	233.3	-70.0
Raptors		
White-Tailed Kite	-100.0	
Northern Harrier	-100.0	
Short-Eared Owl	-30.8	22.2
Merlin	-14.6	-65.7
Red-Tailed Hawk	-8.5	-4.5
Barn Owl	-6.0	0.0
American Kestrel	-5.7	20.0
Red-Shouldered Hawk	-4.5	44.8
Golden Eagle	-2.7	6.3
Peregrine Falcon	-1.4	-1.5
Cooper's Hawk	-0.7	0.9

Table VII.6.6.29. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative E.

	Current to 2030	2030-2060
Great Horned Owl	-0.7	4.4
Turkey Vulture	-0.4	0.9
Western Screech Owl	-0.1	3.0
Northern Pygmy Owl	0.4	2.9
Northern Saw-Whet Owl	0.4	0.8
Sharp-Shinned Hawk	1.1	0.5
Northern Goshawk	1.2	-0.2
Osprey	2.1	5.0
Bald Eagle	2.6	22.1
Spotted Owl	3.3	16.6
Primary Cavity Excavators		
Red-Breasted Sapsucker	-7.5	-0.9
Acorn Woodpecker	-0.5	1.8
Downy Woodpecker	0.0	3.4
Hairy Woodpecker	0.6	17.8
Northern Flicker	1.3	4.7
Pileated Woodpecker	3.7	19.2
Reptiles		
Gopher Snake	-20.5	-10.1
Common Kingsnake	-14.1	0.0
Western Pond Turtle	-10.2	-3.8
Racer	-7.0	-7.5
Ringneck Snake	-6.7	-8.4
Western Skink	-6.1	2.0
Sharp-Tailed Snake	-4.3	-5.0
Western Terrestrial Garter Snake	-3.8	-2.1
Northern Alligator Lizard	-3.1	-25.2
Western Rattlesnake	-2.8	-1.4
Southern Alligator Lizard	-2.0	1.2
Common Garter Snake	-0.6	-2.9
Rubber Boa	0.6	0.0
Western Fence Lizard	0.9	-1.2
Sagebrush Lizard	17.9	-6.5
Amphibians		
Arboreal Salamander	-30.8	33.3
Western Toad	-1.0	0.0
Red-Bellied Newt	-0.9	-1.0
Pacific Chorus Frog	-0.6	1.8
Bullfrog	0.3	1.1
Foothill Yellow-Legged Frog	0.6	-0.6
Rough-Skinned Newt	1.2	0.9
Pacific Giant Salamander	1.3	-1.3
Ensatina	1.5	-0.1
Red-Legged Frog	1.6	-0.5
Black Salamander	2.6	1.1

Table VII.6.6.29. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative E.

	Current to 2030	2030-2060
California Slender Salamander	3.1	0.0
Northwestern Salamander	3.2	8.2
Tailed Frog	3.3	2.3
Clouded Salamander	4.1	11.4
Southern Seep Salamander	5.1	7.7
Bats		
Big Brown Bat	-2.8	-5.7
Western Red Bat	-1.2	0.4
Long-Eared Myotis	-1.1	-15.2
Hoary Bat	-0.9	0.7
Long-Legged Myotis	-0.8	0.6
Little Brown Myotis	-0.4	0.8
Fringed Myotis	0.0	0.7
Silver-Haired Bat	0.0	1.2
Yuma Myotis	0.0	0.7
California Myotis	0.5	-2.6
Townsend's Big-Eared Bat	0.9	0.0
Pallid Bat	1.9	0.0
Resident and other species not assigned to species groups: percent change in habitat capability		
Birds		
California Towhee	-100.0	
House Finch	-47.4	40.0
Western Meadowlark	-41.0	21.7
Lesser Goldfinch	-30.3	0.0
Song Sparrow	-24.6	-39.5
Anna's Hummingbird	-18.3	-3.9
American Crow	-16.7	-36.7
Western Bluebird	-14.8	35.7
Spotted Towhee	-13.4	-19.7
Dark-Eyed Junco	-10.5	-7.4
American Goldfinch	-7.7	-75.0
American Robin	-7.0	5.0
Bewick's Wren	-6.5	-46.5
Brewer's Blackbird	-6.5	-16.5
Wrentit	-6.2	-13.7
Barn Swallow	-6.0	1.1
Pygmy Nuthatch	-5.7	-3.8
Western Scrub-Jay	-4.3	3.0
Bushtit	-3.9	3.0
Oak Titmouse	-3.4	3.0
House Wren	-3.1	-26.5
Black Phoebe	-2.9	3.0
Brown-Headed Cowbird	-2.9	1.3
Common Raven	-1.3	1.3

Table VII.6.6.29. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative E.		
	Current to 2030	**2030-2060**
Hutton's Vireo	-1.2	3.8
Great Egret	-0.9	1.9
Common Nighthawk	-0.8	-3.0
White-Breasted Nuthatch	-0.8	-0.6
Mountain Quail	-0.5	0.7
Pine Siskin	-0.2	3.5
Ruby-Crowned Kinglet	-0.2	0.4
Lark Sparrow	0	0
Purple Finch	0.0	3.2
European Starling	0.5	4.1
Green Heron	0.9	0.9
White-Throated Sparrow	0.9	0.0
Golden-Crowned Kinglet	1.0	1.1
Evening Grosbeak	1.1	-0.3
Steller's Jay	1.1	0.0
Pacific Slope Flycatcher	1.3	0.1
Wood Duck	1.3	37.5
Brown Creeper	2.6	12.3
Marbled Murrelet	2.7	3.4
Varied Thrush	3.4	-0.5
Gray Jay	3.6	1.5
Winter Wren	3.6	6.6
Great Blue Heron	3.7	19.7
Red-Breasted Nuthatch	3.7	0.0
Red Crossbill	16.8	-4.5
Mammals		
American Badger	-100.0	
Broad-Footed Mole	-35.0	30.8
Black-Tailed Jackrabbit	-28.3	-96.7
Common Porcupine	-4.9	-5.6
American Beaver	-2.9	2.9
Deer Mouse	-2.9	-20.8
House Mouse	-2.8	-3.8
Virginia Opossum	0.0	0.0
Norway Rat	0.4	-3.6

Small Mammals

Small mammal species exhibiting a preference for early stages of forest development or significant herbaceous understory/brush component as a consequence of a more open tree canopy layer (Redwood 2D, 3D, 4P, Douglas-fir 2D, 4P) showed some of the largest net reductions in habitat capability in either time period (western harvest mouse, creeping vole, brush rabbit, Sonoma chipmunk, dusky-footed woodrat, California vole). The brush rabbit finds no habitat capability beyond the 2D, 4P, 4M, and 3D stages of forest development for the upland forest types examined. These species experience continued habitat capability decline in the 2030-2060 period with reduction in extent of Montane Hardwood Conifer 4M, 4D, Douglas-fir 2D and Redwood 3D.

Small mammal species with a preference for later stages of forest development with well developed canopies and larger trees showed increases in habitat capability values for the habitat types examined. Northern flying squirrel benefit in both time periods from large trees with cavities for cover and reproduction with recruitment of Douglas-fir 5P, 6 Redwood 6, and Montane Hardwood Conifer 5M, 5D, and 6. Late stages of forest development with dense canopies in Montane Hardwood Conifer 5M and 5D and Douglas-fir 5P and 6 benefited the Douglas squirrel. California red-tree vole habitat capability increases slightly in both time periods with increase in Douglas-fir 5P, 6 and Redwood 5P, 6 followed by second period increase in Montane Hardwood Conifer 5M, 5D and Douglas-fir 6 and Redwood 6.

Raptor Species

Species exhibiting large decreases in habitat capability are for the most part species that find highly suitable habitat conditions in the most open canopies and earliest stages of forest development, showing a preference for grassland/shrub dominated habitats. These species include Northern Harrier and Short-eared Owl. Merlin, a rare winter visitor, does not breed in the assessment area, and frequents open forest conditions, grasslands and coastlines. Accipiters (Northern Goshawk, Cooper’s Hawk and Sharp-shinned Hawk) as a group exhibited limited response to changing habitat conditions over the planning period. Habitat capability for these species remained essentially stable over both time periods. Red-shouldered Hawk habitat capability declines slightly in the first period with reduction in representation of Montane Hardwood Conifer 4M. However, habitat capability increases markedly (+45%) in the second period with increase in the extent of Montane Hardwood Conifer 5M, 5D.

Neotropical Migrants

Neotropical migrants are migratory bird species that nest in the United States and Canada but migrate south to the tropical regions of Mexico, Central and South America and the Caribbean for the non-breeding season (generally south of the Tropic of Cancer). Hayes (1995) has suggested a more refined definition in which the former describes a Nearctic migrant reserving the term Neotropical migrant for species breeding in South America that migrate northward during the non-breeding season. This analysis examines passerine birds found on JDSF that exhibit both migratory patterns.

Decreases in habitat capability are noted for species such as the Lazuli Bunting, Rough-winged Swallow, Tree Swallow, Chipping Sparrow, White-crowned Sparrow, MacGillivray’s Warbler Allen’s Hummingbird, Nashville Warbler, and Yellow Warbler. Decline in extent of early to mid stages of forest development (Douglas-fir 4P, Redwood 2D, 4P are principally responsible for habitat capability decrease in the first period. Reduction in extent of Montane Hardwood Conifer 4M, 4D and Douglas-fir 4D in the second period contributes to a continued decline in habitat capability for these species. Tree and Rough-winged Swallows experience habitat capability decline with decrease in acreage of Montane Hardwood Conifer 4M, 4D over both time periods.

Warbling Vireo habitat capability remains stable during the first period and increases slightly in the second (+5%) with an increase in Redwood 6, Douglas-fir 6 and Montane Hardwood Conifer 5M, 5D, and 6. Olive-sided Flycatcher habitat capability increases slightly (+4%) in the first period followed by a 10% increase in the second period due to an increase in extent of the same stages of forest development that benefited the Warbling Vireo.

Species exhibiting a nesting preference for large trees, such as the Purple Martin and Vaux's Swift experience a slight increase in habitat capability in the first period (both +5%) with increase in Douglas-fir 5P and 6 and Redwood 6. Habitat capability continues to increase in the second period (+63% and +11% respectively) with increase in extent of Redwood 6 and Montane Hardwood Conifer 5M and 5D.

Game Species

In general, many game species exhibit a preference for the early stages of forest development, edge habitats and/or a mosaic of forest structural conditions at a relatively "fine" grain. Late seral forest interior conditions are not typically sought out as a principal source of resources to meet breeding, feeding or cover requirements. Reduction in extent of Montane Hardwood Conifer 4M and Douglas-fir 4P and Redwood 4P reduced mule deer habitat capability in the Current to 2030 period slightly (-2%). Mule deer habitat capability continued to decline in the second period (-9%) with reduction in the extent of Montane Hardwood Conifer 4M and 4D. Mourning Dove habitat capability declines slightly in both periods with reduction in acreage of Montane Hardwood Conifer 4M and 4D. Band-tailed Pigeon and California Quail habitat capability remains stable over both time periods. Blue Grouse habitat remains stable in the first period and then declines slightly in the second (-4%) with reduction in extent of Douglas-fir 4D and Montane Hardwood Conifer 4M and 4D. Wild Turkey habitat capability declines slightly (-3%) with reduction in Montane Hardwood Conifer 4M in the first period. Habitat capability increases slightly (+4%) in the second period with an increase in Montane Hardwood Conifer 5M, 5D, and 6. Wild pig and black bear habitat capability remains stable during the first period and then increases (+8% and +12% respectively) with increase in representation of Montane Hardwood Conifer 5M, 5D, and 6, Douglas-fir 6 and Redwood 6.

Carnivore and Furbearer

Nine of 11 forest dwelling carnivores and furbearers that occur or may occur in JDSF exhibit stable to slightly decreasing (-5% striped skunk and bobcat) trends in habitat capability during the Current to 2030 time period. Larger decreases in habitat capability are noted in the 2030-2060 period. Reduction in extent of Montane Hardwood Conifer 4M, 4D, Redwood 4D and Douglas-fir 4D had a negative influence on habitat capability for ringtail cat (-73%), bobcat (-20%), gray fox (-31%), striped skunk (-18%) and mountain lion (-6%). Racoon habitat capability increases (+9%) as acreage is recruited into the Montane Hardwood Conifer 5M, 5D, 6 and Redwood 6 stages of forest development. Potential Humboldt marten and Pacific fisher habitat capability remains essentially stable to slightly increasing in the 2030-2060 period (marten -2% and fisher +5%) with increases in large tree and closed canopy forest conditions..

Bats
All bat species were essentially stable in habitat capability during the Current to 2030 period. The big brown bat exhibited a slight decline (-3%) with decrease in extent of Douglas-fir 4P and 4D. Similar trends are exhibited in the second period with exception of continued decline in habitat capability for the big brown bat (-6%) and long-eared myotis (-15%). Reduction in extent of Montane Hardwood Conifer 4M, 4D, Redwood 4D and Douglas-fir 4D was principally responsible for the trend exhibited by these species.

Alternative F—Inside JDSF

In general, alternative F model outputs for JDSF indicate an increase in acreage of multi-storied large size Montane Hardwood Conifer (5M, 5D and 6) in later decades of the planning period. Increases are also expected in Douglas-fir 6 and to a lesser extent Redwood 6. As expected, most forest types consisting of smaller tree sizes or open to moderate canopy density exhibit a decrease over time, due to continued forest growth and the absence of management systems associated with moderate to high levels of timber production (Table VII.6.6.30; Figure VII.6.6.16).

Table VII.6.6.30. Estimated CWHR acres on Jackson Demonstration State Forest, Alternative F.

CWHR	2004	2030	2060	CWHR	2004	2030	2060
CSC1	423	228	116	MHC5M		195	6547
CPC2P	608			MHC5D		28	3253
DFR2S		158		MHC6	2683	2712	4751
DFR3M			608	RDW2D	647	117	
DFR2D		608		RDW3D		568	
DFR4P	1725			RDW4S			112
DFR4M			9	RDW4P	847	20	5
DFR4D	1854	1213	628	RDW4M	437	437	
DFR5P		228	228	RDW4D	1686	1384	647
DFR5D		243	311	RDW5P		809	815
DFR6		1896	2599	RDW5M			431
MHC4M	7928	7703		RDW5D		274	1443
MHC4D	3940	3911		RDW6	25873	25920	26149

.
Species with a preference for early seral stages of forest development to fulfill breeding, feeding or cover requirements showed the largest percentage decline in habitat capability. Conversely, species associated with larger tree DBH classes and denser canopy conditions showed increases in habitat capability.

For the Current to 2030 period within JDSF, 101 species experience a decrease in habitat capability (Table VII.6.6.31). A total of 18 species exhibit no change and 82 are positively influenced.

For the 2030-2060 period, 80 species experience a decline in habitat capability. A total of 17 experience no change in habitat capability and 99 are positively influenced. Five species are not projected to occur on JDSF given vegetation modeling results (Northern Harrier, White-tailed Kite, Lazuli Bunting, California Towhee and American badger).

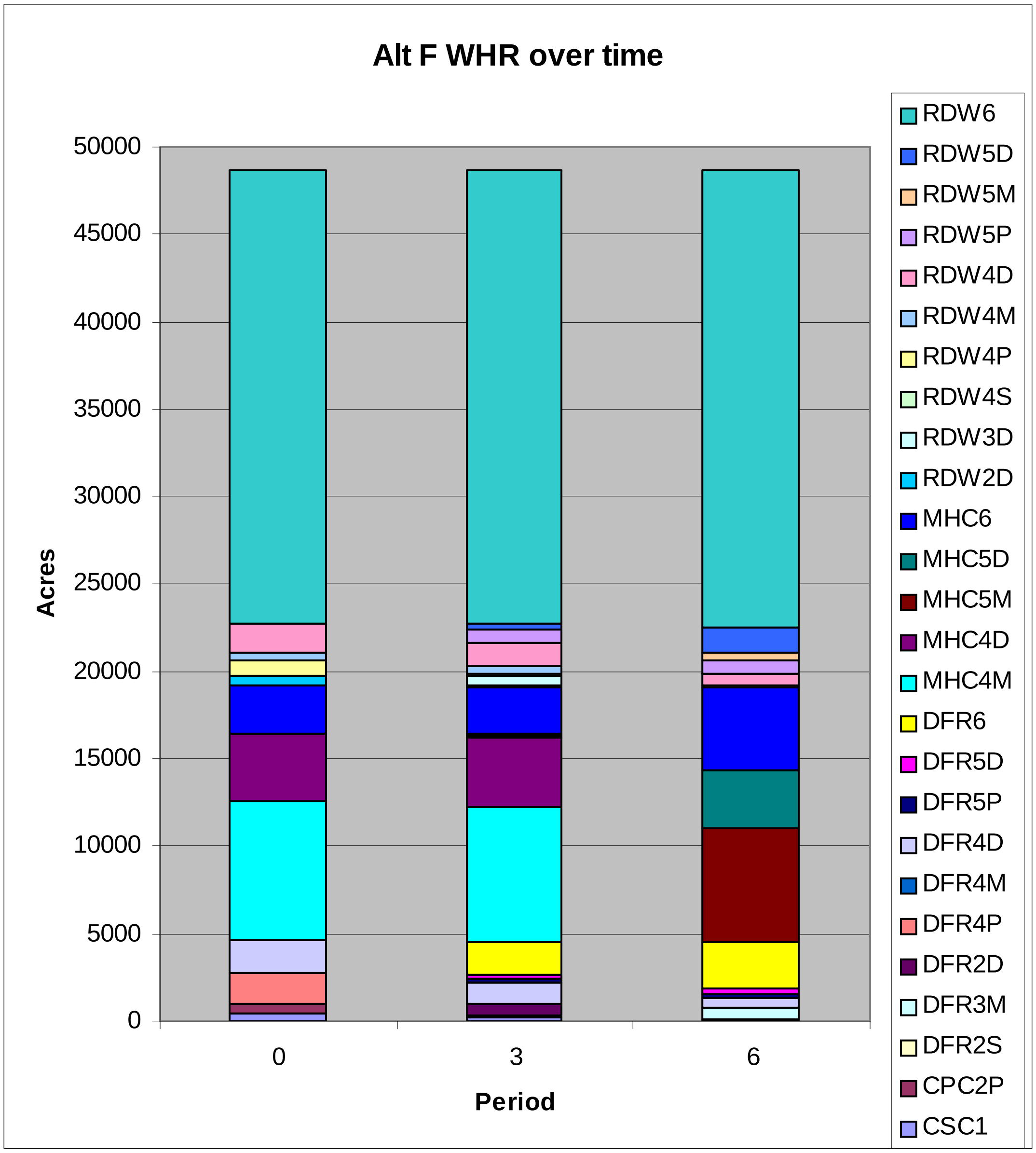


Figure VII 6.6.16. Estimated CWHR acres on Jackson Demonstration State Forest in 2004, 2030 and 2060. Alternative F.

Several vegetation modeling parameters can result in marked increase/decrease in habitat capability or projected presence/absence of a particular species. For discussion see Section 6.6.8-- Approach.

Listed Terrestrial Species

Potential Marbled Murrelet habitat capability is expected to increase slightly in the first period (+5%) and second period (+4%) given increase in extent of Redwood 6 and Douglas-fir 6 under Alternative F. Northern Spotted Owls showed increases in habitat capability over the first period (+5%) due to marked increase in extent of large tree/dense canopy conditions (principally Douglas-fir 6) and the second period (+17% Redwood 5D and Montane Hardwood Conifer 5M, 5D and 6).

Table VII.6.6.31. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative F.

	Current to 2030	2030-2060
Neotropical Migrants		
Lazuli Bunting	-100.0	
Golden-Crowned Sparrow	-69.2	0.0
White-Crowned Sparrow	-57.7	18.2
Allen's Hummingbird	-35.1	-36.5
Fox Sparrow	-20.0	-11.9
Chipping Sparrow	-18.2	-78.4
Rufous Hummingbird	-7.6	-2.2
MacGillivray's Warbler	-6.0	-25.2
Cedar Waxwing	-5.4	1.3
Nashville Warbler	-4.4	-43.3
Orange-Crowned Warbler	-3.8	-20.1
Yellow Warbler	-2.0	-13.0
Warbling Vireo	-0.4	3.2
Yellow-Rumped Warbler	-0.2	1.6
Black-Throated Gray Warbler	0.0	2.1
Bullock's Oriole	0.0	-17.3
Northern Rough-Winged Swallow	0.0	-15.5
Tree Swallow	0.0	-16.4
Violet-Green Swallow	0.0	-1.0
Western Tanager	0.2	1.4
Black-Headed Grosbeak	0.3	2.2
Western Wood-Pewee	0.4	1.9
Chestnut-Backed Chickadee	0.5	1.0
Hermit Warbler	0.7	2.5
Townsend's Warbler	0.8	1.0
Wilson's Warbler	0.9	-1.4
Swainson's Thrush	2.4	-0.5
Hermit Thrush	3.2	0.9
Purple Martin	4.3	58.2
Olive-Sided Flycatcher	4.4	9.3
Vaux's Swift	5.1	10.3
Carnivore And Furbearer		
Ringtail	-27.3	-78.5
Gray Fox	-14.9	-30.7

Table VII.6.6.31. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative F.

	Current to 2030	2030-2060
Mountain Lion	-5.8	-7.6
Striped Skunk	-5.3	-21.0
Bobcat	-4.8	-17.4
Coyote	-4.3	-5.3
Ermine	0.0	1.8
Raccoon	0.7	8.8
Long-Tailed Weasel	0.7	0.9
American Marten	1.3	0.5
Fisher	3.5	5.4
Game Species		
Mourning Dove	-6.8	-5.4
Mule Deer	-2.3	-10.0
California Quail	-0.7	-0.3
Wild Turkey	0.0	0.3
Wild Pig	0.3	3.4
Western Gray Squirrel	0.4	12.6
Band-Tailed Pigeon	0.9	0.7
Black Bear	1.4	13.1
Blue Grouse	1.4	-0.3
Small Mammals		
Brush Rabbit	-76.9	-100.0
Creeping Vole	-74.1	-57.1
Botta's Pocket Gopher	-69.6	0.0
Black Rat	-48.0	-65.4
Pacific Jumping Mouse	-22.6	11.2
Dusky-Footed Woodrat	-14.3	-12.9
California Vole	-13.1	-21.7
Vagrant Shrew	-10.7	2.8
Pinon Mouse	-10.6	29.6
Long-Tailed Vole	-7.6	-3.7
Yellow-Cheeked Chipmunk	-7.5	-3.2
Western Harvest Mouse	-7.3	-48.3
Sonoma Chipmunk	-6.8	-61.6
California Ground Squirrel	-1.9	1.0
Fog Shrew	2.2	0.7
Trowbridge's Shrew	2.2	0.7
California Red Tree Vole	3.3	2.5
Shrew-Mole	5.3	4.6
Western Red-Backed Vole	5.6	18.0
Northern Flying Squirrel	5.7	12.2
Douglas' Squirrel	11.3	16.7
Coast Mole	100.0	-50.0
Raptors		
White-Tailed Kite	-100.0	
Northern Harrier	-100.0	

Table VII.6.6.31. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative F.

	Current to 2030	2030-2060
Short-Eared Owl	-69.2	0.0
Merlin	-22.0	-82.8
Red-Tailed Hawk	-12.6	-1.8
American Kestrel	-10.2	21.0
Peregrine Falcon	-1.4	0.0
Turkey Vulture	-0.6	0.4
Barn Owl	0.0	-18.0
Red-Shouldered Hawk	0.0	25.5
Golden Eagle	0.0	4.6
Great Horned Owl	0.1	1.5
Cooper's Hawk	0.4	0.0
Northern Pygmy Owl	0.5	1.9
Western Screech Owl	1.0	0.3
Northern Saw-Whet Owl	1.3	0.6
Sharp-Shinned Hawk	1.3	0.1
Osprey	2.3	4.6
Bald Eagle	2.6	20.0
Northern Goshawk	3.3	0.7
Spotted Owl	4.8	16.9
Primary Cavity Excavators		
Red-Breasted Sapsucker	-12.1	0.3
Downy Woodpecker	-0.2	1.7
Hairy Woodpecker	0.8	16.0
Acorn Woodpecker	1.4	1.1
Northern Flicker	2.3	2.1
Pileated Woodpecker	5.5	20.4
Reptiles		
Gopher Snake	-32.1	-26.3
Common Kingsnake	-16.2	-3.4
Racer	-11.3	-16.7
Ringneck Snake	-7.9	-12.2
Western Pond Turtle	-6.8	-15.9
Western Terrestrial Garter Snake	-6.5	-4.6
Northern Alligator Lizard	-5.3	-26.8
Western Skink	-4.7	-1.5
Southern Alligator Lizard	-4.5	1.2
Sharp-Tailed Snake	-3.3	-7.8
Common Garter Snake	-1.7	4.1
Western Rattlesnake	-1.4	-4.7
Sagebrush Lizard	0.0	17.9
Rubber Boa	0.6	0.4
Western Fence Lizard	3.4	3.3
Amphibians		
Arboreal Salamander	-66.7	23.1
Red-Bellied Newt	-1.9	-2.1

Table VII.6.6.31. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative F.

	Current to 2030	2030-2060
Western Toad	-0.5	-1.5
Pacific Chorus Frog	0.2	0.0
Foothill Yellow-Legged Frog	0.3	0.0
Pacific Giant Salamander	0.8	-1.6
Ensatina	0.9	0.0
Red-Legged Frog	0.9	0.2
Rough-Skinned Newt	1.1	0.7
California Slender Salamander	1.6	1.0
Bullfrog	2.1	-0.6
Black Salamander	3.3	1.1
Clouded Salamander	4.1	11.1
Northwestern Salamander	4.3	7.8
Southern Seep Salamander	5.3	7.8
Tailed Frog	6.0	2.0
Bats		
Big Brown Bat	-4.8	-11.1
Hoary Bat	-3.8	0.7
Townsend's Big-Eared Bat	-2.7	0.0
Western Red Bat	-2.4	4.0
Silver-Haired Bat	-2.1	0.5
Little Brown Myotis	-1.2	-1.3
Long-Eared Myotis	-1.1	-14.0
Long-Legged Myotis	0.2	-0.4
Yuma Myotis	0.7	0.7
Fringed Myotis	0.7	0.7
California Myotis	1.1	-6.5
Pallid Bat	1.9	0.0
Resident And Other Species Not Assigned To Species Groups: Percent Change In Habitat Capability		
Birds		
California Towhee	-100.0	
Western Meadowlark	-71.8	0.0
House Finch	-63.2	0.0
Lesser Goldfinch	-48.5	17.6
American Crow	-44.4	-5.0
Song Sparrow	-42.1	-21.2
Spotted Towhee	-29.3	-27.6
Bewick's Wren	-28.3	-51.5
American Goldfinch	-23.1	-25.0
Anna's Hummingbird	-21.5	-19.2
Western Bluebird	-20.7	13.1
Dark-Eyed Junco	-17.1	-8.0
American Robin	-10.3	0.3
Brewer's Blackbird	-9.8	-17.1
Barn Swallow	-9.0	-2.7

Table VII.6.6.31. Percent change in habitat capability for species occurring in Jackson Demonstration State Forest for two time periods: Current to 2030 and 2030-2060. Alternative F.

	Current to 2030	2030-2060
Wrentit	-6.7	-16.7
Brown-Headed Cowbird	-5.8	-0.4
Common Nighthawk	-3.8	0.0
Western Scrub-Jay	-1.4	-0.5
Pygmy Nuthatch	-1.4	-15.9
Pine Siskin	-1.1	0.2
Bushtit	-1.0	-0.5
Mountain Quail	-0.9	-0.2
Common Raven	-0.7	0.7
Oak Titmouse	-0.5	-0.5
Lark Sparrow	0.0	0
White-Breasted Nuthatch	0.0	0.6
House Wren	0.0	-28.3
Great Egret	0.0	0.5
Black Phoebe	0.0	0.0
Ruby-Crowned Kinglet	0.2	-0.4
Hutton's Vireo	0.2	1.2
White-Throated Sparrow	0.9	-0.5
Green Heron	0.9	0.5
European Starling	0.9	2.9
Purple Finch	1.5	1.8
Steller's Jay	1.6	0.2
Golden-Crowned Kinglet	1.6	0.8
Wood Duck	1.9	36.3
Red-Breasted Nuthatch	2.2	3.3
Pacific-Slope Flycatcher	2.2	0.6
Varied Thrush	3.0	0.4
Brown Creeper	3.4	12.2
Gray Jay	3.5	2.4
Evening Grosbeak	3.6	1.1
Great Blue Heron	4.6	18.4
Marbled Murrelet	4.9	3.5
Winter Wren	5.0	7.0
Red Crossbill	9.5	1.0
Mammals		
American Badger	-100.0	
Broad-Footed Mole	-65.0	0.0
Black-Tailed Jackrabbit	-23.6	-96.9
Common Porcupine	-9.1	-0.9
Deer Mouse	-4.0	-22.2
Norway Rat	-4.0	3.3
Virginia Opossum	-2.6	0.0
American Beaver	0.0	-2.9
House Mouse	0.0	-6.4

Small Mammals
Small mammal species exhibiting a preference for early stages of forest development or significant herbaceous understory/brush component as a consequence of a more open tree canopy layer showed net reductions in habitat capability in either time period (Botta's pocket gopher, brush rabbit, western harvest mouse, creeping vole, Sonoma chipmunk and yellow-cheeked chipmunk). The brush rabbit and creeping vole find no habitat capability beyond the 4P, 4M, and 3D stages of forest development respectively for the forest types examined. Dusky-footed woodrat habitat capability declines in the first (-14%) and second periods (-13%) with reduction in extent of Redwood and Douglas-fir 4P and in the second period Montane Hardwood Conifer 4M and 4D.

Small mammal species with a preference for later stages of forest development with well developed canopies and larger trees showed modest increases in habitat capability values for the habitat types examined. During the first period, northern flying squirrels benefit (+6%) from large trees with cavities for cover and reproduction (Douglas-fir 6 and Redwood 5P) followed by a modest increase (+12%) during the second period (Montane Hardwood Conifer 5M, 5D and 6). A large increase in Douglas-fir 6 during the first period contributed to a increase in habitat suitability for the Douglas squirrel. This species also experiences an increase during the second period, primarily due to increase in the amount of moderate to dense canopy and large tree Montane Hardwood Conifer habitat.

Raptor Species
Accipiters (Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk) that regularly occur or may occur in JDSF exhibit essentially stable levels of habitat capability within the habitat types examined for the first period. Species exhibiting large decreases in habitat capability for either Current to 2030 or 2030-2060 time periods are for the most part species that find highly suitable habitat conditions in the most open canopies and earliest stages of forest development, showing a preference for grassland/shrub dominated habitats. These species include Northern Harrier, Short-eared Owl, Barn Owl, and White-tailed Kite. Merlin, a rare winter visitor, does not breed in the assessment area, and frequents open forest conditions, grasslands and coastlines. Accipiters (Northern Goshawk, Cooper's Hawk and Sharp-shinned Hawk) as a group exhibited limited response to changing habitat conditions over the second period. Increase in Montane Hardwood Conifer 5M and 5D influenced Red-shouldered Hawk habitat capability positively in the second period (+26%). Habitat suitability for the Golden Eagle is stable during the first period and increases slightly during the second period (+5%) due to an increase in the amount of Montane Hardwood Conifer 5M, 5D and 6 and Douglas-fir 6.

Neotropical Migrants
Neotropical migrants are migratory bird species that nest in the United States and Canada but migrate south to the tropical regions of Mexico, Central and South America and the Caribbean for the non-breeding season (generally south of the Tropic of Cancer). Hayes (1995) has suggested a more refined definition in which the former describes a Nearctic migrant reserving the term Neotropical migrant for species breeding in South

America that migrate northward during the non-breeding season. This analysis examines passerine birds found in JDSF that exhibit both migratory patterns.

Decreases in habitat capability are noted for Neotropical migrants preferring open forest canopies and shrub or grass habitat types. Species such as the Lazuli Bunting, Golden-crowned Sparrow, Fox Sparrow, Chipping Sparrow, White-crowned Sparrow, MacGillivray's Warbler exhibit declines in habitat capability for those habitat types modeled for the Current to 2030 period Habitat capability continues to decline during the second period for the Fox Sparrow, Chipping Sparrow, White-crowned Sparrow, MacGillivray's Warbler, and Allen's Hummingbird. Yellow Warbler habitat capability remains stable in the first period and decreases (-13%) in the second with reduction in extent of modeled upland habitat types (Montane Hardwood Conifer 4M). Warbling Vireo and Swainson's Thrush habitat capability is stable to slightly increasing over both time periods. Purple Martin habitat capability remains stable to slightly increasing during the first period (+4%) and exhibits a marked increase in habitat capability during the second period (+58%). Second period habitat improvement is associated with a projected increase in Montane Hardwood Conifer 5M and 6. Vaux's Swift habitat capability exhibits a slight increase in the first period (+5%) with increase in extent of Douglas-fir 6 and a modest increase (+10%) in the second period with increase in Montane Hardwood Conifer 5M and Redwood 5D.

Game Species

In general, many game species exhibit a preference for the early stages of forest development, edge habitats and/or a mosaic of forest structural conditions at a relatively "fine" grain. Late seral forest interior conditions are not typically sought out as a principal source of resources to meet breeding, feeding or cover requirements. A modest reduction in habitat capability occurs during the first (-7%) and second (-5%) periods for Mourning Dove given reduction in extent of Douglas-fir 4P and Montane Hardwood Conifer 4M respectively. Blue Grouse, Band-tailed Pigeon and California Quail habitat capability remains stable over both time periods. Mule deer habitat capability declines slightly in the first period (-2%) and modestly in the second (-10%) with reductions in Douglas-fir 4P and Redwood 4P followed by decline in extent of Montane Hardwood Conifer 4M and 4D in the second period. Black bear habitat capability remains stable in the first period and increases modestly in the second (+13%) with an increase in extent of Montane Hardwood Conifer 5M, 5D and 6.

Carnivore and Furbearer

Gray fox, ringtail cat, striped skunk, mountain lion, coyote and bobcat all exhibit a decline in habitat capability during the first period principally as a result of reduction in extent of Redwood 2D and 4P and Douglas-fir 4P. Continued decline in habitat capability for these species occurs in the second period with decline in extent of Montane Hardwood Conifer 4M and 4D (ringtail -79% for modeled upland habitats). Potential marten habitat capability remains stable over both time periods and potential and Pacific fisher habitat increases slightly over both periods (populations of the Humboldt marten and Pacific fisher are not known to currently exist in the assessment area).

Bats
All bat species, with the exception of the hoary bat (-4%) (reduction in Douglas-fir 4P) and big brown bat (-5%) (reduction in Douglas-fir 4P) remain relatively stable in habitat capability during the Current to 2030 period.

Habitat capability generally stabilizes or exhibits a small decline or small increase for all bat species in the 2030-2060 period wit the exception of the long-eared myotis (-14%), California myotis (-7%) and big brown bat (-11%). Reduction in Montane Hardwood Conifer 4M and 4D was principally responsible for the decline in habitat capability for these species which was partially offset by an increase in Montane Hardwood Conifer 5M, 5D and 6.

Spatial Pattern Analysis for Species of Concern

Purpose and Background

The primary purpose of the spatial analysis is to report the magnitude of differences between common landscape measures and habitat suitability for selected species of concern across alternatives. In recent years there has been a marked increase in interest over the ability of certain species groups (raptors, late seral forest interior species, Neotropical migrants) to maintain sustainable breeding populations in landscapes that have experienced habitat loss and fragmentation (reduction in size and increase in number of habitat patches) from a variety of land uses. In some regions habitat loss and fragmentation has been a product of relatively irreversible land uses such as urbanization or agricultural conversion as in the eastern United States (Freemark et al. 1995). In western forests, the loss and fragmentation of habitat has generally occurred in landscapes that maintained compositional context. In other words, habitat patches of varying suitability due to size and juxtaposition remain in a matrix of forested conditions versus the relatively more inhospitable agricultural or urban context. Western forest landscape patterns also exhibit other differences and can be expected to be particularly dynamic given differences in topography and natural disturbance regimes of various kinds, the complexity of which is compounded by the application of forestry practices. These two landscape conditions likely differ markedly in their impact on the composition and sustainability of the species populations supported.

Limitations and Uncertainties in Spatial Analysis

Few studies have been conducted on the relationship of landscape structure on species in western forests and no strong conclusions can be made about the effect of landscape structure on some groups such as Neotropical migrants (Freemark et al. 1995), a conclusion that is likely applicable to other less well studied or conspicuous taxa as well. Short-term studies of forest fragmentation based on distribution of abundance can be misleading relative to long-term effects without information on habitat use and associated population demographics. For all but the most extensively studied species (i.e., Northern Spotted Owl) spatially explicit habitat relationship models are not available and population influences resulting from change in forest landscape structure are unclear. Well recognized landscape measures such as patch size, patch isolation, effect of non-forest edge, and degree/extent of forest development in adjacent habitat are mostly unknown or show variation by region when examined for western forest Neotropical migrant birds (Freemark et al. 1995). Rosenberg and Raphael (1986) note that abundance of Wilson's Warbler, MacGillivray's Warbler, and House Wren was higher in areas of fragmented Douglas-fir forest. Although the effect of non-forest edge on birds in western forests is mostly unknown (Freemark et al. 1995), abundances of six Neotropical migrants increased (Olive-sided Flycatcher, Western Wood Pewee, Hammond's Flycatcher, House Wren, Warbling Vireo, and Wilson's Warbler) and two decreased significantly (Western Tanager, Black-headed Grosbeak) with greater length of forest/clearcut edge in 1000 ha blocks of Douglas-fir forest (Rosenberg and Raphael 1986). Freemark et al. (1995) in a review of literature on landscape structure on Neotropical migrants breeding in western forests of a variety of types noted 15 Neotropical migrants intolerant of fragmentation or area reduction. Type and amount of adjacent habitat may have a greater influence on forest species than forest edge. Rosenberg and Raphael (1986) note 12 species with greater abundance in Douglas-fir stands that are adjacent to hardwoods including 3 Neotropical migrants (Warbling Vireo, Western tanager, and Black-headed Grosbeak).

Key assumptions in this analysis follow basic landscape ecology principles. These are that for species preferring interior forest conditions, relatively larger blocks of contiguous habitat located in close proximity and in a matrix of similar habitat represent conditions superior to landscapes where these characteristics are not as well developed. The converse would generally be applicable to species preferring edge habitats or a diversity of habitat types on the landscape. Other assumptions exist in the species habitat relationship models that are applied to patches of habitat across the landscape that are typical of those associated with modeling these kinds of relationships (Airola 1988). Therefore, although one alternative and the habitat conditions expected may well meet the requirements of a particular species over time, its relative value to other alternatives is based on principles of landscape ecology as assessed by the selected landscape measures.

Landscape ecology is based on the concept that landscape patterns influence wildlife populations as well as other ecological values. Quantifying landscape structure is a key step in evaluating trends or change in wildlife habitat capability over space and time. Optimally, a landscape would be considered a species-specific derived area of land made up of habitats or resources at a grain important to the species in question. It is likely that wide-ranging species perceive and respond to habitat patches and resource arrangement differently than a species with more narrow ecological tolerances and fine grain perception of resource arrangement. However, relatively little is known of how individual species perceive and respond to available resources and what grain of landscape is meaningful to that species. Since different species view and use the environment they occupy differently, there is no predetermined acreage that defines a landscape. A spatial grain or area intermediate between an organism's home range size and its regional distribution that also meets the biological needs of that organism generally defines a landscape (McGarigal and Marks 1995). Much progress has been made in this area over the last decade (e.g., regional scale conservation plans for species of concern, recognition of the species meta-population, etc.) and wildlife managers are increasingly aware of the importance of coarse-grained landscape pattern when considering the sustainability of wildlife populations.

Species Selection

Species of concern were selected for more detailed analysis of alternative effects on habitat extent and arrangement when habitat use and other life history attributes such as home range size and response to change in forest structural conditions supported analysis. Species of concern were not selected for additional analysis where habitat suitability was determined more by within stand structural attributes (presence or absence of snags or down logs for example) and responded to habitat conditions of smaller grain than the minimum mapping unit of the vegetation coverage (e.g., small home range or territory size). This is in essence representative of a scale issue, the upper and lower limits of map resolution constraining extrapolation or the inference of differences between landscape patterns. For example, a minimum map unit (acreage of the smallest mapped polygon) that resulted in mapped polygons markedly different (larger or smaller) from the size of habitat patch typically perceived by an organism could lead to erroneous conclusions regarding habitat capability and landscape pattern. In general, it is not known what the most appropriate habitat map resolution should be for a particular species. It is generally recognized that in these cases, it is safest to select a minimum map unit smaller than that considered important for the species being assessed (McGarigal and Marks 1995).

Ecological and data availability considerations helped define the JDSF assessment area. Ecological considerations included potential range of a sub-population of the widest ranging species of concern, watershed boundaries to reflect fisheries and watershed function related issues, and representation of potentially affected or unique plant communities. Availability of spatially explicit species occurrence data, representation of adjacent ownerships with differing management objectives, and availability and quality of GIS data sets also influenced the extent of the assessment area.

Species of concern selected for spatial analysis of alternatives are:

- Marbled Murrelet
- Northern Spotted Owl
- Pacific fisher
- Marten
- Sonoma Red Tree Vole
- Northern Goshawk
- Purple Martin
- Vaux's Swift

Landscape Measure Selection

Landscape measures were selected to capture differences in both composition and configuration at the patch, class, and landscape scales. These two aspects of a landscape work independently or in combination to influence ecological processes and organisms (McGarigal and Marks 1995). *Composition* describes non-spatially, the presence and amount of each habitat type in the assessment area (i.e., the proportion of the landscape within each habitat type). *Configuration* is the spatial distribution of habitat types in the assessment area landscape and includes such measures as mean patch area of habitat and placement relative to other patches of like or dissimilar character, and edge to volume ratio of the patch itself. As such, these measures are dependent on the spatial character of the habitat patch and their relative location.

Individual landscape measures tell us little about the suitability of habitat. However, when viewed at a landscape scale and in conjunction with other measures they can provide useful indicators of trend and hence likelihood of persistence and sustainability for species with specific needs when those needs are known. The spatial alternative analysis reported here for certain vertebrate species of concern makes use of several measures deemed important to an evaluation of habitat value for these species. Each measure selected has limitations relative to the biological needs of the species identified; however, taken in the aggregate they provide a means of alternative evaluation and spatial quantification of habitat heterogeneity and trajectory over time.

Five metrics were selected to describe the spatial pattern of habitat for species of concern in the analysis area and represent values associated with area, patch size, edge, and distribution. Selected landscape metrics are as follows:

Total Area—extent of habitat types on the landscape expressed non-spatially.
Units: acres

Total Class Area (CA)—amount of the landscape comprised of a particular patch type or class (e.g., fully suitable habitat for a particular species).
Units: acres

Number of Patches (NP)—number of patches of a particular habitat type.

Mean Patch Area (MPA) average size of habitat class patch.
Units: acres

Total Edge Index (TECI) — measure of total edge length for a particular patch type.
Units: percent

Mean Nearest Neighbor (MNN)—mean edge to edge distance from a patch to the nearest neighboring patch of the same type.
Units: meters

Landscape Measure Evaluation

Landscape measures compared across alternatives and in consideration with modeled changes in extent of habitat over planning periods, make it is possible to infer change in these measures and possible effects on species of concern in a qualitative way. Change in landscape measures beyond current mapped conditions due to expected trend in habitat extent can be somewhat subjective. However, it is expected that with marked increase or decrease in acreage of a particular type that it can be reasonably assumed that certain landscape metrics such as patch size, number of patches, nearest neighbor of similar habitat and associated connectivity in the landscape matrix will show corresponding trends for the species utilizing those habitat types. Marked increase of

acreage of large trees with well developed canopies should correspond to an increase in patch size, number of patches and improvement in connectivity of that type. In other words, the degree of forest development within the landscape matrix in which the patches of potential late seral habitat are positioned is expected to become increasingly similar to those patches of late seral forest, facilitating species dispersal. Large tree patch connectivity is subsequently increased, habitat fragmentation is decreased, and nearest neighbor values decreased for these more advanced stages of forest development. A spatial description of habitat over two or more points in time would facilitate identification of the likely trajectory of these landscape measures with greater certainty.
For the land area within JDSF and outside JDSF a spatial representation of habitat suitability was derived for each species of concern for current conditions (Table VII6.6.32) and for the area within JDSF at the end of the first 10-year planning period (Table VII.6.6.33.a1-h1). Harvest units and prescriptions previously identified for Alternative C1 provided the basis for characterizing the spatial arrangement of treatments. Retention or removal of Alternative C1 harvest units and/or change in harvest prescription was done for each alternative to emulate alternative objectives.

The reader should note that for the land area outside of JDSF and beyond current mapped habitat conditions, a spatial analysis was not possible since information on location and silviculture prescription of future forest management activities was not available. However, total class area (acreage of habitat present by habitat suitability class) was derived for future decades from non-spatial modeling results. These data are reported to provide a basis for an estimate of possible trends in spatial habitat measures outside JDSF when examined in the light of spatial measures calculated from current conditions.

Similarly, location and silvicultural prescription of future forest management activities in 2030 were deemed too speculative for the area within JDSF and were also not available. However, total class area by habitat suitability class by Alternative for each species of concern was derived by non-spatial modeling (Table VII.6.6.33.a2 through h2).

In addition, mapped vegetation coverages within JDSF and outside JDSF but within the assessment area differ in terms of the minimum mapping unit (level of resolution) applied. Landscape measures used in this analysis may differ in their sensitivity to changes in scale and it is unclear to what degree landscape metrics derived at different scales can be compared (Turner et al. 1989, McGarigal and Marks 1995). Therefore, spatial analysis of baseline conditions and expected trend in landscape measures were analyzed separately for areas within and outside JDSF and should not be compared across ownerships.

BioView, a model developed by the California Department of Fish and Game, was used to illustrate habitat suitability spatially for selected species (http://www.dfg.ca.gov/whdab/html/cwhr.html). A significant limitation of CWHR is that there are no explicit provisions for considering spatial juxtaposition of habitats and minimum functional patch size.

BioView provides a spatially explicit map of habitat capability. A variety of habitat suitability maps and summary statistics can be created for each species selected showing the range of values across a forest or region or project area for reproduction, cover, feeding or an average of all three. For this analysis the arithmetic mean was used to combine habitat suitability scores for reproduction, cover, and feeding. The habitat suitability scores range from 0 to 100. A value of 0 or 1 was considered unsuitable, values from 2 to 65 were considered low suitability, values from 65 – 99 were considered moderate-high, and a value of 100 represented fully suitable. Areas of full or high habitat suitability are optimal for species occurrence and are capable of supporting high population densities. Medium habitat suitability ratings support moderate population densities, while areas with low habitat suitability are considered marginal for species occurrence.

Table VII.6.6.32. Landscape metrics across the assessment area: Current Conditions.

TYPE	Inside JDSF			Outside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Northern Spotted Owl						
Total Class Area	17,147	2,905	26,963	56,230	12,767	68,681
Percentage of Landscape	35	6	55	34	8	42
Number of Patches	180	38	58	938	490	596
Mean Patch Area	95	76	465	24	10	48
Mean Nearest Neighbor	158	571	193	133	279	113
Total Edge Index	2,577	2,503	2,368	2,245	2,543	2,179
Marten						
Total Class Area	208	1,539	14,120	2,204	1,001	30,025
Percentage of Landscape	0	3	29	1	1	18
Number of Patches	40	19	102	198	72	581
Mean Patch Area	5	81	138	30	35	128
Mean Nearest Neighbor	592	1,202	237	399	628	192
Total Edge Index	623	500	99	1,261	807	232
Sonoma Red Tree Vole						
Total Class Area	3,199	40,107	2,282	33,055	86,158	2,933
Percentage of Landscape	7	82	5	20	53	2
Number of Patches	105	16	54	756	430	181
Mean Patch Area	30	2,507	42	108	496	40
Mean Nearest Neighbor	325	179	499	206	123	259
Total Edge Index	2,678	1,420	2,603	2,138	1,183	0
Pacific Fisher						
Total Class Area	4,025	27,467	13,997	14,269	85,061	23,043
Percentage of Landscape	8	56	29	9	52	14
Number of Patches	124	68	88	741	709	1,095
Mean Patch Area	32	404	159	19	120	22
Mean Nearest Neighbor	286	142	258	227	103	141
Total Edge Index	2,668	2,078	2,307	2,281	1,799	2,291

Table VII.6.6.32. Landscape metrics across the assessment area: Current Conditions.						
TYPE	Inside JDSF			Outside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Purple Martin						
Total Class Area	23,096	50		27,624		
Percentage of Landscape	47	0		17		
Number of Patches	108	4		1,028	4	13
Mean Patch Area	214	12		10	2	26
Mean Nearest Neighbor	172	2,822		173	1,712	227
Total Edge Index	15	2,017		14	160	459
Vaux's Swift						
Total Class Area	16,184		31,017	66,672		83,270
Percentage of Landscape	33		64	41		51
Number of Patches	196		50	723		406
Mean Patch Area	83		620	38		83
Mean Nearest Neighbor	158		190	135		129
Total Edge Index	2,589		2,315	2,349		2,321
Marbled Murrelet						
Total Class Area	2,068	24,580	15,286	2,263	62,871	23,387
Percentage of Landscape	4	51	31	1	38	15
Number of Patches	35	77	87	228	893	1,130
Mean Patch Area	59	319	176	10	69	22
Mean Nearest Neighbor	713	147	258	339	111	139
Total Edge Index	2,448	1,580	1,887	1,851	1,169	2,039
Northern Goshawk						
Total Class Area	31,516	12,563	1,599	96,736	8.585	33,180
Percentage of Landscape	65	26	3	59	5	20
Number of Patches	50	100	39	384	223	759
Mean Patch Area	630	126	41	104	16	18
Mean Nearest Neighbor	204	231	683	117	275	166
Total Edge Index	1,838	2,355	2,690	1,811	2,639	2,561

Table VII.6.6.33.a1. (continuing through h1). Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Pacific Fisher	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A:			
Total Class Area	4,025	27,467	13,997
Percentage of Landscape	8	56	29
Number of Patches	124	68	88
Mean Patch Area	32	404	159
Mean Nearest Neighbor	286	142	258
Total Edge Index	2,668	2,078	2,307
Alternative B:			
Total Class Area	4,863	28,775	11,041
Percentage of Landscape	10	59	23
Number of Patches	143	94	151
Mean Patch Area	34	306	73
Mean Nearest Neighbor	260	126	197
Total Edge Index	2,582	1,861	2,189
Alternative C1:			
Total Class Area	4,863	28,775	11,041
Percentage of Landscape	10	59	23
Number of Patches	143	94	151
Mean Patch Area	34	306	73
Mean Nearest Neighbor	260	126	197
Total Edge Index	2,582	1,861	2,189
Alternative C2:			
Total Class Area	4,846	28,578	11,459
Percentage of Landscape	10	59	24
Number of Patches	143	90	163
Mean Patch Area	34	318	70
Mean Nearest Neighbor	260	124	191
Total Edge Index	2,663	2,014	2,274
Alternative D:			
Total Class Area	4,025	28,065	11,697
Percentage of Landscape	8	58	24
Number of Patches	124	73	161
Mean Patch Area	32	384	73
Mean Nearest Neighbor	286	145	185
Total Edge Index	2,566	1,907	1,980
Alternative E:			
Total Class Area	4,025	27,467	13,997
Percentage of Landscape	8	56	29
Number of Patches	124	68	88
Mean Patch Area	32	404	159

Table VII.6.6.33.a1. (continuing through h1). Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Pacific Fisher	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Mean Nearest Neighbor	286	142	258
Total Edge Index	2,668	2,078	2,307
Alternative F:			
Total Class Area	4,074	28,059	12,684
Percentage of Landscape	8	58	26
Number of Patches	124	75	140
Mean Patch Area	33	374	91
Mean Nearest Neighbor	283	140	206
Total Edge Index	1,630	565	2,164

**Alternative A also represents current conditions.*

Table VII.6.6.33.a2. (continuing through h2) Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Pacific Fisher	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	1,313	4,929	41,572	15,886	70,795	42,519
Alternative B: Total Class Area	6,512	10,186	27,065			
Alternative C1: Total Class Area	5,408	16,824	23,849			
Alternative C2: Total Class Area	4,959	14,901	25,196			
Alternative D: Total Class Area	1,331	14,455	32,029			
Alternative E: Total Class Area	1,313	8,113	38,388			
Alternative F: Total Class Area	1,185	12,354	34,125			

Table VII.6.6.33.b1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Marten	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	208	1,539	14,120
Percentage of Landscape	0	3	29
Number of Patches	40	19	102
Mean Patch Area	5	81	138
Mean Nearest Neighbor	592	1,202	237

Table VII.6.6.33.b1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Marten	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Total Edge Index	623	500	99
Alternative B:			
Total Class Area	326	1,538	14,003
Percentage of Landscape	1	3	29
Number of Patches	59	19	112
Mean Patch Area	6	81	125
Mean Nearest Neighbor	449	1,202	208
Total Edge Index	1,053	506	150
Alternative C1:			
Total Class Area	326	1,538	14,003
Percentage of Landscape	1	3	29
Number of Patches	59	19	112
Mean Patch Area	6	81	125
Mean Nearest Neighbor	449	1,202	208
Total Edge Index	1,053	506	150
Alternative C2:			
Total Class Area	323	1,538	14,005
Percentage of Landscape	1	3	29
Number of Patches	59	19	112
Mean Patch Area	5	81	125
Mean Nearest Neighbor	450	1,202	208
Total Edge Index	1,053	506	150
Alternative D:			
Total Class Area	208	1,539	14,120
Percentage of Landscape	0	3	29
Number of Patches	40	19	102
Mean Patch Area	5	81	138
Mean Nearest Neighbor	592	1,202	237
Total Edge Index	623	500	99
Alternative E:			
Total Class Area	208	1,539	14,120
Percentage of Landscape	0	3	29
Number of Patches	40	19	102
Mean Patch Area	5	81	138
Mean Nearest Neighbor	592	1,202	237
Total Edge Index	623	500	99
Alternative F:			
Total Class Area	208	1,539	14,120
Percentage of Landscape	0	3	29
Number of Patches	41	19	102

Table VII.6.6.33.b1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Marten	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Mean Patch Area	5	81	138
Mean Nearest Neighbor	564	1,202	237
Total Edge Index	627	503	99

**Alternative A also represents current conditions.*

Table VII.6.6.33.b2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Marten	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	608		19,556	1,072	118	16,574
Alternative B: Total Class Area	608		13,167			
Alternative C1: Total Class Area	676	13	15,527			
Alternative C2: Total Class Area	700		17,525			
Alternative D: Total Class Area	626		19,438			
Alternative E: Total Class Area	608		16,892			
Alternative F: Total Class Area	661		19,514			

Table VII.6.6.33.c1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Sonoma Red Tree Vole	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	3,199	40,107	2,282
Percentage of Landscape	7	82	5
Number of Patches	105	16	54
Mean Patch Area	30	2,507	42
Mean Nearest Neighbor	325	179	499
Total Edge Index	2,678	1,420	2,603
Alternative B:			
Total Class Area	3,487	39,515	1,776
Percentage of Landscape	7	81	4
Number of Patches	137	30	71
Mean Patch Area	25	1,317	25
Mean Nearest Neighbor	276	128	427
Total Edge Index	2,642	1,274	2,602

Table VII.6.6.33.c1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Sonoma Red Tree Vole	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative C1:			
Total Class Area	3,487	39,515	1,776
Percentage of Landscape	7	81	4
Number of Patches	137	30	71
Mean Patch Area	25	1,317	25
Mean Nearest Neighbor	276	128	427
Total Edge Index	2,642	1,274	2,602
Alternative C2:			
Total Class Area	3,482	39,364	2,135
Percentage of Landscape	7	81	4
Number of Patches	138	46	173
Mean Patch Area	25	856	12
Mean Nearest Neighbor	280	104	198
Total Edge Index	2,652	1,542	2,757
Alternative D:			
Total Class Area	3,291	38,302	2,292
Percentage of Landscape	7	79	5
Number of Patches	125	35	189
Mean Patch Area	26	1,094	12
Mean Nearest Neighbor	292	130	173
Total Edge Index	2,549	1,446	2,797
Alternative E:			
Total Class Area	3,199	38,991	3,398
Percentage of Landscape	7	80	7
Number of Patches	105	22	105
Mean Patch Area	30	1,772	32
Mean Nearest Neighbor	325	166	292
Total Edge Index	2,678	1,613	2,696
Alternative F:			
Total Class Area	3,342	39,356	2,216
Percentage of Landscape	7	81	5
Number of Patches	129	28	135
Mean Patch Area	26	1,406	16
Mean Nearest Neighbor	274	140	239
Total Edge Index	2,582	1,541	2,782

**Alternative A also represents current conditions.*

Table VII.6.6.33.c2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Sonoma Red Tree Vole	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	16,768	29,509	1,538	17,571	94,267	7,698
Alternative B: Total Class Area	16,505	27,779	465			
Alternative C1: Total Class Area	14,850	30,437	794			
Alternative C2: Total Class Area	16,205	27,397	1,455			
Alternative D: Total Class Area	15,988	31,093	734			
Alternative E: Total Class Area	14,057	32,067	1,691			
Alternative F: Total Class Area	15,944	30,906	813			

Table VII.6.6.33.d1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Vaux's Swift	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	16,184		31,017
Percentage of Landscape	33		64
Number of Patches	196		50
Mean Patch Area	83		620
Mean Nearest Neighbor	158		190
Total Edge Index	2,589		2,315
Alternative B:			
Total Class Area	16,654		29,730
Percentage of Landscape	34		61
Number of Patches	204		68
Mean Patch Area	82		437
Mean Nearest Neighbor	156		164
Total Edge Index	2,539		2,097
Alternative C1:			
Total Class Area	16,308		30,279
Percentage of Landscape	34		62
Number of Patches	228		91
Mean Patch Area	72		333
Mean Nearest Neighbor	145		141
Total Edge Index	2,591		2,283
Alternative C2:			
Total Class Area	16,295		30,292
Percentage of Landscape	33		62
Number of Patches	225		91

Table VII.6.6.33.d1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Vaux's Swift	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Mean Patch Area	72		333
Mean Nearest Neighbor	146		141
Total Edge Index	2,590		2,281
Alternative D:			
Total Class Area	16,174		29,324
Percentage of Landscape	33		60
Number of Patches	229		129
Mean Patch Area	71		227
Mean Nearest Neighbor	146		115
Total Edge Index	2,565		2,121
Alternative E:			
Total Class Area	15,069		32,133
Percentage of Landscape	31		66
Number of Patches	220		63
Mean Patch Area	68		510
Mean Nearest Neighbor	150		168
Total Edge Index	2,638		2,351
Alternative F:			
Total Class Area	16,249		30,276
Percentage of Landscape	33		62
Number of Patches	206		98
Mean Patch Area	79		309
Mean Nearest Neighbor	154		126
Total Edge Index	2,598		2,237

**Alternative A also represents current conditions.*

Table VII.6.6.33.d2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Vaux's Swift	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	19,470		28,954	44,505		105,146
Alternative B: Total Class Area	22,980		25,019			
Alternative C1: Total Class Area	21,667		26,410			
Alternative C2: Total Class Area	23,615		24,497			
Alternative D: Total Class Area	20,173		28,250			
Alternative E: Total Class Area	16,652		31,771			
Alternative F: Total Class Area	20,169		28,254			

Table VII.6.6.33.e1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Purple Martin	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	23,096	50	
Percentage of Landscape	47	0	
Number of Patches	108	4	
Mean Patch Area	214	12	
Mean Nearest Neighbor	172	2,822	
Total Edge Index	15	2,017	
Alternative B:			
Total Class Area	25,981	246	
Percentage of Landscape	53	1	
Number of Patches	118	11	
Mean Patch Area	220	22	
Mean Nearest Neighbor	141	1,460	
Total Edge Index	34	1,380	
Alternative C1:			
Total Class Area	25,775	275	273
Percentage of Landscape	53	1	1
Number of Patches	115	43	51
Mean Patch Area	224	6	5
Mean Nearest Neighbor	139	436	449
Total Edge Index	45	1,176	0
Alternative C2:			
Total Class Area	25,775	275	273
Percentage of Landscape	53	1	1
Number of Patches	115	43	51
Mean Patch Area	224	6	5
Mean Nearest Neighbor	139	436	449
Total Edge Index	45	1,176	0
Alternative D:			
Total Class Area	25,604	147	
Percentage of Landscape	53	0	
Number of Patches	139	29	
Mean Patch Area	184	5	
Mean Nearest Neighbor	133	579	
Total Edge Index	19	665	
Alternative E:			
Total Class Area	25,786	269	
Percentage of Landscape	53	1	
Number of Patches	113	23	
Mean Patch Area	228	12	
Mean Nearest Neighbor	156	729	
Total Edge Index	48	1,427	

Table VII.6.6.33.e1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.			
	Inside JDSF		
Purple Martin	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative F:			
Total Class Area	24,873	80	
Percentage of Landscape	51	0	
Number of Patches	110	11	
Mean Patch Area	226	7	
Mean Nearest Neighbor	162	1,484	
Total Edge Index	14	782	

**Alternative A also represents current conditions.*

Table VII.6.6.33.e2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.						
	Inside JDSF 2030			**Outside JDSF 2030**		
Purple Martin	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	42,411			20,142		
Alternative B: Total Class Area	31,491					
Alternative C1: Total Class Area	26,135					
Alternative C2: Total Class Area	27,621					
Alternative D: Total Class Area	34,092					
Alternative E: Total Class Area	40,445					
Alternative F: Total Class Area	35,380					

Table VII.6.6.33.f1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.			
	Inside JDSF		
Marbled Murrelet	Low Suitability	Moderate – High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	2,068	24,580	15,286
Percentage of Landscape	4	51	31
Number of Patches	35	77	87
Mean Patch Area	59	319	176
Mean Nearest Neighbor	713	147	258
Total Edge Index	2,448	1,580	1,887
Alternative B:			

Table VII.6.6.33.f1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Marbled Murrelet	Inside JDSF		
	Low Suitability	Moderate – High Suitability	Fully Suitable
Total Class Area	2,045	24,780	13,489
Percentage of Landscape	4	51	28
Number of Patches	38	105	154
Mean Patch Area	54	236	88
Mean Nearest Neighbor	644	129	173
Total Edge Index	2,405	1,405	1,650
Alternative C1:			
Total Class Area	2,045	23,886	14,603
Percentage of Landscape	4	49	30
Number of Patches	39	166	247
Mean Patch Area	52	144	59
Mean Nearest Neighbor	628	104	130
Total Edge Index	2,404	1,741	1,958
Alternative C2:			
Total Class Area	2,045	23,737	14,752
Percentage of Landscape	4	49	30
Number of Patches	39	173	242
Mean Patch Area	52	137	61
Mean Nearest Neighbor	628	104	131
Total Edge Index	2,404	1,737	1,959
Alternative D:			
Total Class Area	2,067	23,947	14,216
Percentage of Landscape	4	49	29
Number of Patches	35	121	354
Mean Patch Area	59	198	40
Mean Nearest Neighbor	713	118	109
Total Edge Index	2,421	1,902	2,063
Alternative E:			
Total Class Area	2,067	21,889	17,977
Percentage of Landscape	4	45	37
Number of Patches	35	135	117
Mean Patch Area	59	162	154
Mean Nearest Neighbor	713	128	197
Total Edge Index	2,448	1,870	2,021
Alternative F:			
Total Class Area	2,067	24,568	14,575
Percentage of Landscape	4	50	30
Number of Patches	35	107	197
Mean Patch Area	59	230	74

Table VII.6.6.33.f1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Marbled Murrelet	Inside JDSF		
	Low Suitability	Moderate – High Suitability	Fully Suitable
Mean Nearest Neighbor	713	127	153
Total Edge Index	2,408	1,812	2,041

**Alternative A also represents current conditions.*

Table VII.6.6.33.f2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Marbled Murrelet	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	2,919	2,433	27,244	764	54,599	50,763
Alternative B: Total Class Area	486	2,433	25,785			
Alternative C1: Total Class Area	0	7,784	22,379			
Alternative C2: Total Class Area	486	8,270	19,947			
Alternative D: Total Class Area	486	2,919	29,190			
Alternative E: Total Class Area	1,946	2,919	27,731			
Alternative F: Total Class Area	973	2,919	26,933			

Table VII.6.6.33.g1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Northern Spotted Owl	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	17,147	2,905	26,963
Percentage of Landscape	35	6	55
Number of Patches	180	38	58
Mean Patch Area	95	76	465
Mean Nearest Neighbor	158	571	193
Total Edge Index	2,577	2,503	2,368
Alternative B:			
Total Class Area	18,373	5,579	22,247
Percentage of Landscape	38	11	46
Number of Patches	191	142	144
Mean Patch Area	96	39	154
Mean Nearest Neighbor	155	217	137

Table VII.6.6.33.g1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Northern Spotted Owl	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Total Edge Index	2,513	2,552	2,270
Alternative C1:			
Total Class Area	17,980	4,949	23,473
Percentage of Landscape	37	10	48
Number of Patches	221	144	161
Mean Patch Area	81	34	146
Mean Nearest Neighbor	141	189	123
Total Edge Index	2,597	2,612	2,443
Alternative C2:			
Total Class Area	17,968	4,812	23,622
Percentage of Landscape	37	10	49
Number of Patches	218	137	161
Mean Patch Area	82	35	147
Mean Nearest Neighbor	142	193	123
Total Edge Index	2,596	2,599	2,439
Alternative D:			
Total Class Area	17,184	4,964	11,468
Percentage of Landscape	35	10	24
Number of Patches	215	168	265
Mean Patch Area	80	30	43
Mean Nearest Neighbor	148	187	133
Total Edge Index	1,663	2,274	1,990
Alternative E:			
Total Class Area	15,813	3,124	28,079
Percentage of Landscape	32	6	58
Number of Patches	210	56	70
Mean Patch Area	75	56	401
Mean Nearest Neighbor	150	429	176
Total Edge Index	2,628	2,556	2,397
Alternative F:			
Total Class Area	17,332	3,949	25,061
Percentage of Landscape	36	8	52
Number of Patches	189	87	139
Mean Patch Area	92	45	180
Mean Nearest Neighbor	155	269	127
Total Edge Index	2,570	2,576	2,367

**Alternative A also represents current conditions.*

Table VII.6.6.33.g2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Northern Spotted Owl	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	6,851		41,572	35,841	2,705	104,112
Alternative B: Total Class Area	17,578	2,795	27,627			
Alternative C1: Total Class Area	17,910	901	29,225			
Alternative C2: Total Class Area	17,845	945	29,292			
Alternative D: Total Class Area	9,829	1,136	37,458			
Alternative E: Total Class Area	6,537	1,312	40,575			
Alternative F: Total Class Area	9,968	382	38,039			

Table VII.6.6.33.h1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Northern Goshawk	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: *			
Total Class Area	31,516	12,563	1,599
Percentage of Landscape	65	26	3
Number of Patches	50	100	39
Mean Patch Area	630	126	41
Mean Nearest Neighbor	204	231	683
Total Edge Index	1,838	2,355	2,690
Alternative B:			
Total Class Area	30,776	12,544	1,547
Percentage of Landscape	63	26	3
Number of Patches	62	112	42
Mean Patch Area	496	112	37
Mean Nearest Neighbor	175	224	601
Total Edge Index	1,621	2,315	2,676
Alternative C1:			
Total Class Area	30,977	12,545	1,548
Percentage of Landscape	64	26	3
Number of Patches	54	112	42
Mean Patch Area	574	112	37
Mean Nearest Neighbor	189	224	601
Total Edge Index	1,734	2,327	2,687
Alternative C2:			
Total Class Area	30,977	12,545	1,548
Percentage of Landscape	64	26	3

Table VII.6.6.33.h1. Landscape Metrics for Species of Concern by Habitat Suitability Class within JDSF at the End of the First Decade by Alternative.

Northern Goshawk	Inside JDSF		
	Low Suitability	Moderate - High Suitability	Fully Suitable
Number of Patches	54	112	42
Mean Patch Area	574	112	37
Mean Nearest Neighbor	189	224	601
Total Edge Index	1,734	2,327	2,687
Alternative D:			
Total Class Area	29,813	12,563	1,599
Percentage of Landscape	61	26	3
Number of Patches	72	100	39
Mean Patch Area	414	126	41
Mean Nearest Neighbor	173	231	683
Total Edge Index	1,528	2,276	2,567
Alternative E:			
Total Class Area	31,516	12,563	1,599
Percentage of Landscape	65	26	3
Number of Patches	50	100	39
Mean Patch Area	630	126	41
Mean Nearest Neighbor	204	231	683
Total Edge Index	1,838	2,355	2,690
Alternative F:			
Total Class Area	30,840	12,563	1,599
Percentage of Landscape	63	26	3
Number of Patches	55	100	39
Mean Patch Area	561	126	41
Mean Nearest Neighbor	196	231	683
Total Edge Index	1,675	2,343	2,624

**Alternative A also represents current conditions.*

Table VII.6.6.33.h2. Total Habitat Area by Suitability Class for Species of Concern by 2030 in the Assessment Area; by Alternative.

Northern Goshawk	Inside JDSF 2030			Outside JDSF 2030		
	Low Suitability	Moderate - High Suitability	Fully Suitable	Low Suitability	Moderate - High Suitability	Fully Suitable
Alternative A: Total Class Area	28,867	2,093	15,925	114,075	8,741	21,130
Alternative B: Total Class Area	33,727	3,224	9,479			
Alternative C1: Total Class Area	31,626	4,812	9,926			
Alternative C2: Total Class Area	28,929	4,395	11,717			
Alternative D: Total Class Area	30,399	3,577	15,127			
Alternative E: Total Class Area	32,265	2,009	13,214			
Alternative F: Total Class Area	30,462	4,279	15,235			

Pacific Fisher

At the end of the first decade of alternative implementation, within JDSF, habitat extent considered fully suitable was similar across all alternatives though slightly higher under alternatives A and E. The alternatives with the greatest extent of moderate-high habitat value were Alternative B and C1 over the first decade but only slightly. The difference in acreage (total class area) across all alternatives at the end of the first decade was largely inconsequential. In the fully suitable and moderate-high suitability habitat value class, habitat is found in the fewest patches under Alternative A and E. Similarly, average habitat patch size was also greatest under Alternative A and E. Habitat patches in the moderate-high suitability class were, on average, closer to one another under Alternative C2, C1 and B and closer to one another in the fully suitable habitat value class under Alternative D followed by C2, C1 and B. Total amount of habitat patch edge was least under Alternative D followed by alternatives F, C1 and B. By 2030, the greatest extent of habitat classed as fully suitable occurs under Alternative A followed by Alternative E. When moderate-high and fully suitable acreage is considered, alternatives A, D, E, and F are in essence equivalent in acreage extent. For the area outside of JDSF acreage classed as fully suitable increases markedly in extent by 2030 (23,043 acres to 42,519 acres)

Marten

At the end of the first decade of alternative implementation, within JDSF, the alternatives exhibit virtually no change in any landscape metric with the exception of minor differences between Alternative B, C1, C2 as a group and alternatives A, D, E, F as a group. The latter set of alternatives exhibit slightly better values. It is likely that after 10 years of implementation, habitat conditions that have not sufficiently diverged from one another as measured by the selected landscape metrics or silvicultural prescriptions applied to existing habitat have not sufficiently altered habitat conditions. By 2030, Alternative A, F, and D are expected to provide the greatest extent of habitat classed as fully suitable. For the area outside of JDSF, habitat classed as moderate-high and fully suitable (31,026 acres) under current conditions, declines to 16,693 acres in 2030. Reduction in acreage of Montane Hardwood Conifer 4D and Douglas-fir 4D are primarily responsible for the decline. Recruitment of Montane Hardwood Conifer 5D in the 2030-2060 period reverses the decline. Marten habitat capability increases 7% by 2060 from 2030 levels.

Sonoma Red Tree Vole

At the end of the first decade of alternative implementation, within JDSF, Alternative A and E result in the greatest extent of red tree vole habitat. However, Alternative E markedly exceeds Alternative A in the fully suitable class. Patches of habitat are fewest (least fragmented) under Alternative A in both the moderate-high and fully suitable habitat classes. Similarly, average patch size is largest under Alternative A in the moderate-high and fully suitable habitat classes. Patches of moderate-high habitat suitability are closest to one another on average (mean nearest neighbor) under Alternative C2 and under Alternative D for the fully suitable habitat class. Amount of patch edge (total edge index) is lowest for both habitat suitability classes under alternatives B and C1. By 2030, Alternative E is expected to result in the greatest extent of habitat considered moderate-high and fully suitable. Alternatives D, F, and C1 surpass Alternative A in moderate-high and fully suitable habitat by 2030. For the area outside of JDSF and by 2030, habitat classed as moderate-high and fully suitable increases from 89,091 acres to 102,325 acres.

Vaux's Swift

At the end of the first decade of alternative implementation, within JDSF, Alternative A and E result in the greatest acreage extent (47,202 acres) potentially supporting or able to recruit snags of a size utilized by this species. Alternative A shows the fewest habitat patches and largest average patch size. Alternative B results in the least amount of edge although only slightly different from the other alternatives. Habitat patches are closest under Alternative D. By 2030, all alternatives are essentially equal in extent of habitat classed as low and fully suitable. However, Alternative E results in the greatest acreage considered fully suitable exceeding the next closest alternative (A) by 1,100 acres. For the area outside of JDSF, habitat classed as fully suitable increased by 2030 from 83,270 acres to 105,146 acres. These figures assume an increase in the frequency of snags and other forest structural features of a size to support nest cavity requirements of swifts that is commensurate with an increase in acreage of forest conditions potentially providing those features.

Purple Martin

Alternatives C1 and C2 were the only alternatives with acreage in the fully suitable habitat value class (273 acres each). At the end of the first decade of alternative implementation, within JDSF, Alternative C1 (275 acres), C2 (275 acres) and E (269 acres) and B (246 acres) resulted in the greatest acreage extent potentially supporting or able to recruit snags of a size utilized by this species and in the moderate-high habitat value class. Alternatives A and F resulted in the least acreage (50 acres and 80 acres respectively).

Of the relatively few acres of moderate-high suitability class, the fewest habitat patches occur under Alternative A., which is likely a product of acreage extent. The largest amount of habitat in fewest patches occurs under Alternative B (highest mean patch area). Habitat patches are on average closest to one another under Alternative C1 and C2 probably as a result of the relatively larger number of patches of habitat resulting under these alternatives. Patch proximity is potentially an important landscape measure for these colonially nesting species. Habitat patch edge extent (Total Edge Index) is least under Alternative D and F, which is likely a product of the relatively low amount of moderate-high habitat under this alternative over the first decade.

By 2030, Alternative A followed by Alternative E provides the most potentially occupied habitat. The amount of potential habitat outside of JDSF decreases slightly from 27,624 acres to 20,142 acres in 2030, although all acreage is in the low habitat suitability class. These figures assume the presence of snags and other forest structural features of a size to support nest cavity requirements of martins that is commensurate with an increase in acreage of forest conditions potentially providing those features.

Marbled Murrelet

At the end of the first decade of alternative implementation, within JDSF, Alternative E would result in the greatest extent of potentially occupied Marbled Murrelet habitat modeled as fully suitable in value. However, this finding does not account for the likelihood that site and potential nest site-specific conditions that facilitate selection of a tree or forest stand to meet nesting and cover requirements are met. Acreage nearest the coast and with the greatest potential for attaining nest site-specific requirements would be most likely used by murrelets. In this case, alternatives F, followed by C2 and

C1 (with incorporation of suggested management measures) would be favored. Raphael et al. (2002) found that at the regional scale, abundance of murrelets as determined from off shore surveys was correlated with the amount of nesting habitat and to a lesser extent the fragmentation of that habitat. Similar patterns were noted at the watershed scale. Predation was shown to increase with proximity to forest edges when the matrix contained human settlements and recreation areas, but not when the matrix was dominated by regenerating forest (See Marbled Murrelet species account). Alternative A shows the fewest habitat patches and largest mean patch area in the fully suitable habitat class followed by Alternative E. On average, habitat patches are closest to one another (mean nearest neighbor) under Alternative D for the fully suitable habitat class. Total edge in the fully suitable habitat class was least under Alternative B. This is probably due to more intensive levels of timber management on fewer acres under B relative to other alternatives. By 2030, alternatives D and E result in the greatest extent of habitat classed as fully suitable. The site and potential nest site specific requirements described above also apply in 2030. For the area outside JDSF, the fully suitable habitat class acreage increases from 23,387 acres to 50,763 acres in 2030. It is unlikely that this apparent significant increase in potentially occupied acreage is attained considering site- and tree-specific Marbled Murrelet habitat requirements. However, it does illustrate a positive trend in potential habitat over a relatively short time period.

Northern Spotted Owl

At the end of the first decade of alternative implementation, within JDSF, alternatives E (31,203 acres) and A (29,868 acres) result in the greatest extent of habitat considered moderate-high and fully suitable, although Alternative E results in a larger amount (28,079 acres) of that total in the fully suitable habitat value class. Alternative D resulted in the least habitat in these categories (16,432 acres). The fewest habitat patches (least fragmentation) in moderate-high and fully suitable habitat occurs under Alternative A followed by Alternative E. Similarly, largest average habitat patch size in the fully suitable and moderate-high habitat classes occurs under Alternative A. On average habitat patches in the moderate-high and fully suitable classes were closest to one another (mean nearest neighbor) under Alternative D, C1 and C2 and Alternative C1, C2 and F respectively. Patch edge was least under Alternative D and greatest under alternatives C1 and C2. The latter alternatives having a generally positive effect on prey availability and access. By 2030, alternatives A and E result in the greatest acreage classed as fully suitable followed by D and F. For the area outside of JDSF habitat classed as fully suitable increases markedly from 68,681 acres to 104,112 acres in 2030.

Northern Goshawk

At the end of the first decade of alternative implementation, within JDSF, the alternatives exhibit virtually no change in any landscape metric with the exception of minor differences between Alternative B, C1, C2 as a group and alternatives A, D, E, F as a group. The latter set of alternatives exhibits slightly better values. It is likely that after 10 years of implementation, habitat conditions have not sufficiently diverged from one another as measured by the selected landscape metrics or silvicultural prescriptions applied to existing habitat have not sufficiently altered habitat conditions. At the end of the first decade of alternative implementation, within JDSF, Alternative A and E result in the greatest extent of habitat considered low, moderate-high, and fully suitable (45,678 acres) although only slightly more than the other alternatives. By 2030, alternatives F and D result in the greatest extent of habitat classed as moderate-high and fully suitable. Outside of JDSF, Northern Goshawk habitat extent classed as moderate-high and fully suitable (41,765 acres) declines to 29,871 acres in 2030. The decrease in habitat extent is primarily due to reduction in acreage of suitable foraging habitat to 2030. This trend is reversed with an increase in acreage of highly suitable breeding, feeding, and cover conditions in Montane Hardwood Conifer 5D and Montane Hardwood 5D by 2060.

6.6.9 Alternatives Comparison

Table VII.6.6.34 provides a summary comparison of the potential environmental effects of the seven alternatives.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Potential to have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the CDFG or U.S. Fish and Wildlife Service.						
Impact: Late Successional/Old-growth Forest						
Alt. A		■				Alternative A does not propose the removal of old-growth or late successional habitats. Unlike alternatives C1, C2, D, E, and F, it does not provide for specific management to advance the development of late-successional habitats. Although the natural development of late successional habitats is a long process, the quality of late successional habitats on JDSF is expected to slightly improve under Alternative A within the 10 year planning period. However, the development of late successional habitat is expected to take longer under Alternative A than under alternatives C1, C2, D, E and F
Alt. B			■			Although Alternative B is expected to retain the 459 acres of designated old-growth groves, stands containing CWHR 6, 5D, or 5M could be harvested resulting in the degradation of late successional habitats. Like Alternative C1, the amount of late successional habitat that would be harvested under Alternative B is unknown. Alternative B does not propose any specific management to advance the development of late successional habitat and it has greater emphasis on evenaged management than Alternative C1. However, due to FPR requirements and restrictions for late successional habitats, Alternative B is not likely to significantly reduce the amount of late successional habitat on JDSF. In the long term, stands where harvesting is restricted should develop into late successional habitat, but to a lesser extent than under the other alternatives and not within the 10 year planning period.
Alt. C1 May 2002 DFMP			■			Refer to section: “Project Impacts.”
Alt. C2 Nov. 2002 Plan			■			Similar to C1, though more late-seral habitat would be provided.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D			■			Under Alternative D, JDSF will be managed as largely an uneven-aged forest. Like Alternative C1, existing stands of old-growth and aggregates will be retained, and designated areas will be managed for the development of late successional forest. In addition, the emphasis on uneven-aged management and the retention of late successional elements such as snags, LWD, etc. in harvest areas should minimize potential degradation of late successional habitat on JDSF. Although harvesting may occur within late succession habitats and short-term degradation would be expected, the amount and quality of late successional habitat is expected to increase over time. Thus, the impacts of Alternative D on late successional habitats are expected to be less than significant within the 10 year planning period and beneficial in the long term.
Alt. E	■					Alternative E does not propose the removal of any late-successional or old-growth habitats. In addition, where harvesting did occur, it would focus on the development of late successional habitat. Although late successional habitat is not expected to be developed within the life of this plan, the management direction under Alternative E would be expected to improve the condition of late successional habitat in the short term and increase quality and quantity in the long term.
Alt. F	■					Alternative F would prevent timber harvest in old-growth stands. Any tree alive since 1850 or earlier is not subject to timber harvest unless a health or safety hazard. This alternative would provide greater areas of late seral forest than most other alternatives. Requires the development of contiguous older forest conditions using existing old growth groves. Late seral development is promoted in Marbled Murrelet Management Areas and riparian zones.
Impact: Snags and Down Wood						
Alt. A	■					Alternative A does not propose the removal or creation of snags and downed wood. Therefore, the number of snags and amount of downed wood is expected to naturally increase within the 10 year planning period under Alternative A.
Alt. B				■		Although snags and downed wood will be retained as directed by the FPRs, their removal is still likely to occur under Alternative B. Snags and downed wood are lacking on JDSF and without specific retention measures, the number of snags could be significantly reduced on JDSF under Alternative B. This impact could be mitigated to less than significant by applying snag protection measures similar to Mitigation 1.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. C1 May 2002 DFMP				■		Refer to detailed project impacts above. Apply Mitigation 1 to reduce impacts to less than significant.
Alt. C2 Nov. 2002 Plan				■		Similar to C1.
Alt. D				■		The potential impacts to snags under Alternative D are the same as under Alternative C1, except that the increase in recreation could increase the number of snags considered a safety hazard. Thus, the potential impacts of Alternative D on snags could be slightly greater than those of alternative C1. Application of Mitigation 1 would reduce impacts to less than significant.
Alt. E	■					The potential impacts to snags under Alternative E are similar to Alternative D. However, Alternative E has proposed harvest on only 25% of the Forest and will focus on the development of late-successional habitat. This will likely include the retention /recruitment of snags. The impacts of Alternative E are expected to be beneficial.
Alt. F	■					Expected increase in amount of late seral forest conditions under this alternative would likely increase the density of large snags over time. Retention of individual trees alive since 1850 or earlier would also increase density of snags. Maintenance of high stocking levels is expected to increase snag recruitment.
Impact: Hardwoods						
Alt. A		■				Alternative A does not propose the removal of hardwoods. Therefore, Alternative A will not impact the number, distribution, or availability of hardwoods.
Alt. B				■		Under Alternative B, hardwoods are recognized for their habitat value, but would be aggressively reduced and replaced with native conifers. Impacts on hardwoods and their habitat values are expected to be significant, but could be mitigated with measures like those in C1 to mange hardwoods to natural stand levels.
Alt. C1 May 2002 DFMP		■				Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan		■				Same as C1

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D	X					Under Alternative D, hardwoods will be managed as a significant component of the stand. Although some hardwoods are expected to be harvested under Alternative D, the overall effect is expected to be beneficial.
Alt. E	X					Under Alternative E, JDSF would manage hardwoods to maintain a species mix similar to old-growth forest conditions. In other words, hardwoods would be managed as a significant portion of the stands. Although some hardwoods may be harvested, the impacts are expected to be positive but less than Alternative D.
Alt. F	X					Would manage hardwoods to achieve levels associated with late seral/old growth forest. Impacts are positive but less than Alternative D.
Impact: Riparian						
Alt. A		X				Alternative A does not propose the removal or alteration of riparian habitats. Thus, Alternative A is not expected to impact Riparian habitats.
Alt. B				X		Under Alternative B, riparian habitats will be managed according to FPRs. Protection is somewhat less than Alternative C1. Impacts of Alternative B are expected to be significant but could be feasibly mitigated to less than significant with measures such as those provided in C1.
Alt. C1 May 2002 DFMP	X					Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan	X					Same as C1.
Alt. D	X					Alternative D proposes larger WLPZs (FEMAT) than Alternative C1. WLPZs will be managed for the development of late successional habitat. These measures should protect and/or improve the conditions of riparian habitats
Alt. E	X					The protection and management of riparian habitats are the same under Alternative E as under Alternative D. Impacts of Alternative E on riparian habitats would be similar to Alternative D.
Alt. F	X					This alternative proposes NOAA Fisheries short-term HCP standards for riparian protection. This high-level of protection will benefit riparian forest habitat and ecosystem function.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible
Impact: Other Unique/Special Habitats and Features						
Alt. A		■				Alternative A does not propose management activities that will impact or degrade unique habitats or special features. Therefore, Alternative A is not expected to impact unique or special habitat features.
Alt. B			■			The protection and management of unique or special habitat features would be guided by the FPRs. Impacts would be less than significant with application of mitigations similar to C1.
Alt. C1 May 2002 DFMP				■		Refer to detailed project impacts above. Impacts will be beneficial with application of Mitigation 1.
Alt. C2 Nov. 2002 Plan				■		Similar to C1.
Alt. D	■					In addition to protections of the FPRs, Alternative D seeks to emulate forest species mix found in late seral/old-growth forest. Enhanced riparian zone width and no or minimal harvest SCAs benefit overall habitat connectivity. FEMAT management for wetland areas.
Alt. E	■					Similar to Alt. D regarding forest stand species composition and wetland management. Emphasis on old-growth and late seral development will tend to enhance habitat connectivity for species utilizing this type of forest structure.
Alt. F	■					Alternative seeks to maintain and restore high quality habitat for native flora and fauna and forest stands of a particular age class considered scarce regionally. National Marine Fisheries Service and HCP guidelines for wetland management. Develops water based core areas that link key areas and old-growth groves to enhance habitat connectivity for species utilizing these forest conditions.
Impact to: Wildlife Communities and Species Habitat Value						
Alt. A	■					Without management, some stands would become denser rendering them less suitable for some species. Wildlife preferring early successional and open habitats would encounter reduced habitat capability over time as the young stands mature. Early successional stands (CWHR class 1) would likely experience the most significant change, followed by the more sparse forest habitats of size class 2 and 3. These stands would become denser and contain larger trees than they do currently. As an example, WHR 2M may become 3D during the life of the plan. However, in the same timeframe, CWHR class 5s are not likely to become 6s under this alternative. Habitat value for species preferring dense stands would increase.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B			■			Extent of early successional stands may increase and late seral stands may decrease compared to existing conditions and the conditions anticipated under Alternative A. An increase in early seral habitats would benefit a variety of species that prefer these habitat types. On the other hand, a decrease in late seral habitat may negatively affect species that require this type of habitat. These differences may not result in a composition of different species in the short term, but would affect habitat capability as measured by relative abundance.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above. Species habitat value trend similar to Alternative B .
Alt. C2 Nov. 2002 Plan			■			Similar to C1. Species habitat value trend similar to Alternative B .
Alt. D	■					Alternative D would focus on uneven-aged management and the development of late successional habitats in the large riparian protection zones. Increasing the amount of late successional habitats on JDSF would favor species associated with this type. Because clearcutting would not be used under Alternative D, early successional habitat and associated species would be reduced on JDSF over time, but not within the 10 year planning period. Increase in recreational opportunity under this alternative may negatively influence some wildlife species. For example, some bat species are highly susceptible to human intrusion and may abandon a site after being disturbed by humans; food refuse from recreationists may attract corvids that predate Marbled Murrelet nests. Thus, an increase in recreation has the potential to negatively impact wildlife communities on JDSF.
Alt. E	■					Alternative E focuses on the development of late seral forest conditions on JDSF. Like alternatives A and D, the lack of clearcutting and the maturation of stands of early successional habitats would result in the gradual reduction of early successional habitats and associated species over time. Species that require closed canopy forest habitats and late successional forest conditions would be expected to benefit under Alternative E over the next 30 years. Under Alternative E, habitat value for 64 terrestrial vertebrate species is expected to increase and decrease for 130.
Alt. F	■					Similar to Alternative E focusing on the development of late seral forest conditions across forest and within riparian zones. Under Alternative F, habitat value is expected to increase for 75 terrestrial vertebrate species and decrease for 115 species over the next 30 years.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Impact: Game Species						
Alt. A			X			The maturation of early successional habitats over time will reduce the amount of available foraging and/or reproductive habitat for several game species. Reduction in acreage of Montane Hardwood Conifer 4M/4D primary factor in habitat trend.
Alt. B			X			Under this alternative, 8 of 9 game species expected to occur will experience net decline in habitat value over the next 30 years for reasons noted in Alt A.
Alt. C1 May 2002 DFMP			X			Refer to detailed project impacts above. Trend in game species habitat value similar to Alt. B.
Alt. C2 Nov. 2002 Plan			X			Similar to Alternative C1 in terms of species and magnitude of change in habitat capability over both planning periods.
Alt. D			X			Similar to Alternative A. Although these impacts could be considered significant in the long term, they are considered less than significant within the 10 year planning period. Montane Hardwood Conifer 6 increases in the 2030-2060 planning period compensate for decrease in extent of Montane Hardwood Conifer 4M in the Current to 2030 period. Species under this Alternative exhibit generally stable to small declines in habitat capability over the Current to 2030 period.
Alt. E			X			Similar to Alternative D. Decrease in extent of Montane Hardwood Conifer 4M results in small to modest decline in mule deer and Mourning Dove habitat capability in the first period. Band-tailed Pigeon habitat capability remains stable over both periods. Marked increase in Montane Hardwood Conifer 6 may provide some compensating habitat value. Gray squirrel and black bear exhibit small increase in habitat capability. Greater emphasis on extent of late seral forest conditions will reduce the amount of available foraging, cover and/or reproductive habitat for most game species in the long term..
Alt. F			X			Similar to Alternative E but late seral forest recruitment less extensive. Increase in acreage of mid seral closed canopy conditions will reduce forage availability. Similar to Alt. E with declining trend in Montane Hardwood Conifer 4M/4D representation and increasing trend in Montane Hardwood Conifer 6 acreage. Net increase in habitat capability for gray squirrel and black bear over both planning periods.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Impact: Lotis Blue Butterfly						
Alt. A		■				Since Alternative A does not allow for timber harvesting or other management activities that may harm individuals or degrade bogs or other potential habitat, implementation of this alternative is not expected to impact lotis blue butterflies directly. However, management directed toward the development of habitat potentially used by this species would not occur.
Alt. B	■					Similar to Alternative C1
Alt. C1 May 2002 DFMP	■					Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan	■					Similar to Alternative C1.
Alt. D		■				Riparian management measures, Pygmy Forest Reserve management, and species-specific management measures for the lotis blue butterfly under Alternative C1 would be the same or greater under Alternative D. However, unlike Alternative C1, no potential habitat would be created under Alternative D.
Alt. E	■					Similar to Alternative D with respect to lotis blue butterflies and their habitat. However, restoration emphasis would provide for creation of habitat.
Alt. F	■					
Impact: Southern Torrent Salamander and Tailed Frog						
Alt. A			■			Since no timber management would occur under this alternative, no habitat or individuals are expected to be impacted by harvest activities. Canopy cover in riparian habitats and over watercourses would increase and water temperatures are expected to remain similar to or below current conditions. Southern torrent salamanders and tailed frogs are expected to benefit from these conditions in the long term. However, the lack of a Road Management Plan and erosion control measures in this alternative may allow the input of sediment from road failure that could degrade breeding habitat in the short term. Although southern torrent salamanders and tailed frogs are expected to benefit from the lack of harvest, sediment input represents a potential negative impact; these effects are roughly offsetting. A slight increase in habitat capability for both species is expected over the next 30 years under this alternative.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: **(1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B				■		Under this alternative, JDSF would continue current management practices in riparian areas adjacent to Class II watercourses, springs and seeps, as described in the FPRs. Although these practices follow current FPRs, they provide less protection than Alternative C1. Road management would follow current FPRs and does not propose a Road Management Plan to further control sediment delivery into watercourses. High level of sediment input could result in the degradation of breeding habitat of these species. Therefore, without additional mitigation to manage roads and prevent road failure in areas not associated with a THP, implementation of Alternative B may result in significant impacts to the breeding habitat of southern torrent salamanders and/or tailed frogs.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above. Sedimentation levels originating from Class III likely higher than under Alternatives A, D, E, F.
Alt. C2 Nov. 2002 Plan			■			Similar to C1.
Alt. D	■					Under Alternative D, JDSF would establish larger WLPZ protection buffers along Class II and III watercourses than the proposed protection under Alternative C1. Like Alternative C1, Alternative D would implement a Road Management Plan to minimize sediment input. These measures are expected to increase the quality and quantity of southern Torrent salamander and tailed frog habitat over time. However, there is still the slight potential for sediment delivery to watercourses from road sediment in some areas that may degrade some potential breeding habitat in the short term. Human impacts could be magnified by the increase in recreation and access expected under this alternative. Nonetheless, the overall impacts of Alternative D are expected to benefit southern Torrent salamanders or tailed frogs. Late seral conditions adjacent to Class IIIs.
Alt. E	■					Under Alternative E, JDSF would follow the same riparian management practices and implement the same road management plan as under Alternative D. However, less timber harvest and recreation would be expected than under Alternative D. The impacts of Alternative E on southern Torrent salamanders and tailed frogs are not expected to adversely affect these species. Increase in Class II and Class III riparian protections similar to Alternative D and management for late seral conditions. Habitat value for both species expected to increase over the next 30 years.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. F	■					Greater protection of Class II and III drainages than Alternative C1 with Aquatic Protection and Aquatic Management Zones, but width of riparian protection zone less than alternatives D or E. Habitat value is expected to increase for both species over the next 30 years. Aquatic Management Zone to be managed to late seral conditions.
Impact: Northern Red-legged Frog						
Alt. A		■				Since no harvesting would occur under this alternative, habitat for this species would not be affected. As the habitats mature, the quality of habitat would improve. Habitat quality for this species is expected to remain stable over the next 30 years.
Alt. B			■			Under this alternative, JDSF would continue current management practices in riparian areas adjacent to watercourses, springs and seeps, and ponds, as described in the FPRs. Although these practices follow current FPRs, they provide less protection than Alternative C1. Other factors are similar to those identified for Alternative C1 and C2. Red legged frogs are likely to continue to occur at levels similar to existing conditions. Habitat value for this species outside of the WLPZ is expected to exhibit a small increase over the next 30 years.
Alt. C1 May 2002 DFMP		■				Refer to detailed project impacts above. Habitat value for this species outside of the WLPZ is expected to exhibit a small increase over the next 30 years.
Alt. C2 Nov. 2002 Plan		■				Similar to C1.
Alt. D	■					In riparian areas, Alternative D would provide larger riparian buffers (FEMAT) with more restrictions on management practices along Class I watercourses than Alternative C1. However, timber harvest that promotes late successional habitat could be conducted. Tree retention requirements would improve habitat quality for red-legged frogs. As described for Alternative A, this measure would benefit red-legged frogs by minimizing disturbance of streamside vegetation and benches that red-legged frogs use for foraging and resting. However, the increase in recreation along watercourses could result in increased disturbance to individuals, but not adversely. Because red-legged frogs depend on aquatic habitat to reproduce, the improvement in aquatic habitat conditions expected under Alternative D would benefit red-legged frogs.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. E	X					Management measures for riparian areas would be similar to Alternative D. Upland habitat would remain abundant on JDSF as under Alternative D, except that lands would be managed for the development of late successional habitats. Effects of Alternative E on red-legged frogs would be similar to those described for Alternative D.
Alt. F	X					Similar to Alternative D.
Impact: Foothill Yellow-legged Frog						
Alt. A			X			Under Alternative A, no harvesting would occur on JDSF and riparian area canopy cover and potentially reduced stream temperature may have a slightly negative effect on habitat quality. The lack of a Road Management Plan and erosion control measures in this alternative may allow the input of sediment from road failure that could degrade breeding habitat quality in the short term. Yellow-legged frogs are known to occur in JDSF and should continue to occur at populations and habitat conditions similar to current levels.
Alt. B			X			Under this alternative, JDSF would continue management practices in riparian areas adjacent to Class I and II watercourses, springs and seeps, and ponds, as described in the FPR. Although these practices follow current FPR, they provide less protection than Alternative C1. Other factors are similar to those identified for Alternative C1.
Alt. C1 May 2002 DFMP		X				Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan		X				Similar to C1.
Alt. D	X					Under Alternative D, JDSF would implement larger riparian buffers (FEMAT) and more harvest restrictions in Class I and II watercourses than under Alternative C1. Increase in canopy cover of riparian areas may have slight negative influence on the availability of basking sites. Alternative D also would implement a Road Management Plan similar to that of Alternative C1. Increase in recreation proposed under this alternative could negatively impact individuals, habitat or their reproductive success. This could result from increased human use of streams and rivers. The degree to which recreational activities will impact individuals is unknown but it is expected to be less than significant. The overall effects of Alternative D are expected to be beneficial.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. E						Management measures for riparian areas and sediment control would be the same under Alternative E as under Alternative D. However, Alternative E proposes less of an emphasis on recreation than Alternative D. Additionally, timber harvest would be reduced on JDSF and be focused on the development of late successional habitat.
Alt. F						Similar to Alternative D.
Impact: Northwestern Pond Turtle						
Alt. A						Alternative A does not propose management activities that would impact northwestern pond turtles or their habitat. Over time, forest stand development may become too dense for suitable pond turtle nesting, resulting in the potential loss of nesting habitat.
Alt. B						Management activities and effects that could impact northwestern pond turtles are the same under Alternative B as under Alternative C1
Alt. C1 May 2002 DFMP						Refer to detailed project impacts and habitat capability modeling limitations applicable to all alternatives above.
Alt. C2 Nov. 2002 Plan						Similar to Alternative C1.
Alt. D						Management measures that could impact northwestern pond turtle habitat under this Alternative Are similar to those described under Alternative C1. However, the low level of evenaged management may reduce the availability of upland nesting habitat compared to Alternative C1 although at unknown levels. The riparian protection measures of this Alternative are expected to benefit this species by reducing the chance of incidental harm from management activities near upland nest sites and allowing the recruitment of LWD, which is important for basking. Increased recreational activity could negatively impact individuals particularly in ponded or slow moving water environments.
Alt. E						Similar to Alternative A.
Alt. F						Similar to Alternative A.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Impact: Northern Goshawk						
Alt. A		■				Alternative A does not propose any management activities that would impact Northern Goshawk habitat. Due to the lack of specific management to advance the development late successional habitat, stands of unsuitable habitat will take longer to develop into suitable Goshawk habitat than under Alternative C1. However, over time, the natural thinning and development of the stand will gradually increase the amount and quality of Goshawk habitat on JDSF, but significant changes are not expected within the life of the DFMP. In fact, some stands that are currently considered Goshawk habitat may temporarily become dense while other stands already in the thinning phase may increase in quality. Goshawks are not known to nest on JDSF and habitat would continue to be provided at levels similar to existing conditions during the life of the DFMP. Net change in habitat capability over the Current to 2030 and 2030-2060 periods was stable.
Alt. B				■		The impacts to Northern Goshawk habitat under Alternative B are expected to be greater than the impacts of Alternative C1 or C2. This is because Alternative B focuses more on evenaged management that is expected to remove more habitat than the management practices proposed under Alternative C1 and C2. Additionally, the protection of nest sites will be completed according to current FPR (5 acre minimum protection buffer), which are considered too small to adequately protect nest sites. Reynolds (1983) recommends an uncut buffer of approximately 20 acres. This alternative results in the least amount of fully suitable habitat in 2030. Net change in habitat capability over the Current to 2030 and 2030-2060 periods was -22% and +7% respectively. Impacts are expected to be less than significant with the development of a mitigation measure addressing foraging, cover, and nesting habitat requirements and spatial arrangement for any goshawk territory identified over the term of the project.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above. Net change in habitat capability over the Current to 2030 and 2030-2060 periods was -15% and -13% respectively. Survey and habitat provisions of identified Goshawk territories reduce to less than significant the modest decrease in habitat capability over the Current to 2030 and 2030-2060 time periods.
Alt. C2 Nov. 2002 Plan			■			Similar to Alternative C1. Net change in habitat capability over the Current to 2030 and 2030-2060 periods were modest declines of -10 and -11% respectively.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: **(1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D		X				With the exception of the limited evenaged management, Alternative D is similar to Alternative C1 with respect to Goshawks nest site protection. Through the use of uneven-aged management and the advancement of late successional habitat, habitat quality and quantity is expected to increase under Alternative D in the long and short term. However, the lack of silvicultural methods that create small openings in the stand may reduce the overall quality of JDSF in the long term, but not within the life of the DFMP. Although Northern Goshawks prefer late successional habitats, small openings, meadows, or woodlands are necessary for providing foraging opportunities. Increased recreation on JDSF could result in an increase of human caused disturbance to nesting Goshawks. Although unlikely, this has the potential to impact the breeding success of Goshawks should they occur on JDSF. Net change in habitat capability over the Current to 2030 and 2030-2060 periods was +3% and +3% respectively.
Alt. E	X					Under Alternative E, JDSF would follow the same general management practices as under Alternative D. However, recreation would be less of an emphasis than Alternative D. Human disturbances are not expected to increase and habitat is expected to improve in terms quality and quantity, Alternative E should be of slightly greater benefit to Northern Goshawks. Net change in habitat capability over the Current to 2030 and 2030-2060 periods was stable.
Alt. F		X				Similar to Alternative D. Net change in habitat capability over the Current to 2030 (+3%) and 2030-2060 periods (0% change) is expected to be essentially stable.
Impact: Cooper's Hawk						
Alt. A		X				Alternative A does not propose the removal or recruitment of Cooper's Hawk habitat. As the younger forested habitats on JDSF mature, they will increase in quality for Cooper's Hawks in the short term. Reduction in occurrence of forest openings over time does not favor Cooper's Hawk foraging opportunity. Nonetheless, Alternative A is expected to maintain habitat for Cooper's Hawks over the next 30 years.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B				■		Although Alternative B proposes greater emphasis on evenaged management, potential impacts to Cooper's Hawk habitat are expected to be similar to those under Alternative C1. Reduction in hardwood/conifer mix acreage under Alternative B would decrease the quality of habitat for Cooper's Hawks over the next 30 years. Habitat capability is expected to decline by approximately 13% over the Current to 2030 period. This impact could be mitigated by implementing hardwood management measures similar to Alternative C1.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above. Overall impacts are considered to be less than significant (-11% in habitat capability Current to 2030) given survey and nest site protections.
Alt. C2 Nov. 2002 Plan			■			Similar to C1 (-8% change in habitat capability Current to 2030).
Alt. D			■			Small group selection and single tree selection could enhance habitat value as late seral conditions increase. Since Cooper's Hawks are known to successfully nest in areas of high human use, the impacts of increased recreation are not expected to adversely impact Cooper's Hawks. Habitat capability is essentially stable over the Current to 2030 period.
Alt. E			■			Under Alternative E, JDSF would follow the same general management practices as under Alternative D with the exception of no even-aged management prescriptions for forest opening creation. Habitat capability is expected to remain stable.
Alt. F			■			Similar to Alternative D. Habitat capability is essentially stable over the Current to 2030 and 2030-2060 periods.
Impact: Golden Eagle						
Alt. A			■			As early successional and open to sparse canopy habitats mature, potential Golden Eagle foraging habitat will decline over time. Lack of cliff habitat on JDSF limits potential nesting structure to individual large trees. Golden Eagles are not known to use JDSF for nesting. Habitat capability is expected to remain stable over both time periods.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B			X			Take will be avoided through the protection of nest sites consistent with current FPRs as in Alternative C1. Under Alternative B, forest stands that provide nesting opportunities for Golden Eagles are likely to decrease compared to existing conditions resulting in a modest to marked decline in habitat capability rating (-11% Current to 2030 and -26% 2030-2060). However, evenaged management application will maintain foraging habitat at levels similar to existing conditions. Ample large tree nest site opportunity would remain and result in a less than significant effect overall.
Alt. C1 May 2002 DFMP			X			Refer to detailed project impacts above. Nest site survey and habitat protections are expected to reduce impacts to a less than significant level should the species occupy JDSF. Marked decline in the Current to 2030 period (-27%) is followed by modest increase (+10%) in the 2030-2060 period.
Alt. C2 Nov. 2002 Plan			X			Similar to Alternative C1. Greater emphasis on late seral forest recruitment results in reduced impact to potential nesting habitat value than under Alternative C1.
Alt. D			X			Similar to Alternative C1. Take would be avoided through the protection of nest sites. Although the risk is considered minimal because of the lack of large expanses of suitable foraging habitat, the increase in recreation could disturb nesting Golden Eagles, should they nest on JDSF. Golden Eagles are not known to use JDSF and amount and quality of nesting habitat is expected to remain stable or improve over time. Impacts are expected to be less than significant.
Alt. E			X			Take is avoided through the protection of nest sites. Amount and quality of foraging habitat will decline over time under Alternative E as late seral areas are developed; impacts are expected to be less than significant overall with potential improvement in habitat capability in the 2030-2060 period (+6%).
Alt. F			X			Similar to Alternative E in terms of overall change in habitat capability.
Impact: Bald Eagle						
Alt. A		X				Alternative A does not propose the removal, degradation, or improvement of potential Bald Eagle nesting, winter roosting, or foraging habitat and is not expected to impact Bald Eagles. Habitat capability is expected to remain stable in the Current to 2030 period and exhibit a marked increase in the 2030-2060 period.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B			■			The potential impacts to nesting, roosting, and foraging Bald Eagles under Alternative B generally exceed those of Alternative C1. Like Alternative C1, Alternative B proposes to protect existing old-growth groves, however, unoccupied large residuals and unidentified patches of old-growth could be harvested. This represents the loss of potential nesting habitat for this species. Take will be avoided through the protection of nest sites and winter roosts consistent with current FPRs and/or through consultation with CDFG or the USFWS. Although some unoccupied potential nesting habitat may be harvested, numerous potential nest/roost trees will not be harvested and all nest /roost sites will be protected. Impacts of Alternative B on potential Bald Eagle nesting habitat is expected to be similar to that expected under Alternative C1, but is still not likely to significantly impact Bald Eagle nesting or other life requisites.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan			■			Similar to C1
Alt. D		■				Alternative D will likely result in greater levels of potential nest sites/roost habitat than Alternative C1. However, the potential exists for increased recreation associated disturbance to nesting or wintering Bald Eagles. These impacts are expected to be minimal and ultimately will be determined on a site specific basis. Take will be avoided through the protection of nest sites and winter roosts consistent with current FPRs and/or through consultation with CDFG or the USFWS. Since Bald Eagle nest and roost sites will be protected and increased recreation is generally not expected to have adverse effects, no impacts are anticipated. Overall habitat capability is expected to remain stable In the Current to 2030 period and exhibit a modest increase in the 2030-2060 period (+18%).

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. E	X					Alternative E proposes to protect all old-growth residuals and snags, unless they pose a safety hazard. As described for Alternative C1, take will be avoided through the protection of nest sites and winter roosts consistent with current FPRs and/or through consultation with CDFG or the USFWS. Since no potential nesting habitat is expected to be removed and nest and roost sites will be protected and developed over time, no impacts to Bald Eagles are expected. Increased management for late seral representation on the forest will increase the number of possible nest sites or conditions suitable for winter roosts over the longer term and have a beneficial effect on habitat over the long term.
Alt. F	X					Similar to Alternative E .
Impact: Osprey						
Alt. A		X				Alternative A does not propose management activities that would measurably influence potential or actual Osprey habitat. Therefore, Alternative A is not expected to impact Ospreys.
Alt. B			X			Although Alternative B proposes to protect existing old-growth groves, large residuals could be harvested. This represents the loss of potential nesting habitat for this species. Like Alternative C1, take will be avoided under Alternative B through the protection of nest sites consistent with current FPRs and/or through consultation with CDFG. This will include, at minimum, the protection of the nest tree and buffer, and silvicultural and noise disturbance buffers. Although some unoccupied potential habitat may be harvested numerous potential nest sites will be available and all nest sites will be protected. Therefore, implementation of Alternative B is not expected to significantly impact Osprey.
Alt. C1 May 2002 DFMP			X			Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan			X			Similar to C1.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: **(1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D		■				Alternative D is largely the same as Alternative C1 with respect to occupied Osprey nesting habitat and nest site protections. Alternative D has the potential for increased disturbance to nesting birds from higher recreation levels. However, the impacts of increased type and amount of recreation are expected to be minimal given Osprey tolerance for human activity. Acreage potentially recruited as late seral has a positive effect on nest site opportunities. As described for Alternative C1, take will be avoided through the protection of nest sites consistent with current FPRs and/or through consultation with CDFG. Since Osprey nest sites will be protected and recreation is not expected to have significant adverse impacts on nesting Osprey, no impacts from Alternative D are expected
Alt. E		■				Alternative E proposes to protect all old-growth residuals and snags, unless they pose a safety hazard and recruit late seral forest conditions forest wide. As described for Alternative C1, take will be avoided under Alternative E through the protection of nest sites consistent with current FPR and/or through consultation with CDFG.
Alt. F		■				Similar to Alternative E .
Impact: Peregrine Falcon						
Alt. A		■				No suitable cliff nesting habitat exists on JDSF. However, large trees are present and represent atypical nesting habitat for this species. Alternative A does not propose management activities that would impact or disturb typical Peregrine Falcon nesting or foraging habitat.
Alt. B			■			Similar to Alternative C1.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan			■			Similar to Alternative C1.
Alt. D			■			Similar to Alternative C1. Given minimal level of evenaged management, low quality foraging habitat in the form of forest openings will diminish as the stands mature, but these losses are not expected to be significant. Due to the lack of typical nesting habitat on JDSF, the likelihood of recreation causing impacts to nesting individuals is considered minimal. Although the incremental loss of foraging habitat is expected to occur over the long term, impacts to Peregrine Falcons are expected to be less than significant.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. E			X			Similar to Alternative C1/D.
Alt. F			X			Similar to Alternative C1/D.
Impact: Marbled Murrelet						
Alt. A			X			Alternative A does not propose any management activities that would remove potential murrelet nesting habitat or directly take the species. Since nesting murrelets would be protected from noise and disturbing activities, implementation of Alternative A is not likely to adversely impact nesting murrelets. Forest stand management as a means of speeding the recruitment of potentially occupied murrelet nesting habitat would not occur. Recruitment of habitat with or without management may not keep pace with the habitat recovery needs to sustain murrelet populations.
Alt. B				X		Like Alternative C1, the take of nesting Marbled Murrelets is unlikely under Alternative B given that surveys will be completed prior to commencing operations in or near potential habitat. Alternative B provides for the protection of the 459 acres of old-growth present on JDSF, but unlike Alternative C1, it does not protect all unoccupied remnant old-growth patches and residual trees or propose management to advance the development of late successional habitat. Current distribution of old-growth may not be conducive to murrelet occupancy. Thus, depending on the characteristics of the stand, patch, or tree, there is potential for loss of unoccupied habitat. Little or no contribution would be made to habitat and species recovery. Impacts could be reduced to less than significant with the application of management measures similar to Alternative C1, including the Contribution to Recovery of Marbled Murrelet Habitat management measure.
Alt. C1 May 2002 DFMP			X			Refer to detailed project impacts and proposed management measures above. Harvest of spatially valuable recruitment habitat can minimize future occupancy without proposed management measures to develop, beyond the project term, suitable nesting habitat. Implementation of the Contribution to Recovery of Marbled Murrelet Habitat management measure will result in increased Murrelet habitat over the long term.
Alt. C2 Nov. 2002 Plan			X			Similar to Alternative C1 with increase in the area (primarily in the vicinity of upper Russian Gulch, lower Big River, and upper Thompson Gulch) dedicated to development of late seral forest conditions specifically with the intent of Murrelet habitat recruitment.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: **(1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D				X		Under Alternative D, JDSF would implement the same species (not habitat) protection measures for Marbled Murrelets as Alternative C1, except for the Contribution to Recovery of Marbled Murrelet Habitat management measure. Increase in width of riparian protection zones is expected to have minimal influence on habitat recruitment given edge influences. The anticipated increase in human activity and associated increase in food availability for corvids will likely result in increases in jays and ravens and thus indirectly adversely impact murrelet populations by increasing mortality. This impact could be mitigated by not encouraging recreation activities (e.g., not providing or closing trails, posting areas as off limits) in areas of suitable murrelet habitat. Incorporating Marbled Murrelet Habitat management measures as a mitigation would likely result in a beneficial effect over the longer term.
Alt. E	X					Under Alternative E, JDSF would implement the same species protection measures for Marbled Murrelets as Alternative C1. Late seral habitat conditions would be developed across the forest where likelihood of success was greatest but without specifically addressing the spatial requirements of murrelets. However, implementation of this alternative is expected to have a slightly beneficial influence on availability of murrelet habitat over the long term.
Alt. F	X					Similar to Alternative E except increased emphasis on the recruitment of murrelet habitat in areas considered most likely to be occupied on the western portion of the forest. Creates a 3,498 acre Marbled Murrelet Recovery and Demonstration area to recruit high quality potential nesting habitat. Alternative includes human disturbance and adjacent habitat management to minimize disturbance and loss to corvids.
Impact: Northern Spotted Owl						
Alt. A		X				Alternative A does not propose any management activities that would alter Spotted Owl habitat. However, as early successional habitats mature, prey populations are likely to decrease over time, but not within the 10 year planning period. Implementation of Alternative A is not likely to adversely impact Spotted Owls and habitat capability is expected to remain stable.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***<u>Impact Levels</u>: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B			X			Like Alternative C1, take of Northern Spotted Owls would be unlikely under Alternative B due to FPR nest site protection requirements and minimum habitat retention standards. Alternative B also proposes the protection of the 459 acres of old growth. However, outside of these areas, forest management activities would not be specifically undertaken for Spotted Owls and suitable, unoccupied, Spotted Owl habitat could be harvested. Increase in prey populations could be expected under this alternative. Owl populations are likely to continue to exist at levels similar to existing conditions under Alternative B. Impacts of Alternative B are expected to be less than significant.
Alt. C1 May 2002 DFMP		X				Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan		X				Similar to Alternative C1.
Alt. D	X					Alternative D is similar to Alternative C1 with regard to the protection of nesting Northern Spotted Owls. However, the larger WLPZ and focus on unevenaged management likely will provide greater quantities of nesting and roosting habitat. Decrease in foraging habitat quality and extent can be expected over the longer term.
Alt. E	X					Alternative E is similar to Alternative C1 with respect to Spotted Owl habitat and the protection of nest sites. Additional potential nesting habitat is created over time with increases in late seral forest development. Decrease in foraging habitat quality and extent can be expected over the longer term.
Alt. F	X					Similar to Alternative E. Late seral recruitment will likely enhance nesting and cover opportunities with some decrease in incidence of woodrat prey. Decrease in foraging habitat quality and extent can be expected over the longer term.
Impact: Vaux's Swift and Purple Martin						
Alt. A		X				Alternative A does not propose management that will impact Purple Martin or Vaux's Swift habitat. Over time, the lack of timber management will allow trees to encroach on existing snags rendering them less suitable for Purple Martins. Likelihood of recruitment of additional snags is enhanced through retention of tree mortality. Vaux's Swift experience a slight increase in habitat capability in the current to 2030 period.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B				■		Alternative B does not provide specific protection of snags and old-growth remnants, other than meeting the requirements of the FPRs and retaining existing old-growth groves. The removal of large snags and old-growth remnants on JDSF represents the loss of potential habitat for these species and could preclude nesting on JDSF in the future. This impact could be mitigated by retaining these habitat features through measures similar to those in the DFMP and Mitigation 1.
Alt. C1 May 2002 DFMP				■		Refer to detailed project impacts above. Apply Mitigation 1 to enhance nesting opportunity.
Alt. C2 Nov. 2002 Plan				■		Similar to alternative C1
Alt. D	■					Under Alternative D, JDSF would follow the same management practices as they pertain to snags as under Alternative C1. However, increased recreation could increase likelihood of disturbance to nesting Vaux's Swifts and/or Purple Martins although this is not expected to be significant. Increased recruitment of late seral forest conditions would enhance large tree cavity nesting opportunity for these species.
Alt. E	■					Greater emphasis on late seral forest development forest wide and snag retention is expected to benefit Vaux's Swifts or Purple Martins.
Alt. F	■					Similar to Alternative E.
Yellow Warbler						
Alt. A			■			Alternative A does not propose management that will impact or degrade upland or riparian Yellow Warbler habitat. Over time, the early successional habitats (e.g., 3P, 4P, and 4S) will mature and become too dense or mature to provide Yellow Warbler foraging/understory nesting habitat.
Alt. B				■		Alternative B has less riparian area protection than C1. Increased level of evenaged management in upland areas would enhance shrub representation and habitat value. However, Alternative B would provide much less of the hardwood/conifer mix habitat utilized by this species in upland areas. Mitigation to increase hardwood retention in sparse to open canopy stands would reduce the impact associated with this alternative to less than significant. Modeled habitat capability resulted in marked declines in the Current to 2030 (-33%) and 2030-2060 periods (-24%).

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: **(1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. C1 May 2002 DFMP			X			Refer to detailed project impacts above.
Alt. C2 Nov. 2002 Plan			X			Similar to Alt. C1
Alt. D			X			Alternative D will implement larger WLPZ protection zones, although maintenance of obligate riparian shrub species extent is likely similar across all alternatives, and manage hardwoods as a significant component of the stand. Although long-lasting early successional habitats are not expected to be created under this alternative, the opening of younger stands will improve foraging conditions for Yellow Warblers in upland areas. Thinning of dense habitats and minimizing edge creation will also contribute to the general maintenance of Yellow Warbler habitat capability over the longer term.
Alt. E			X			The focus of Alternative E is on the development of late successional habitat. In the long run, this will degrade upland habitat conditions for Yellow Warblers especially in the first period, but the opening up of younger stands to hasten development of late seral characteristics is expected to improve upland habitat conditions in the short term. Overall, the thinning of dense habitats and minimization of edge creation are expected to maintain upland Yellow Warbler habitat capability over the Current to 2060 period. Similar to Alternative D relative to riparian zone habitat and provision.
Alt. F			X			Similar to Alternative D
Impact: Sonoma Red Tree Vole						
Alt. A		X				Alternative A does not propose any management activities that would affect red tree vole habitat. In time, many of the young-growth conifers stands not currently classified as red tree vole habitat will develop into suitable habitat for this species and connectivity of habitat is expected to increase. Change in habitat capability for the Current to 2030 and 2030-2060 periods increase slightly or are stable.
Alt. B			X			The impacts to red tree vole habitat under Alternative B are expected to be greater than the impacts of Alternative C1 given a greater focus on even aged management. Unlike Alternative C1, Alternative B does not propose any specific conservation strategies for red tree voles, or management designed to advance the development of late successional habitat. Modeled change in habitat capability shows a slight decline in the Current to 2030 period (-5%).

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. C1 May 2002 DFMP		■				Refer to detailed project impacts above. Habitat capability remains stable to a slight decline over the Current to 2030 period and improves in the second period.
Alt. C2 Nov. 2002 Plan		■				Similar to Alternative C1 although a greater decline in habitat capability in the first period (-8%) improving in the second period
Alt. D		■				Even-aged management would be very limited under this Alternative and all identified red tree vole trees would be retained. This alternative is not expected to remove or significantly degrade occupied habitat in the short term and is expected to improve overall habitat conditions for red tree voles in the long term with recruitment of additional habitat. Modeled habitat capability values increase slightly (+4%) in the Current to 2030 period and are stable (+3%) in the 2030-2060 period.
Alt. E	■					Alternative E is similar to Alternative D. However, additional Douglas-fir acreage in a late seral condition is expected over time across the forest which would likely increase quality of nesting and dispersal habitat. Modeled habitat capability values exhibit a slight to moderate increase in habitat capability in the Current to 2030 period (+4%) and stable in the 2030-2060 period.
Alt. F		■				Similar to Alternative D. Modeled habitat capability values remain stable to slightly increasing over the Current to 2030 and 2030 – 2060 periods period.
Impact: Pacific Fisher						
Alt. A	■					Since no timber harvest or other management activities would occur on JDSF under Alternative A, Pacific fisher habitat would not be impacted or degraded. Management activities that enhance or advance the development of late successional habitat would not be conducted under this alternative. Although the development of late successional habitat will take more time under this alternative, Pacific fisher habitat is expected to improve with increase in extent of moderate to dense canopy closure conditions. Modeled change in habitat capability for the Current to 2030 period shows a stable habitat condition and slight increase of 5% in the 2030-2060

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B				■		Impacts to potential Pacific fisher habitat under Alternative B are expected to be greater than the impacts of Alternative C1, given a greater emphasis on even aged management and conversion of hardwood to conifer. Non-spatial habitat capability modeling shows a marked decrease in the Current to 2030 period (-11%) given reduction in extent of Montane Hardwood Conifer and late seral forest followed by an increase of 20% in the 2030-2060 period principally as a result of increase in acreage of mid seral redwood and Douglas-fir of moderate to dense canopy closure. Alternative B does not propose any specific conservation strategies, snag recruitment, or mitigation designed to advance the development of late successional habitat with a hardwood component. No specific direction or consideration to enhance connectivity of habitat types. Mitigation measures that address these habitat conditions would likely reduce impacts to a less than significant level.
Alt. C1 May 2002 DFMP			■			Refer to detailed project impacts above. Modeled change in habitat capability exhibits a slight decrease (-7%) in the Current to 2030 period but and increase in (+8%) the 2030 to 2060 period.
Alt. C2 Nov. 2002 Plan			■			Similar to Alternative C1 but additional acreage is managed toward a late seral forest condition. Change in habitat capability shows a slight decrease (-7%) in the Current to 2030 period but increase +8% in the 2030 to 2060 period.
Alt. D	■					The effects of Alternative D are expected to be similar to those of Alternative A. However, Alternative D allows management that enhances and/or advances the development of late successional habitats. Large riparian buffers and primarily uneven-aged management silvicultural prescriptions would increase the amount of habitat for this species. The management of hardwoods proposed in this alternative would also markedly benefit fishers. However, the population and distribution of many important prey species may decrease as the early successional stands mature. Natural disturbances, such as wind throw and fire, may create early successional habitats, but the magnitude and timing of these events are unpredictable. Since these animals tend to avoid humans, the focus on recreation under this alternative may have a negative affect on Pacific fishers, should they occur on JDSF. Management activities proposed under Alternative D would increase the amount and quality of Pacific fisher habitat (+4% in the Current to 2030 period and 2030 to 2060 period (+7%)).

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.						
Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. E	■					Under Alternative E, JDSF would follow the same general management practices as under Alternative D. Old-growth/late seral development is emphasized and would promote connectivity of optimal habitat conditions. The likelihood of human disturbance as a factor decreasing habitat value would be less under Alternative E. Hardwoods as a component of the landscape would be less under this alternative than Alternative D. Habitat capability is stable in the Current to 2030 period and increases slightly (+5%) in the 2030 to 2060 period.
Alt. F	■					Similar to Alternative E. Alternative F emphasizes the development of contiguous late seral/old growth forest conditions. A watercourse-based linkage is developed to provide connectivity to key areas and across watershed boundaries that would be a benefit to Pacific fisher habitat value. Hardwood extent would be similar to Alternative E. Habitat capability increases (+4%) in the Current to 2030 period and +5% in the 2030 to 2060 period.
Impact: Reduce the number or restrict the range of a rare or endangered animal.						
Alt. A		■				Management activities that would impact the range or number of sensitive species would not occur. Conversely, forest stand management as a means of speeding the recruitment of potentially occupied habitat to the benefit of sensitive species would not occur.
Alt. B				■		Lack of protection for remnant old-growth patches and individual trees or proposed management to recruit late seral habitat conditions will negatively influence certain species of concern. Implementation of Additional Management Measures described above (section VII.6.6.4) and watercourse and late seral forest protections as in Alternative C1 would likely reduce associated impacts to a less than significant level.
Alt. C1 May 2002 DFMP				■		Implementation of aquatic and terrestrial wildlife protection measures described, control of sediment as an influence on aquatic wildlife species and application of Mitigation 1 to provide snag habitat will likely markedly reduce associated impacts and result in a less than significant or beneficial effect.
Alt. C2 Nov. 2002 Plan				■		Similar to Alt. C1.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D			X			Increase in recreation infrastructure and expected level of public use may negatively affect certain sensitive species such as the Marbled Murrelet and other species potentially occupying JDSF. Change in habitat capability is generally stable to positive or beneficial for species of concern sans potential disturbance related species impacts.
Alt. E	X					Increase in late seral habitat conditions, road management, and WLPZ protections (aquatic wildlife species) will generally increase habitat availability and quality for sensitive wildlife species.
Alt. F	X					Similar to Alt. E
Impact: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery areas.						
Alt. A			X			Lack of any forest management activities would generally result in no further impact to terrestrial wildlife species movement or reproduction requirements for at least the short-term. Aquatic wildlife species (amphibians) would likely experience negative effects from increased levels of sedimentation from road erosion and crossing failures. Lack of active planning and management to reduce fire risk could result in marked habitat alteration depending on the location of fire start and attendant weather conditions. Lack of late seral forest development would slow recruitment rate and representation of this forest condition.
Alt. B			X			Similar to Alternative A for the short term relative to forest management. Converse to Alt A., movement and use of nursery areas for species associated with early stages of forest development would likely be enhanced over the longer term. Tree species diversity would be reduced.
Alt. C1 May 2002 DFMP				X		Increased extent of late seral forest conditions over the long-term and further development of riparian forest condition across the range of stream classes will enhance movement and corridor opportunities. Improvement in habitat conditions for certain late seral forest associated species of concern will also enhance movement and reproductive habitat for the more common species associated with these forest conditions. With application of Mitigation 1, overall effects will be beneficial.
Alt. C2 Nov. 2002 Plan				X		Similar to Alt. C1.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						Discussion
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. D			X			Increased levels of expected recreational use and associated level of disturbance would likely result in heightened levels of disturbance to certain areas used for reproduction and of high public interest. Species particularly sensitive to human disturbance or increase in potential predator populations as a result of recreational use (Marbled Murrelet) could be negatively affected. Emphasis on uneven aged management and strengthened riparian zone and hardwood management are compensating features of this alternative.
Alt. E	X					Similar to Alternative C1. Emphasis on late seral forest development and uneven aged management will enhance habitat quality for species utilizing resultant forest conditions over the longer term.
Alt. F	X					Similar to C1 and E, Alternative F includes specific direction to establish contiguous older forest habitat and a watercourse based linkage of key areas.
Impact: Conflict with the provisions of an adopted Habitat Conservation Plan (HCP), or other approved local, regional, or State habitat conservation plan related to a wildlife resource.						
Alt. A		X				No alternative will conflict with the provisions of an HCP or other approved local, regional or State habitat conservation plan.
Alt. B		X				
Alt. C1 May 2002 DFMP		X				
Alt. C2 Nov. 2002 Plan		X				
Alt. D		X				
Alt. E		X				
Alt. F		X				
Impact: Cause a wildlife population to drop below self-sustaining levels or threaten to eliminate an animal community.						
Alt. A		X				Management activities that would impact the range or number of sensitive species would not occur. Conversely, forest stand management as a means of speeding the recruitment of potentially occupied habitat to the benefit of sensitive species would not occur. Net change in habitat capability for species of concern generally positive although likely protracted over time.

Table VII.6.6.34. Comparison of Wildlife-Related Impacts in Relation to the Various Alternatives.

Alternatives						**Discussion**
Impact*	**1**	**2**	**3**	**4**	**5**	***Impact Levels**: (1) Beneficial (2) No Impact (3) Less than Significant (4) Less than Significant After Mitigation (5) Significant -Mitigation Not Feasible**
Alt. B				■		Lack of protection for remnant old-growth patches or proposed management to recruit late seral habitat conditions will negatively influence certain species of concern utilizing these habitat conditions. Lack of Road Management Plan, LWD recruitment measures or enhanced WLPZ management could result in increased stream temperature and sediment levels and negative effect on sustainability of certain aquatic wildlife species. These measures could be implemented as mitigations to reduce impacts to less than significant.
Alt. C1 May 2002 DFMP			■			The DFMP provides for a variety of habitats, including old-growth and late successional habitats, riparian, and uneven and even-aged stands. Management for hardwoods and other key elements will maintain or improve most key habitat elements under this alternative. The overall effects of the proposed action on the wildlife communities on JDSF, including candidate, sensitive, or special status species, game species, Neotropical migratory birds, or other species that occur, would not threaten to eliminate an animal community and are not expected to cause a wildlife population to drop below self-sustaining levels. Proposed management measures for the benefit of Marbled Murrelet habitat recruitment and sediment control (Accelerated Road Management Plan, LWD and WLPZ management) will benefit aquatic wildlife.
Alt. C2 Nov. 2002 Plan			■			Similar to C1.
Alt. D				■		Increase in recreation infrastructure and expected level of public use may negatively affect certain sensitive species such as the Marbled Murrelet and other species potentially occupying JDSF. Change in habitat capability over time for species of concern is generally positive if the level of human disturbance is reduced. Managing location and timing of recreational activity may effectively mitigate to less than significant some forms of disturbance and indirect impacts.
Alt. E	■					Increase in late seral habitat conditions, connectivity of late seral forest types, road management, and WLPZ enhancements will generally increase habitat availability and quality for sensitive wildlife species. Reduction in extent of early seral forest conditions could result in decreased foraging opportunity for some sensitive species (Northern Spotted Owl) over time.
Alt. F	■					Similar to Alt. E