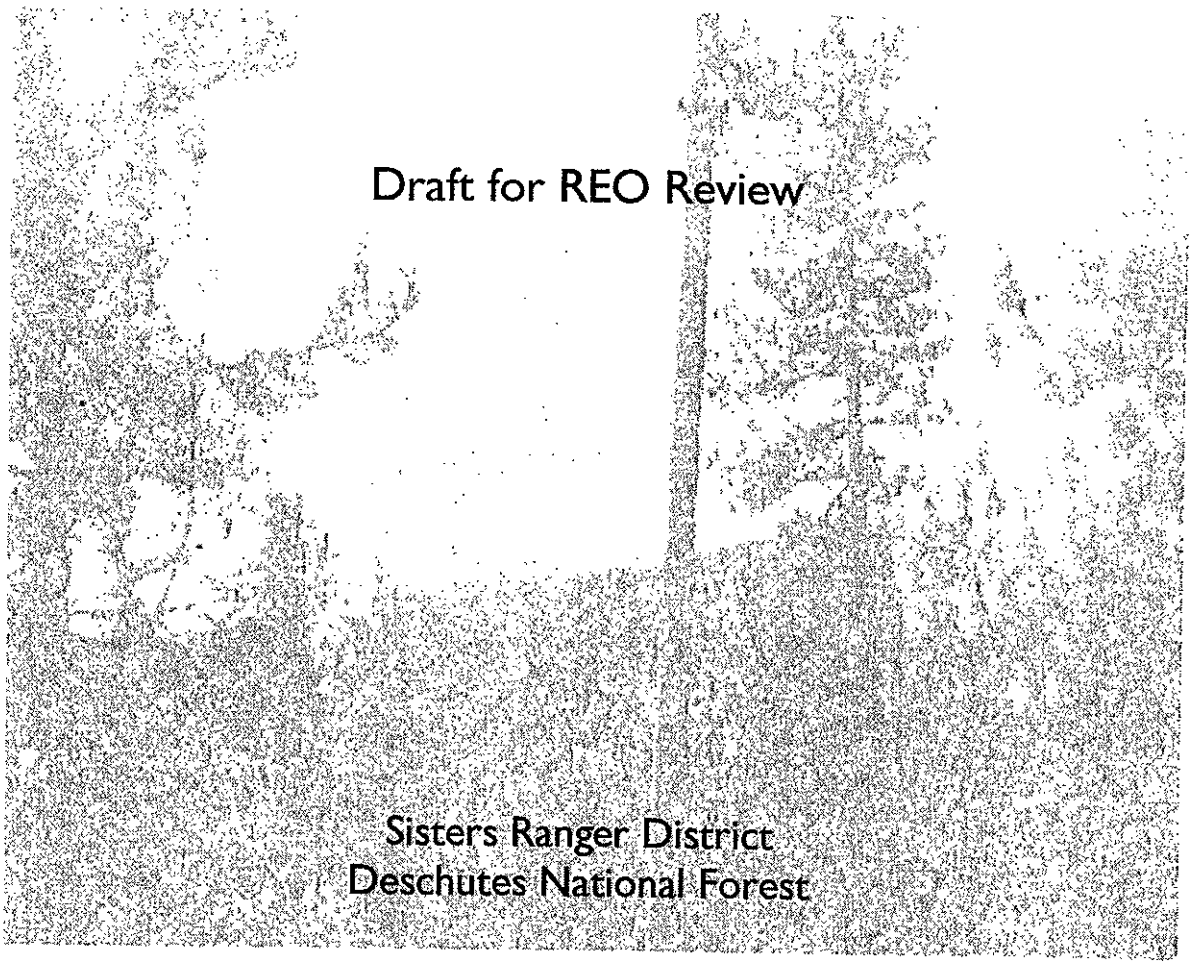
Why-chus Late-Successional Reserve Assessment



March 2001

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CHAPTER I
INTRODUCTION AND BACKGROUND

Introduction

The Why-chus Late-Successional Reserve Assessment addresses lands in the south half of the Cache/Trout Late-Successional Reserve (#0-52), and the Three Creeks Late-Successional Reserve (#0-53). The area is located within the Eastern Oregon Cascade Physiographic Province on the Deschutes National Forest.

The Why-chus Late-Successional Reserve Assessment area (Figure I-1) is located southwest of Sisters, Oregon and encompasses 14,900 acres. There is no private land within the Late-Successional Reserve boundary. The Why-chus Late-Successional Reserve Assessment area connects to the Cache Late-Successional Reserve to the north, borders the Three Sisters Wilderness to the west and most of the south, borders matrix lands to the west of Squaw Creek and to the east, and private lands to the northeast. The next Late-Successional Reserve, Sheridan Mountain on the Bend/Ft. Rock Ranger District, is approximately 14 miles to the south.

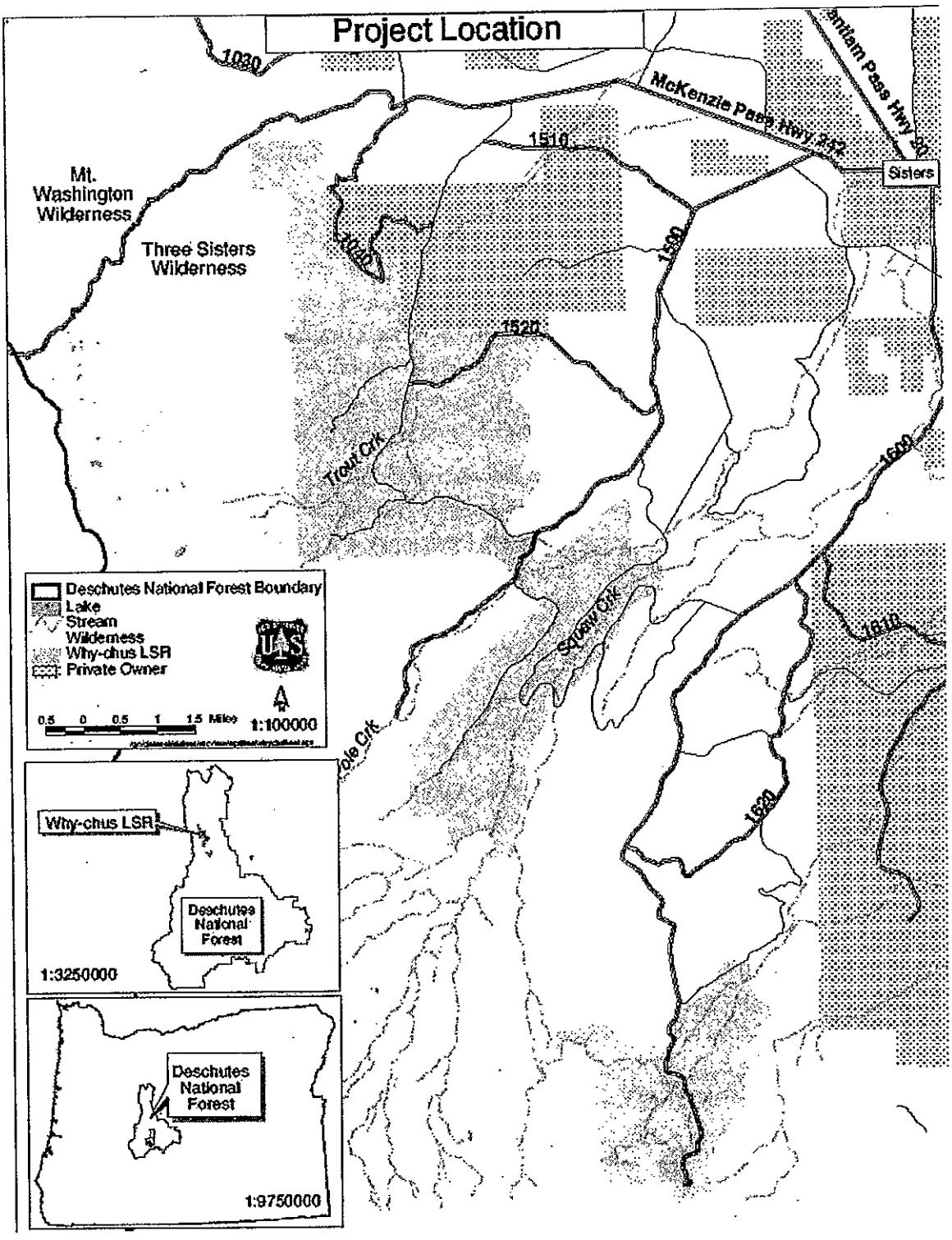
This assessment is a strategic document that provides an assessment of current late-successional conditions, and management activities needed to reduce the risk of habitat loss from catastrophic disturbances such as fire, insects and disease, and sustain late-successional habitats in both fire and climatic late-successional forests. It also addresses management options for reducing impacts to late-successional species from existing human uses, such as recreation and road use.

The assessment sets the framework for projects, but does not make any decisions to undertake a project. It recommends actions to meet Late-Successional Reserve goals and objectives. The assessment is not a National Environmental Policy Act (NEPA) decision document; it does not make site-specific decisions.

The Northwest Forest Plan and Deschutes National Forest Late-Successional Reserve Overview, and Why-chus Watershed Analysis create the foundation for the assessment.

This document is organized into 5 chapters. Chapter I provides background information on direction and guidance for Late-Successional Reserve Assessment. Chapter II describes the Why-chus Late-Successional Reserve, including the historic and current conditions of the forest vegetation and late-successional habitat, disturbance processes, late-successional associated species, soil and hydrology, and land uses. At the end of this section, these topics are also summarized by Management Strategy Area. Chapter III addresses the goals and objectives for this Late-Successional Reserve, and a description of the desired future condition. Chapter IV focuses on appropriate treatments for moving the Late-Successional Reserve toward the desired future condition, including the priority for implementation and monitoring of proposed projects. Lastly, Chapter V is a Fire Management Plan. There are also several appendices that provide additional details and background information.

Figure I-1. Location of the Why-chus Late-Successional Reserve



The Northwest Forest Plan

The Record of Decision (ROD) for Management of Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl (1994) directs that Late-Successional Reserves be managed to provide, develop and maintain quality late-successional and old growth habitat and ecosystems, and reduce the probability of losing these forest ecosystems to large-scale disturbances. Prior to designing and implementing management actions, an assessment of each Late-Successional Reserve is required (ROD, C-11). This document provides the management assessment for the Why-chus Late-Successional Reserve area.

This assessment also incorporates the objectives from the Aquatic Conservation Strategy (ACS), defined by the Northwest Forest Plan, to restore and maintain the ecological health of the watershed and the aquatic ecosystems contained within them. The primary goals of the ACS are to identify and maintain disturbance regimes within the watersheds, prevent further degradation of habitat, and restore habitats and ecological processes.

1990 Deschutes Land and Resource Management Plan

The 1990 Deschutes National Forest Land and Resource Management Plan (LRMP), as amended by the Northwest Forest Plan, identifies the Why-chus Late-Successional Reserve Assessment area overlapping the following management allocations: Front Country, Scenic Views, Winter Recreation, Dispersed Recreation and Intensive Recreation, General Forest, and Wild and Scenic River. Standards and guidelines from the ROD are to be applied to Late-Successional Reserves unless standards and guidelines from the underlying LRMP allocations are "more restrictive or provide greater benefits to late-successional related species." As the LRMP allocations indicate, recreation and scenic quality are very important values within this Late-Successional Reserve. Recommendations proposed in this assessment are intended to enhance these values where they are not in direct conflict with late-successional habitat goals.

Deschutes National Forest-Wide Late-Successional Reserve Overview

The Deschutes National Forest Overview For Site-Specific Late-Successional Reserve Assessments (September 1995) sets the context for assessments by providing general information on forest processes, pattern, structure, and function. The Forest Overview establishes a desired condition for Late-Successional Reserves that includes providing for a landscape mosaic of "fire climax" and "climatic climax" late-successional habitat typical of eastern Oregon Cascade ecological conditions.

The Forest Overview describes the importance of the Why-chus Late-Successional Reserve Assessment area for late-successional associated species such as the northern spotted owl, American marten, white-headed woodpecker, northern goshawk, cascade frogs, and black-backed woodpeckers.

Why-chus Watershed Analysis

The Why-chus Watershed Analysis (1998) characterized watershed and ecological processes to meet specific resource and social objectives. It provides essential resource and social information, including the current and historic physical, biological, and social resource conditions and trends, historic ranges of variability, and management opportunities and recommendations for a variety of resources including general guidelines for providing late-successional habitats.

This assessment tiers to the Why-chus Watershed Analysis, and incorporates by reference relevant information within the Watershed Analysis.

CHAPTER II
HISTORIC AND CURRENT CONDITIONS

A. FOREST VEGETATION

This section describes the historic and current vegetation in the Late-Successional Reserve, disturbance events that have influenced vegetation, and the late-successional habitat condition (including a discussion of potential old-growth). There is also a discussion about the concept of "Range of Variability" and sustainable conditions.

PLANT ASSOCIATION GROUPS

Plant associations were determined through field mapping of the potential natural vegetation using the protocol established by Volland (1988), with input from the Area IV Ecologist and other Forest Specialists including silviculturists, ecologists, botanists and stand exam personnel. The associations and series were then grouped by their climax species, site potential, and temperature and moisture similarities into Plant Association Groups (PAGs), using the categories listed in the Deschutes WEAVE document (v.1.12) and are displayed in Table II-1 and Figure II-1.

Table II-1 - Plant Association Groups

Plant Association Group (PAG)	Common Abbreviation	Lumped Plant Association Groups	Acres	Percent of the LSR
Mixed Conifer Wet	MCW	MCW	5263	35%
Mixed Conifer Dry	MCD	MCD	5762	39%
Ponderosa Pine (wet and dry)	PP	PP	32	<1%
Mountain Hemlock Dry	MHD or TSME	HIGH ELEV. FOREST	1125	8%
Lodgepole Pine (wet and dry)	LPW	LP	2231	15%
Cinder, Rock, Water	CINDER, ROCK, WATER	NON-FOREST	117	<1%
Riparian, Meadow	RIP, MDW	RIPARIAN	325	2%
TOTAL			14,919	100%

A more detailed discussion of each plant association follows. The current conditions are compared to conditions during 1953 (County Timber Type Maps) and baseline historic ranges of variability conditions estimated from 1) vegetation information mapped during the late 1800's, 2) information on past disturbance events, successional pathways, current stand ages, 3) ranges of

variability calculated for the Ochoco National Forest, and the Davis and Metolius Late-Successional Reserves on the Deschutes National Forest, and 4) from discussions among ecologists, silviculturists, fire managers, entomologists and pathologists. Tables 2 through 7 compare the distribution of size/structure and species composition between the estimated historical ranges of variability (HRV), the known historical reference point (1953) and the present (1997).

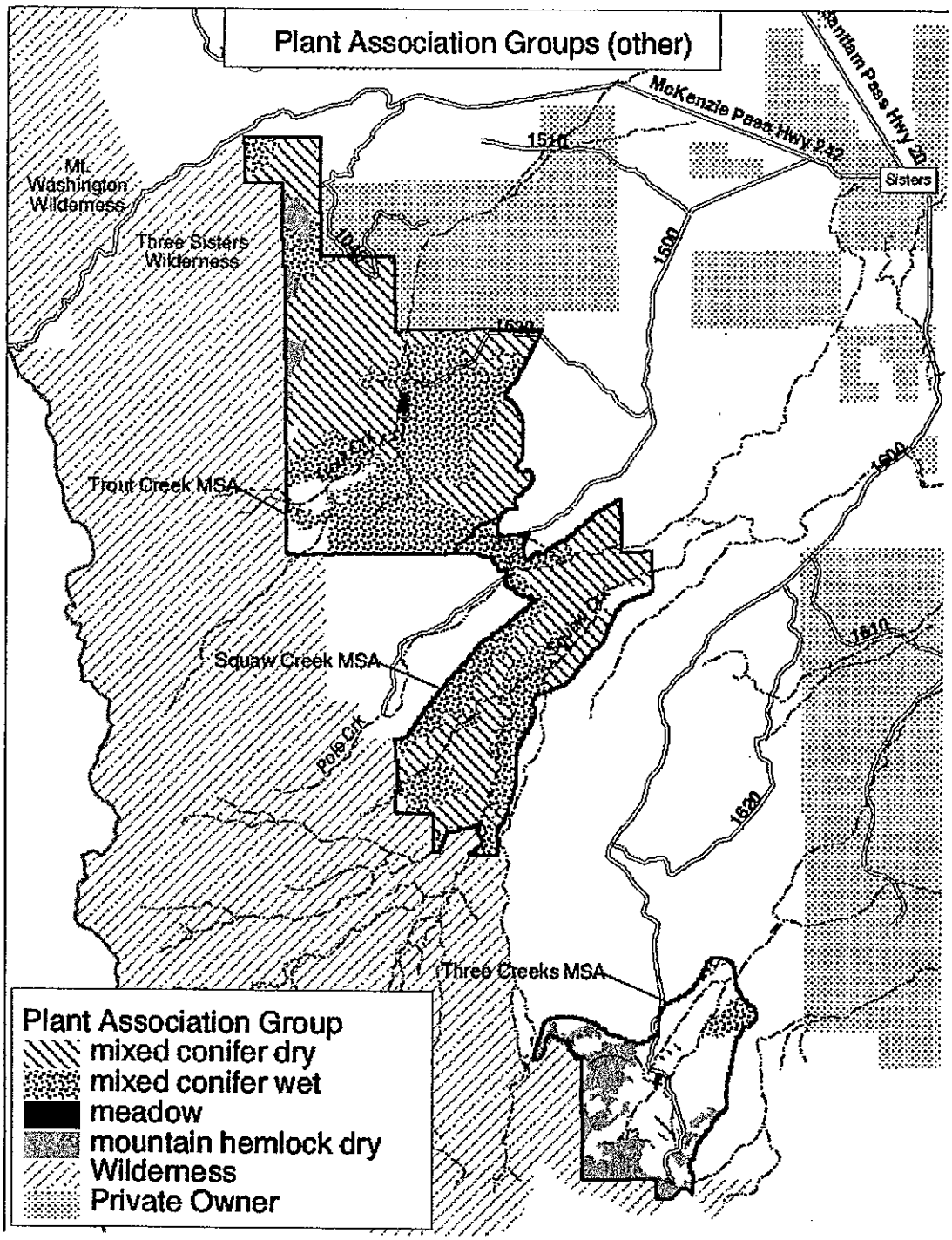
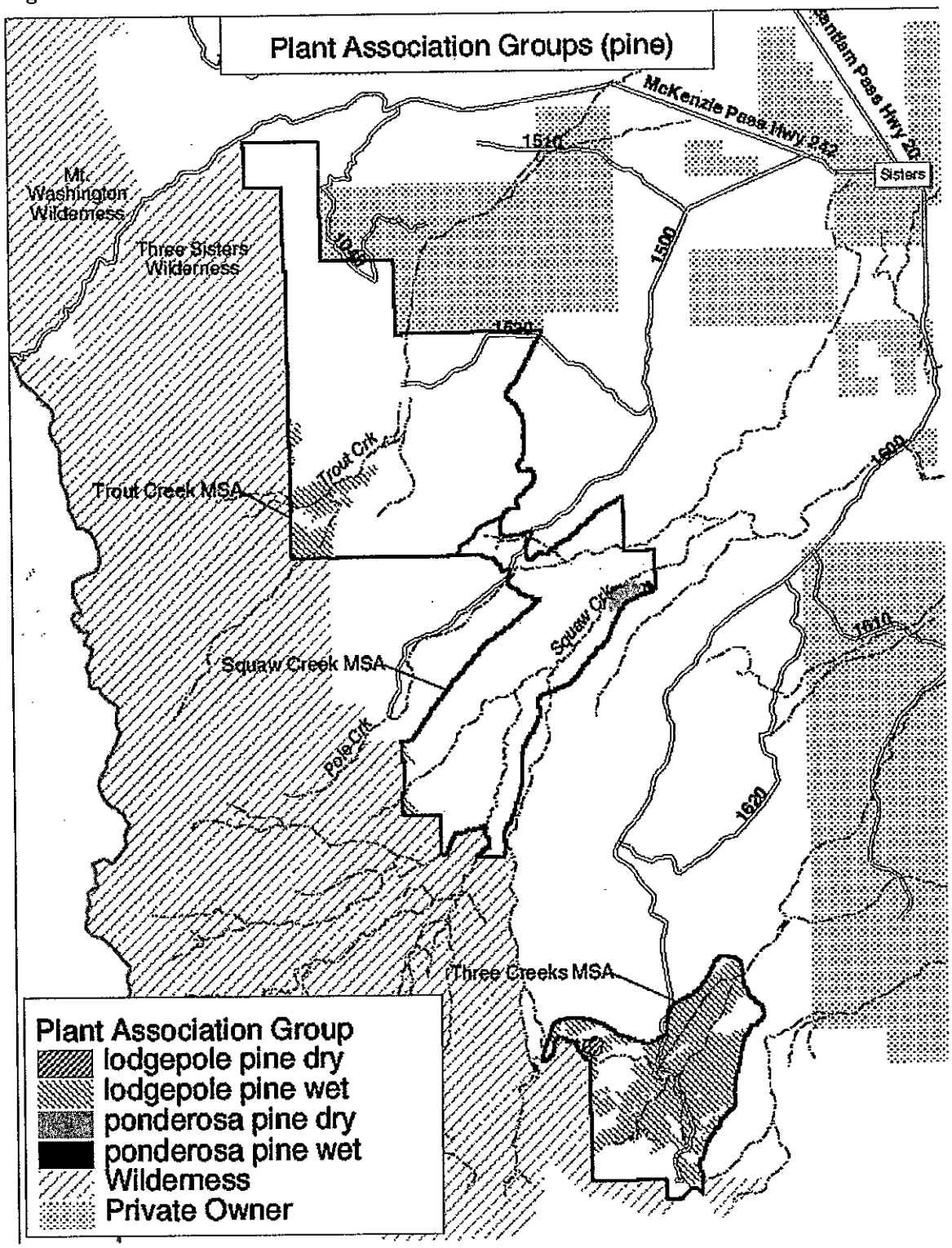


Figure II-1a. Plant Association Groups, excluding pines

Figure II-1b. Pine Plant Association Groups



In summary, the historic conditions derived from the 1870 Surveyor Notes indicate that fire played a significant role in creating open, park-like, fire climax forests from the eastern boundary of the Late-Successional Reserve to the upper elevation mixed conifer forests. The notes described the Ponderosa Pine plant association as large even-aged stands of pure, large diameter ponderosa pine with grass understories. Mid elevation mixed conifer stands were described as heavy yellow pine (ponderosa pine) with open understories. The higher elevation mixed conifer was described as dense understories of pine, fir, willow and chinquapin were present in some areas. The forests as a whole were described as being fairly contiguous stands of large diameter ponderosa pine.

Aerial Photo Interpretation from 1953 photos indicate conditions similar to the 1870 surveyor's notes, though the presence of denser stand conditions was increasing at higher elevations and in sites with more moisture, due largely to the suppression of fire. The forest were still dominated by large diameter ponderosa pine, with relatively open understories, but both ponderosa pine and some white-fir understories were more common due to the suppression of fires.

In the following discussion, size was classified for each stand based on the size class with the most basal area regardless of the total stand basal area. The only exception to this are regeneration harvest acres, which were assigned to the seedling/sapling size class regardless of age or residual tree basal area remaining on the unit. Stands were classified as primarily pioneer or climax species if 75% or more of the stand basal area was composed of pioneer or climax species, respectively. Stands were classified as mixed species if both pioneer and climax species represented 25% or more of the total basal area.

Mixed Conifer Wet and Dry **74% of Total Late-Successional Reserve Acres**

The majority of the Late-Successional Reserve is made up of Mixed Conifer (wet and dry) plant associations where the dominant climax species are grand fir/white fir and Douglas fir. In these series in the Why-chus Late-Successional Reserve, ponderosa pine and lodgepole pine (and in some cases Douglas-fir) should be the dominant early seral species, but throughout much of the area they are now subordinate to the true firs.

Mixed-conifer dry plant associations are found on the slopes of the Cascades down to the flatter areas of pure pine stands along the eastern edge of the Late-Successional Reserve. Generally these areas have moderate to high productivity. Current tree vegetation consists of true firs, ponderosa pine, Douglas fir, lodgepole pine and small amounts of other species.

Table II-2. **Mixed-Conifer Dry** Size and Composition: Comparison of Historic and Current

Size	Time Period	Percent of Acres			
		Pioneer Species	Mixed	Climax Species	Total
Seed/ Sapling (to 4.9" diameter)	HRV	2-15	1-10	0-1	3-26
	1953	0	0	0	0
	1997	13	0	0	14
Pole (5-8.9" diameter)	HRV	5-21	2-15	1-4	8-40
	1953	1	0	0	1
	1997	7	5	0	12
Small (9-20.9" diameter)	HRV	12-40	6-30	3-5	21-75
	1953	5	0	0	5
	1997	16	29	7	52
Medium/ Large (21"+ diameter)	HRV	15-42	5-28	3-5	23-75
	1953	59	33	0	92
	1997	4	17	1	23
TOTAL	HRV	35-100	14-83	7-15	
	1953	65	33	0	100
	1997	41	51	8	100

HRV = Historic Range of Variability

Total acres in Late-Successional Reserve = 14,900

In mixed-conifer wet, the productivity is generally higher than in the mixed-conifer dry plant associations. Current vegetation consists of true firs, ponderosa pine, Douglas-fir, and lodgepole pine. Spruce can be found in the wetter uplands and riparian areas.

Table II-3. **Mixed-Conifer Wet** Size and Composition: Comparison of Historic and Current

Size	Time Period	Percent of Acres			
		Pioneer Species	Mixed	Climax Species	Total
Seed/ Sapling (to 4.9" diameter)	HRV	3-20	0-25	0-9	3-54
	1953	0	0	0	0
	1997	16	1	0	16
Pole (5-8.9" diameter)	HRV	1-11	5-30	1-10	7-51
	1953	1	0	0	1
	1997	6	0	0	6
Small (9-20.9" diameter)	HRV	1-11	10-32	2-14	13-57
	1953	4	0	0	5
	1997	10	30	14	54
Medium/ Large (21"+ diameter)	HRV	1-11	8-28	2-14	11-53
	1953	68	26	0	94
	1997	8	13	2	23
TOTAL	HRV	6-73	23-100	5-47	
	1953	73	26	0	100
	1997	40	44	15	100

HRV = Historic Range of Variability

Total acres in Late-Successional Reserve = 14,900

Ponderosa Pine **<1% of Late-Successional Reserve Acres**

In this plant association group, ponderosa pine is the main seral and climax species, growing in small, even-age groups. Minor amounts white fir and Douglas-fir may be present particularly in the ecotones with the mixed conifer plant associations. The Ponderosa Pine plant association is mostly along the eastern boundary of the Squaw Creek Management Strategy Area, where the topography is flat. Ponderosa pine is the dominant species, but fir is increasing adjacent to the mixed conifer plant association due to adjacent seed sources and protection from fire.

Table II-4. **Ponderosa Pine** Size: Comparison of Historic and Current

Size	Time Period	Percent of Acres
		Pioneer, Mixed and Climax
Seed/ Sapling (to 4.9" diameter)	HRV	3-21
	1953	0
	1997	31
Pole (5-8.9" diameter)	HRV	3-21
	1953	59
	1997	17
Small (9-20.9" diameter)	HRV	20-50
	1953	0
	1997	39
Medium/ Large (21"+ diameter)	HRV	30-70
	1953	38
	1997	12

HRV = Historic Range of Variability

Total acres in Late-Successional Reserve = 14,900

Lodgepole Pine **15% of Total Late-Successional Reserve Acres**

This vegetation type is commonly found mostly at higher elevations, most within the Three Creeks Management Strategy Area. The areas where lodgepole pine is climax tend to have poor cold air drainage, or soil or moisture conditions that other species can't tolerate.

The majority of this plant association has not been classified, so values represented below under 1997 are estimates from a small sample.

Table II-5. **Lodgepole Pine** Size: Comparison of Historic and Current

Size	Time Period	Percent of Acres
		Pioneer, Mixed and Climax
Seed/ Sapling (to 4.9" diameter)	HRV	0-60
	1953	0
	1997	2
Pole (5-8.9" diameter)	HRV	10-80
	1953	61
	1997	7
Small (9-20.9" diameter)	HRV	0-80
	1953	30
	1997	90
Medium/ Large (21"+ diameter)	HRV	0-2
	1953	6
	1997	1

HRV = Historic Range of Variability

Total acres in Late-Successional Reserve = 14,900

High Elevation Mt Hemlock **8% of Total Late-Successional Reserve Acres**

Generally these sites are of low to moderate productivity. This plant association is found at the higher elevations along the boundaries of the Three Sisters Wilderness area and in the Three Creeks Management Strategy Area. In this plant association lodgepole pine is the major early seral species and sub-alpine fir, whitebark pine and western white pine are minor early seral species.

The majority of this plant association has not been classified, so values represented below under 1997 are estimates from a small sample.

Table II-6. **High Elevation mountain hemlock** Size: Comparison of Historic and Current

Size	Time Period	Percent of Acres
		Pioneer, Mixed and Climax
Seed/ Sapling (to 4.9" diameter)	HRV	0-8
	1953	0
	1997	2
Pole (5-8.9" diameter)	HRV	5-30
	1953	9
	1997	0
Small (9-20.9" diameter)	HRV	5-55
	1953	60
	1997	87
Medium/ Large (21"+ diameter)	HRV	5-20
	1953	17
	1997	11

HRV = Historic Range of Variability

Total acres in Late-Successional Reserve = 14,900

Riparian **2% of Total Late-Successional Reserve Acres**

There is no data on the historic range of variability for riparian stands, but it is assumed that the amount of riparian habitat has probably not changed much from historic conditions. The quality of riparian habitats, however, has probably decreased over the decades. In the early 1900's sheep grazing, and to a lesser degree, cattle grazing were common. More recently, timber harvest activities and recreational uses have impacted many of the riparian habitats in the Late-Successional Reserve.

Riparian vegetation can be very diverse. The successional classes of riparian vegetation in the Late-Successional Reserve for 1953 show a dominance (70%) of riparian acres in medium/large sized pioneer species. In 1997 the dominant successional class was still medium/large size classes (44%), but small mixed and climax species have increased. This trend is primarily the result of the increase of white/grand-fir with the exclusion of wildfire, shifting most mixed conifer stands toward white fir dominated, pole and small sized stands.

Table II-7. **Riparian** Size: Comparison of Historic and Current

Size	Time Period	Percent of Acres
		Pioneer, Mixed and Climax
Seed/ Sapling (to 4.9" diameter)	1953	0
	1997	4
Pole (5" – 8.9" diameter)	1953	21
	1997	12
Small (9" – 20.9" diameter)	1953	8
	1997	44
Medium/ Large (21"+ diameter)	1953	70
	1997	8

Total acres in Late-Successional Reserve = 14,900

OVERALL STRUCTURE AND COMPOSITION

Species composition was mapped from the 1953 photos and from recent (primarily 1996 and 1997) stand exams and photo interpretation. The stand exams do not cover plantations, non-forested areas, nor much of the Three Creeks Management Strategy Area.

Species Composition

The most dramatic changes in species composition, based on basal area, are the differences between the number of acres dominated by ponderosa pine and white fir between 1953 and 1997. The acres dominated by ponderosa pine have decreased from 73% to 43%, and the acres

dominated by white fir have increased from 0% to 29%. These changes would have been greater if approximately 1788 acres of mixed conifer association had not been regeneration harvested and reforested to early seral species, primarily ponderosa pine, over the last 30 years. There have not been significant changes in the other species groups and what changes there are may be attributed more to differences in mapping/classification rather than true species changes.

These shifts in species composition have occurred primarily in the mixed conifer plant associations. These shifts can be attributed primarily to the exclusion of fire which allowed the shade tolerant, fire intolerant white fir to reproduce and grow successfully to the exclusion of the early seral species such as ponderosa pine, and to the selective harvest of the early seral species (i.e., ponderosa pine) overstory component. See Figures II-2 and II-3 for a comparison of dominant species composition in 1953 and 1997.

Size Class

There have also been dramatic shifts in size class over the last half-century. The most significant has been the decrease in the number of acres classified as medium/large and the increase in the small and seedling/sapling size classes.

Table II-8. Most Significant Changes in Size Class Over Time

Size class	Percent of Late-Successional Reserve Acres	
	1953	1997
Seedling/sapling (< 4.9")	0	12
Small (9" – 20.9" dbh)	14	60
Large/Medium (21"+ dbh)	72	18

The shifts in size classes can be attributed primarily to harvesting most of the overstory component across the northern 2/3 of the analysis area, and to regeneration harvests on approximately 12% of the acres. The exclusion of fire has also allowed a younger, smaller cohort to develop, which has contributed to the dramatic increase in the number of trees less than 21" diameter across the analysis area. See Figures II-4 and II-5 for a comparison of size class in 1953 and 1997.

Figure II-2. Historic Dominant Vegetation Species Composition: 1953

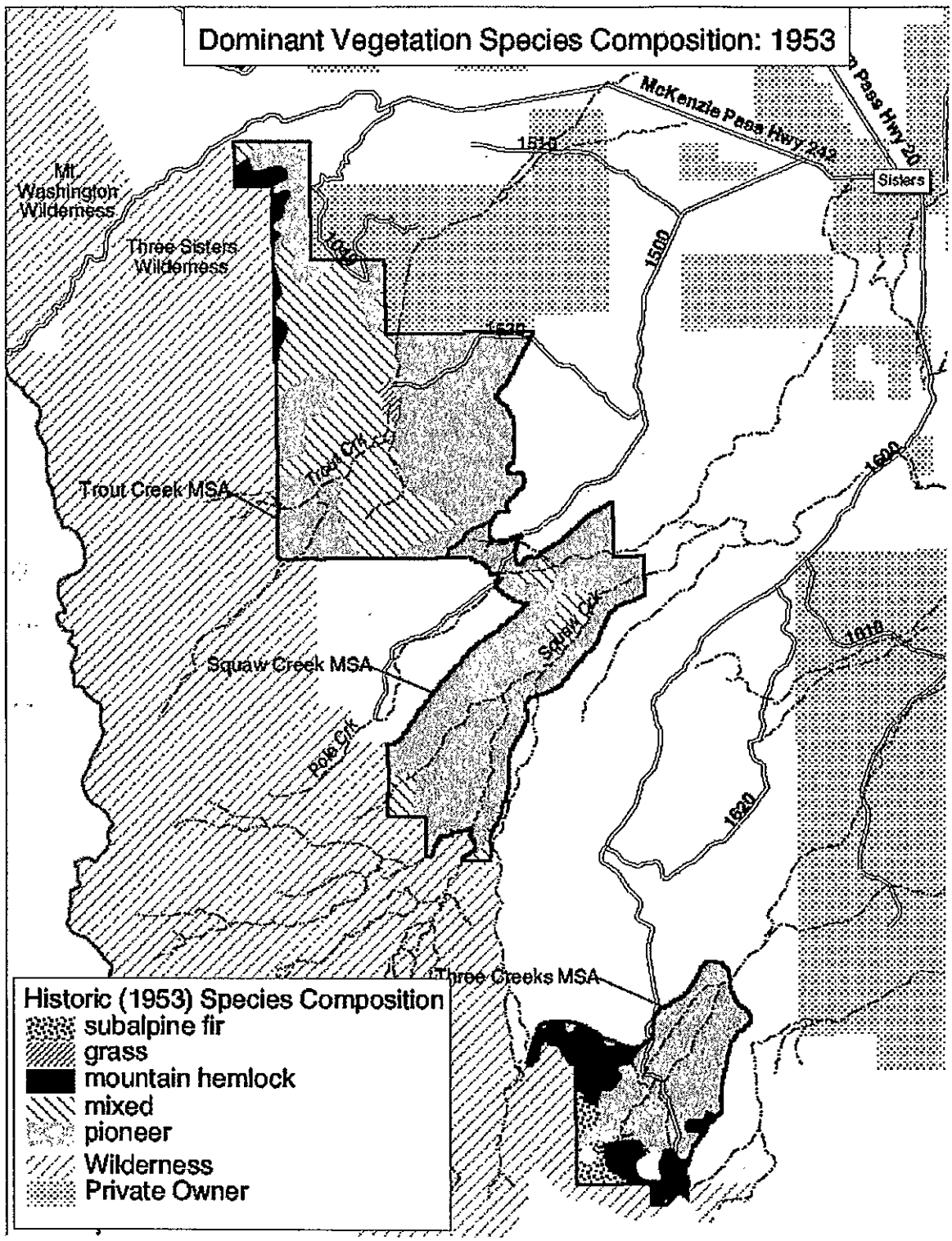


Figure II-3. Current Dominant Vegetation Species Composition: 1997

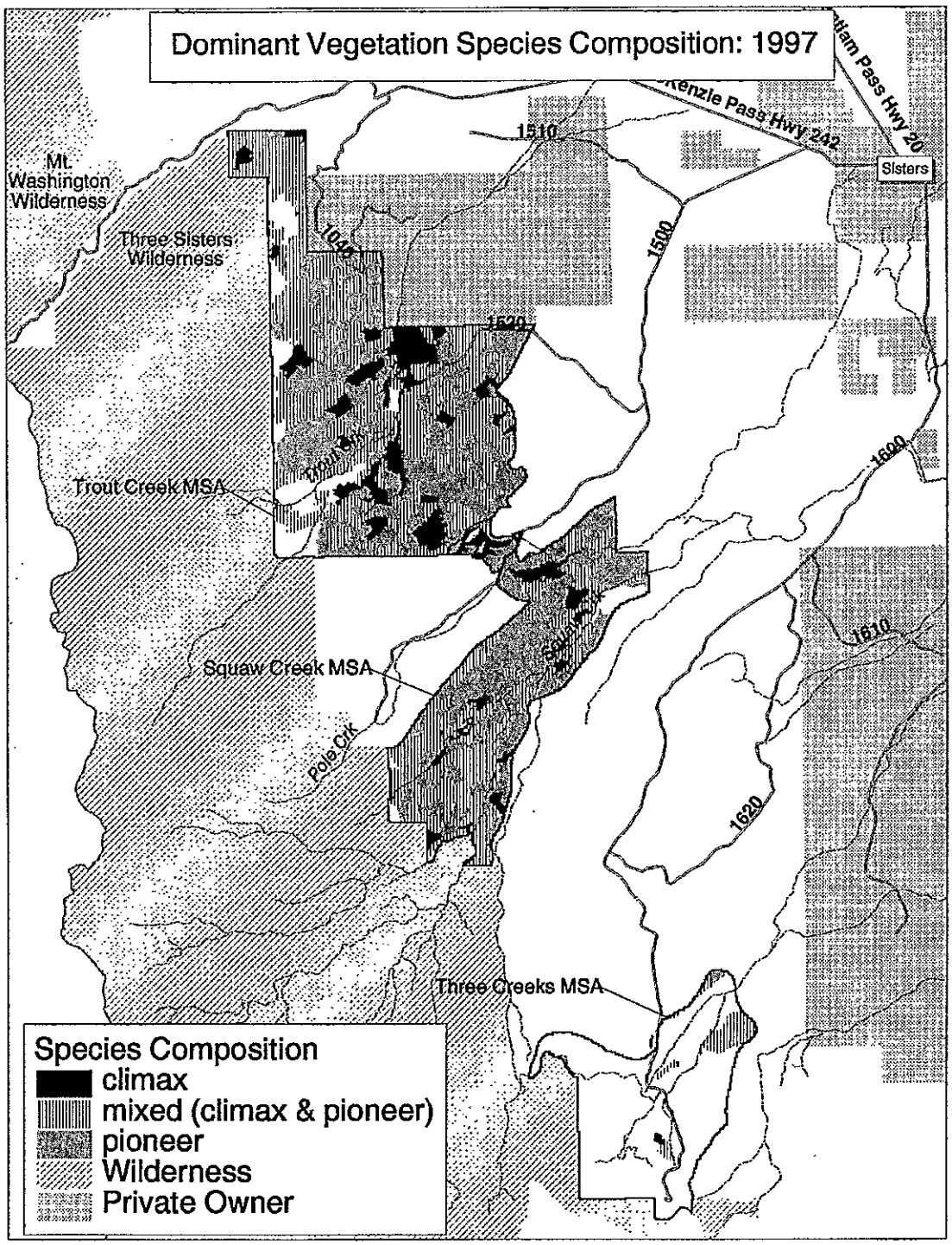


Figure II-4. Vegetation Size Class: 1953

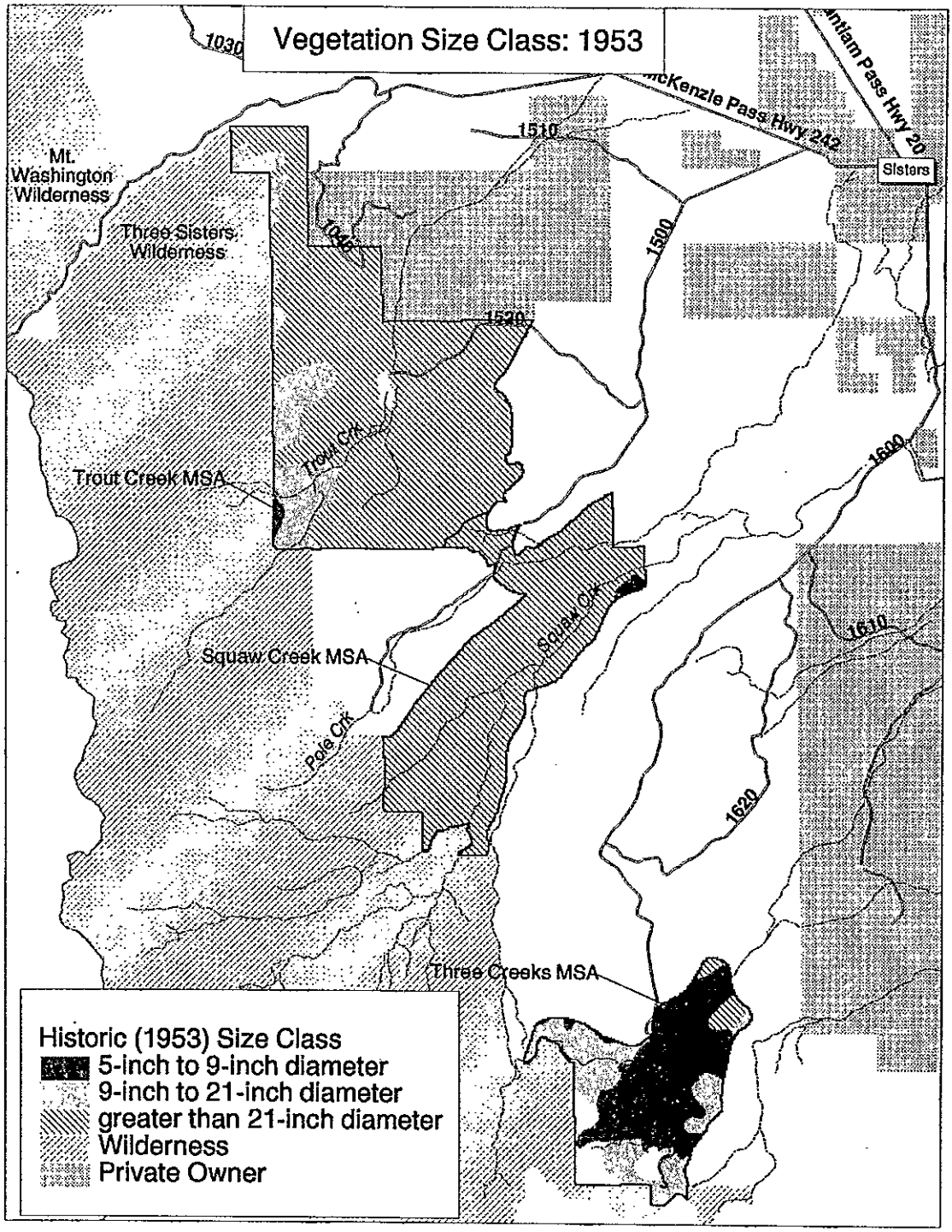
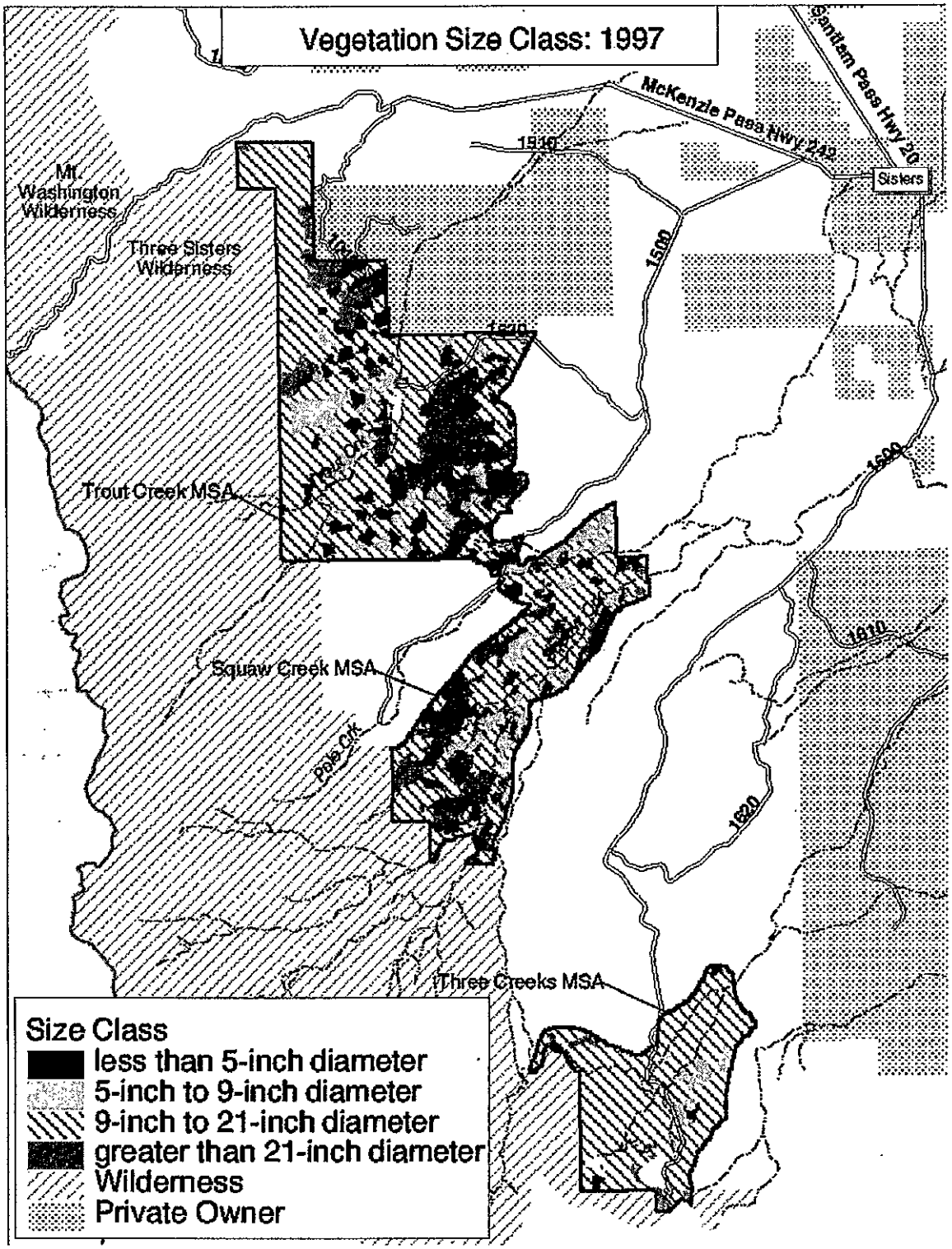


Figure II-5. Vegetation Size Class: 1997



Canopy Cover

There are no historical records of canopy cover, but we can estimate that with lower densities maintained by frequent underburns in much of the Late-Successional Reserve, canopy cover was lower historically than it is at present. Table II-9 shows the current percent of acres by percent canopy cover class within each plant association group.

Table II-9 - Distribution of Acres by Canopy Cover Class within Plant Association Groups

Plant Association Groups	Percent of Late-Successional Reserve Acres					
	<20%	20-29%	30-39%	40-59%	60%+	TOTALS
High Elevation	1	1	1	3	1	7
Lodgepole Pine	2	1	3	6	3	16
Mixed Conifer Dry	11	5	8	10	6	40
Mixed Conifer Wet	8	5	6	9	7	35
Ponderosa Pine	<1	<1	<1	<1	<1	1
TOTALS	22	13	19	28	17	99*

* An additional 1% of the acres are in the meadow and riparian plant association groups

Stand Densities

Maintaining stand densities at sustainable levels is essential for promoting forest health and maintaining or creating large trees and habitats in dry areas. Growth Basal Area (GBA) (Hall, 1987) is being used to describe a range of stand densities that are likely to result in healthy forest conditions. Of particular importance is the maximum "healthy" density limit or "upper management zone" (UMZ), as described by Cochran, et al. (1994). The upper management zone is a site-specific threshold density, above which forest health conditions and large tree health are likely to deteriorate. The primary cause is that, on any given piece of ground, there are limits to the resources available for plant growth. These resources include light, water, nutrients, and growing space. When these limits are reached, losses of plant growth and/or mortality are common elements of the stand. These conditions can be ideal for certain late successional old growth plant and animal species. However, these habitat conditions historically developed only after the large tree component grew under considerable lower stand densities.

In ponderosa pine or lodgepole pine, the UMZ is calculated somewhat differently from the other species. This was recommended by Cochran et al. (1994), to show the level above which higher levels of large tree mortality are much more likely to occur. For these tree species, the UMZ correlates to a high risk threshold for markedly increased tree mortality due to many of the forest pests that are dependent on density and lower tree growth for epidemic levels to be reached. Other factors besides density, such as species composition, must be considered for the density independent forest pests such as the fir engraver beetles and spruce budworm. However, the use of UMZ in stands which are typically not hosts to density dependent pests is still recommended if the desire is to let small trees grow to large trees more quickly and safely especially where large

trees are in short supply. This is because the presence of a suppressed class of trees would indicate average tree growth in the stand is beginning to slow down, perhaps significantly.

The descriptions and recommendations for species composition shown in each plant association summary are based on the Deschutes LRMP, the Northwest Forest Plan, and long-term forest health and sustainability considerations for the major plant associations described herein (see Appendix A, page 5, for details on UMZ).

Stand densities were calculated from stand exams. Table II-10 and Figure II-6 below shows the percent examined acres in each plant association that are above and below the upper management zone (i.e., above sustainable densities). Over 1/3 of the acres exceed sustainable densities.

Table II-10. Percent of Stand Examined Acres Above and Below Upper Management Zone for each Plant Association Group.

Plant Association Group	Percent of Late-Successional Reserve Acres		
	No UMZ Established	Below UMZ	Above UMZ
High Elevation, Mountain Hemlock	73	7	21
Lodgepole Pine	77	0	23
Mixed Conifer Wet	28	40	32
Mixed Conifer Dry	29	17	54
Ponderosa Pine	79	0	21
Riparian	86	0	14
TOTALS	40	21	39

Mortality

Mortality across the Late-Successional Reserve is generally low, though there are scattered pockets of higher mortality. Slightly higher levels of mortality can also be found in the north portion of the Late-Successional Reserve due to the effects of an epidemic spruce budworm outbreak in the late 1980s and early 1990s, which severely affected mixed conifer stands in the Cache and Metolius Late-Successional Reserves located to the north. The southern extent of the outbreak affected the Why-chus Late-Successional Reserve, south to approximately Trout Creek Swamp (Figure II-7). In this portion of the Late-Successional Reserve, mortality levels may be under-estimated by stand exam data due to continued mortality that has occurred since the data was collected. Table II-11 below displays the levels of basal area mortality by Management Strategy Area. Mortality below 10% of the total stand basal area is considered normal and endemic.

Figure II-6. Current Forest Stand Density

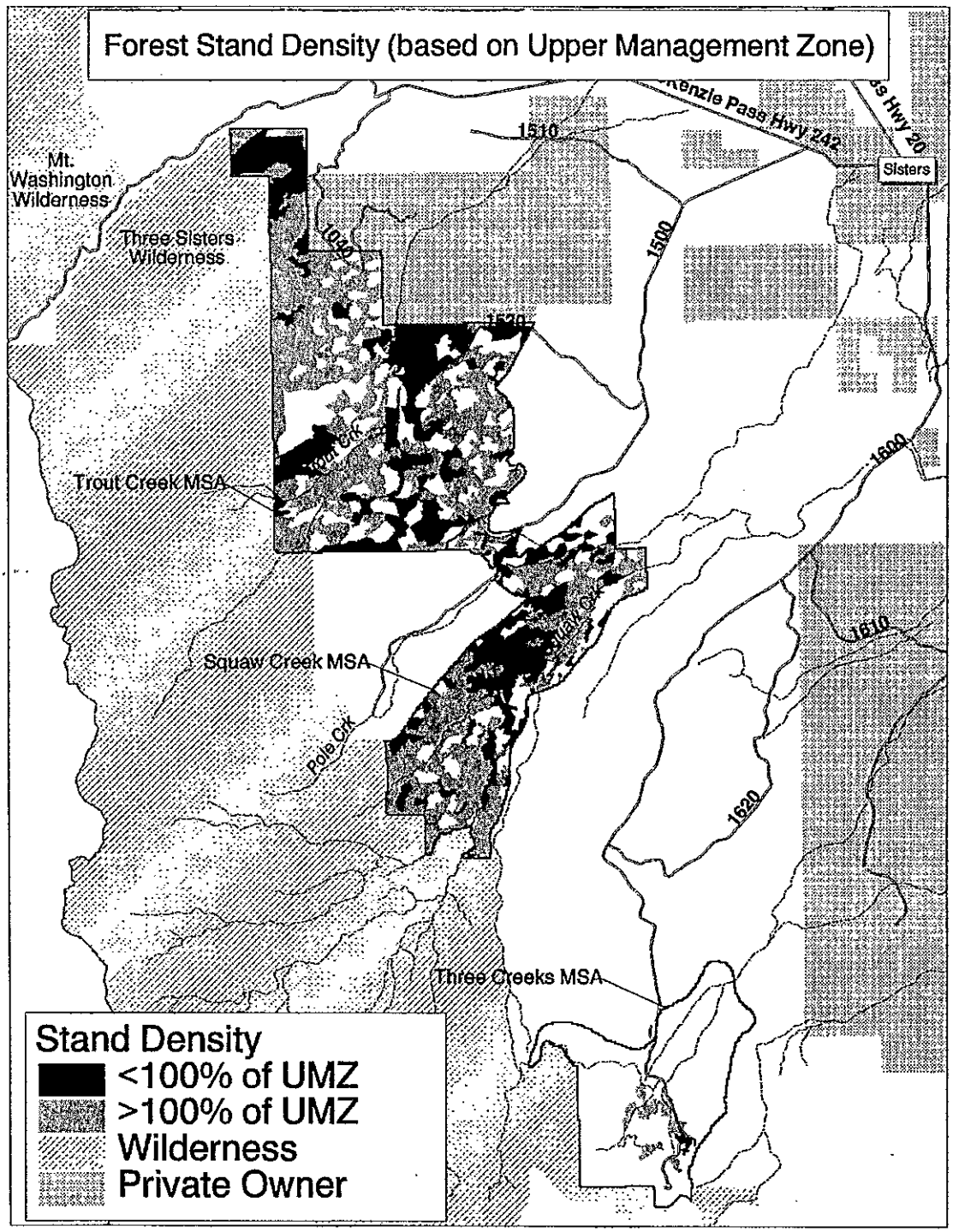


Figure II-7. Tree Mortality Levels

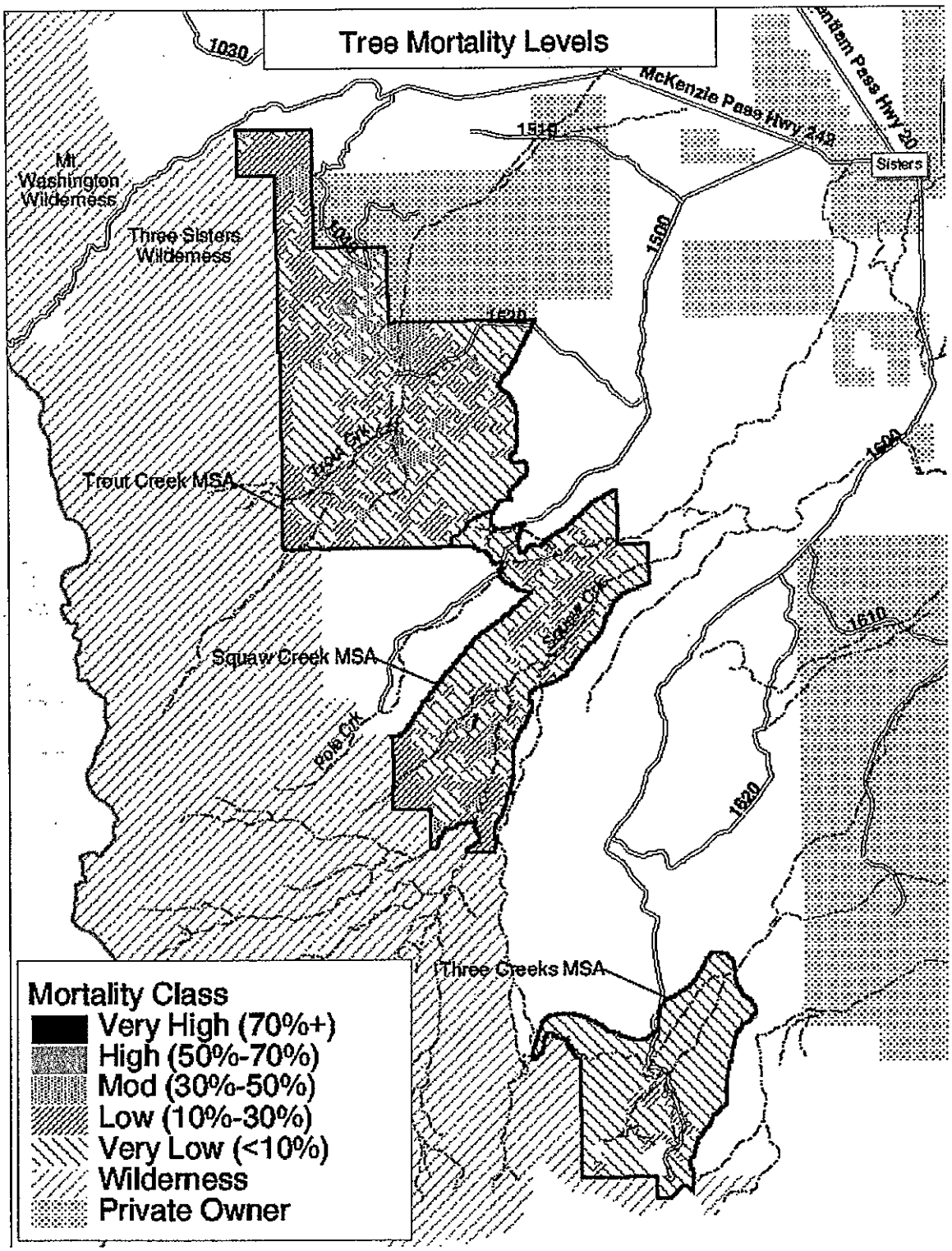


Table II-11. Percent of Acres with Mortality (measured as either basal area or percent of dead trees) for each Management Strategy Area.

Management Strategy Area	Very Low <9%	Low 10-29%	Moderate 30%-49%	High to Very High 50%-69%
Trout Creek	25	22	4	<1
Squaw Creek	17	11	1	<1
Three Creeks*	18	1	0	<1
TOTAL	60	34	5	<1

TRENDS AND RISKS FOR FOREST VEGETATION

Primary Plant Association Groups

Mixed Conifer and Ponderosa Pine

- Historically, mature stands in mixed conifer and ponderosa pine plant associations were primarily composed of early seral species. Ponderosa pine was the major species present, with small amounts of lodgepole pine, Douglas-fir, and true fir increasing in higher elevations and in mixed-conifer wet stands. On a landscape scale, stands in these plant associations are outside this range, with a significantly greater component of white fir, or lodgepole pine.
- Forest composition has shifted in the ponderosa pine and mixed-conifer to dense stands of white fir. Many of the largest ponderosa pine have been removed.
- There has been a significant shift in overall size/structure from large to smaller trees.
- 38% of the acres are currently above the upper management zone and thus at unstable densities. On 40% of the acres the densities related to upper management zone are unknown and may also be unstable.
- The greatest amount of mortality is found in the mixed conifer plant associations, though there is still relatively low amounts. However, high stand densities place over 1/3 of the stands at risk of catastrophic loss, so mortality may increase over time.

Lodgepole pine and High Elevation Mountain Hemlock

- Lodgepole pine stands have not changed in species composition over the last century. These stands are simple in structure and most are relatively even-aged. Most of the current stands are mature and it is expected that there will be a large and rapid shift in structure to early seral conditions when these stands decline, probably within the next 20 to 40 years.
- Stand densities in certain lodgepole pine stands are above upper management zone, though this is typical for this plant association group.
- There has not been a significant shift in overall structure and composition in high elevation mountain hemlock, though there are fewer large trees and more small trees.
- Mortality is currently very low in these plant associations.

- There has been a significant change in size class in the lodgepole dry association, from 61% pole size dominated to 90% small size dominated.

Sustainability of Habitat Conditions

Following are a few observations about the sustainability of late-successional habitat conditions in the Late-Successional Reserve, and some consequences of allowing unsustainable conditions to persist.

- An assumption is that landscapes within the historical range of variability are more likely to provide healthy, sustainable, resilient ecosystems and habitats than landscapes outside of the historical range of conditions (Watershed Assessment, pg. 57)[1].
- It is possible to temporarily have conditions that are outside the range of historical variability, such as in much of the denser spotted owl habitat in the Dry Mixed Conifer plant association. Because of limited moisture, this habitat cannot be maintained over time without some density reduction, either natural or human-induced. However, it can provide short-term habitat at high risk and probability of loss. Eventually, a combination of drought and some form of disturbance will bring densities and species composition back to more historic levels. This has already occurred in many areas of the Sisters Ranger District over the last 15 years due to insect and disease infestations. The risk is still very high for losing much of this habitat to large catastrophic fires, or insect and disease outbreaks.
- Maintenance of stands at higher densities also results in greater risk of losing medium and large ponderosa pine trees (a limited resource across the landscape), and retards growth.
- Excessive numbers of small trees or vigorous brush species in the understory, even though they don't contribute significantly to the total basal area, do compete for moisture, and can lower the vigor of larger trees in the stand, even if total basal areas are below critical levels. When the objective is to keep healthy large trees over time as a component of the landscape, it may be beneficial to thin understories to reduce competition for moisture. These treatments may also decrease the risk of catastrophic crown fires by reducing ladder fuels.

[1] "A key concept of sustaining ecological systems is that when systems are pushed outside the bounds of natural variability there is substantial risk that biological diversity and ecological function will not be maintained, and therefore, ecological systems will not be naturally sustained" (USDA Forest Service, 1991). Since *natural* variability may be a highly subjective determination ("natural when?"), *historic* variability may be substituted as a baseline. Historic period used was around 1870s.

DISTURBANCE EVENTS THAT INFLUENCE VEGETATION

Disturbance to natural vegetation has occurred from insects and disease, tree harvest, roads and fires. Each plant association group responds differently to disturbances. The climax species would be the dominant species with little or no disturbance, and in most cases except in ponderosa pine and lodgepole pine plant associations, other species would dominate after a disturbance event.

Harvest Related Disturbances

Tree harvest and silvicultural treatments have had a large impact on the northern 2/3 of this Late-Successional Reserve. Historically large ponderosa pine and other species were selectively removed (partial or risk cutting) from large tracts of land, leaving white fir and other species. More recently, treatments have been prescribed to reduce dwarf mistletoe and stand densities.

In the mixed conifer plant associations, many regeneration harvests have been implemented to convert stands to fast growing early seral species, thus reducing the impacts from dwarf mistletoe and the probability of western pine beetle.

In the Ponderosa Pine and Mixed Conifer plant association groups removal of "high risk" ponderosa pine and other types of partial cutting harvests have been a source of disturbance in this area during the past 50 years.

The known regeneration units cover approximately 2,187 acres. The known timber stand improvement activities cover approximately 409 acres, mostly in pole size or small size structure. Intermediate harvest activities (e.g. individual tree selection, commercial thinning, partial overstory removal), have occurred on approximately 4,377 acres.

Past timber harvest has fragmented late-successional habitat within the Late-Successional Reserve. Fragmentation can limit the amount of suitable habitat available for late-successional associated species, and hinders successful dispersal for some plants and wildlife.

Insects and Disease

The roles of insects and diseases as disturbance agents in the forest are very closely tied to vegetation patterns. Factors such as species composition, size structure, and density of forest stands are all very important in determining which agents are likely to be present in the forested environment, their abundance, and how profound their effect is likely to be on that vegetation. By their actions, forest insects and diseases sometimes alter the vegetative patterns that provided them with suitable habitat, and set the stage for new processes to occur.

The primary insects and diseases include various bark beetles, defoliators, mistletoes, and root diseases. One or more of these agents affects all of the conifer species. The key associates include the Douglas-fir beetle, fir engraver, western pine beetle, mountain pine beetle, western spruce budworm, western dwarf mistletoe, Armillaria root disease, and laminated root disease.

Dwarf Mistletoe. A primary disturbance agent active in the Late-Successional Reserve is ponderosa pine dwarf mistletoe. Dwarf mistletoe is a parasitic plant that diverts the nutrients from the host tree, resulting in reduced growth and eventual death of the host once it is severely infected. Dwarf mistletoe is an integral part of the forested ecosystem, and can provide forage for birds, mammals and insects, and create structural diversity (brooms and snags) for nesting, roosting and cover habitats (Pollock and Suckling, 1995). However, epidemic levels of dwarf mistletoe can result in the loss and repression of other important forest structures, particularly large trees. The damaging effects of mistletoe can best be minimized, and the ecological benefits maximized, by recreating forest stands with age, size and density distributions similar to forest conditions within the range of natural variability (Pollock and Suckling, 1995).

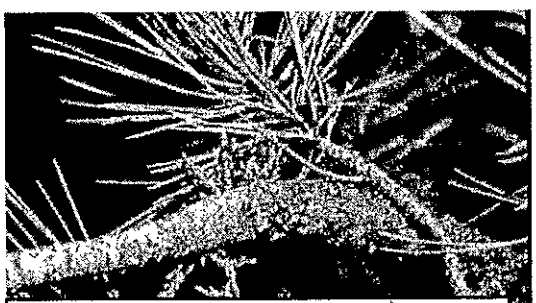


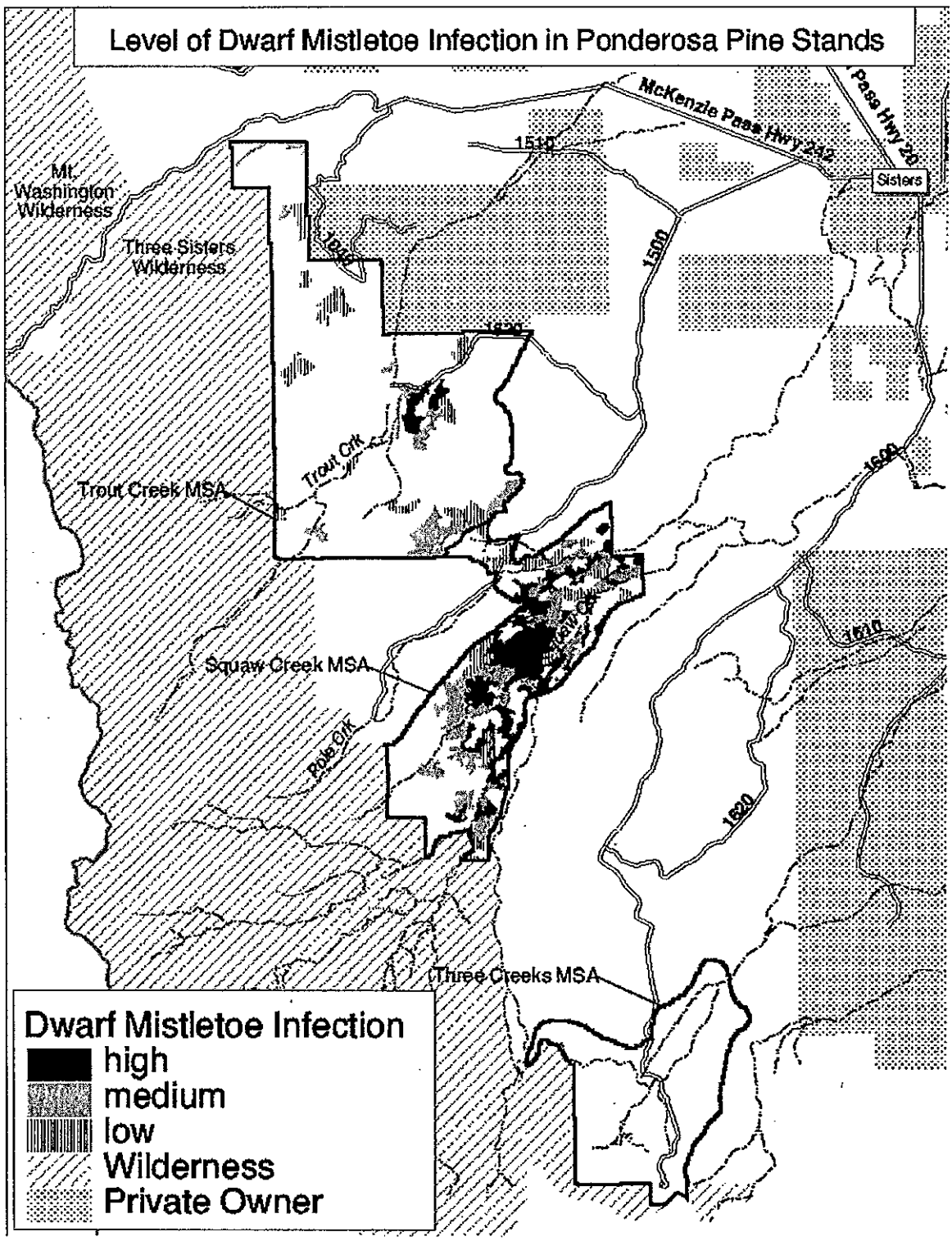
Photo II-1. Dwarf mistletoe infection in ponderosa pine

Dwarf mistletoe is widespread across Central Oregon, and a study (DeMars, 1980) on the Deschutes National Forest showed that the parasite could be found in approximately 45% of the ponderosa pine stands, with about 24% of the trees in these stands exhibiting some level of infection. An estimated 18,000 to 22,000 acres of ponderosa pine in this area of the Why-chus Watershed are infected by dwarf mistletoe in the mixed conifer and ponderosa pine plant associations. Within the Late-Successional Reserve, there are approximately 2,794 acres (almost 20% of the Late-Successional Reserve) of infected stands, most within the Squaw Creek Management Strategy Area (Table II-12, Figure II-8).

Table II-12. Dwarf Mistletoe Infection in Ponderosa Pine Stands, by Management Strategy Area

Ponderosa Pine Dwarf Mistletoe – Severity of Infection in Stands	**Trout Creek MSA**	**Squaw Creek MSA**	**Three Creeks MSA**	**Totals**
High	106	895	0	**1,001**
Moderate	356	750	0	**1,106**
Low	382	305	0	**687**
Total Acres of MSA Infected	**844**	**1950**	**0**	**2,794**

Figure II-8. Current Level of Dwarf Mistletoe Infection in Ponderosa Pine



It is assumed that the number of trees infected and the level of infection on individual trees (due to the exclusion of fire) are much higher now than in the past. Based on research of increases in dwarf mistletoe over time in the southwest United States, it is estimated there may be 30% more dwarf mistletoe now than historic levels (Maffei, 2000). This increase is probably due, in part, from decades of fire exclusion. Fire is the only natural disturbance agent of dwarf mistletoe, and historic low-intensity fires tended to crown out in dwarf mistletoe pockets, killing the host trees, then returning back to ground-level fires. New trees were able to grow back into these pockets without being re-infected with dwarf mistletoe.

Research (Hawksworth and Wiens, 1996) has shown that dwarf mistletoe tends to spread much more rapidly in uneven-aged stands than in even-aged structure. Selective harvest of large trees and the exclusion of fire has created multi-storied structure. This stand condition, in combination with higher stand densities from fire exclusion, is conducive to the spread and proliferation of dwarf mistletoe.

The Douglas Cabin Late-Successional Reserve Assessment reported that:

> Infection levels of dwarf mistletoe are related to both the density of host species and proximity of individual host trees to each other. Further, studies suggest that population levels of dwarf mistletoe of all species are lower in areas subjected to frequent fire since small, infected trees and infected lower branches are often burned. In addition, dwarf mistletoe seed germination is reduced when exposed to smoke for 60 minutes or longer (Hawksworth and Wiens, 1996). (pg. 71).

Stands infected by dwarf mistletoe tend to be at high risk for severe crown fires, since dwarf mistletoe retards the growth of infected trees, and creates heavy branch structure ("brooms") low on the tree, and thus reduces the distance between the ground and live crown (Koonce and Roth, 1985).

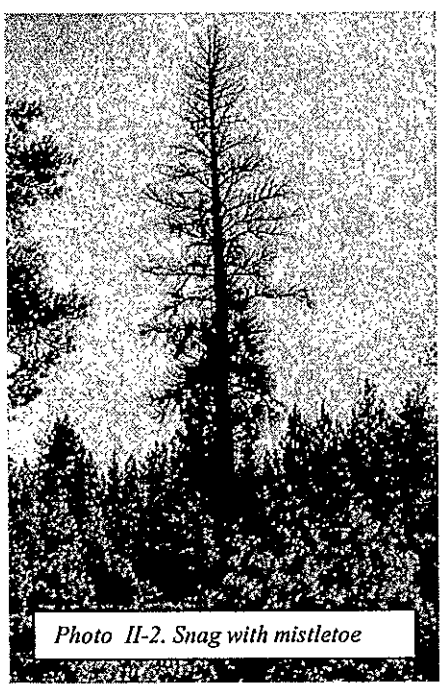


Photo II-2. Snag with mistletoe

The result of increasing spread of dwarf mistletoe over the landscape is a reduced ability to develop adequate canopy cover to provide late-successional habitat conditions, or to develop large ponderosa pine trees in infected stands (DeMars, 1980). It is predicted that this trend will continue while mistletoe is present in the overstories (a common way for mistletoe to spread is through seeds ejected from parasitic plants in overstory host trees, down on to the understory).

One of the primary focal species in the Squaw Creek Management Strategy Area is the white-headed woodpecker, which require large trees (generally 24-27" diameter) for nesting, roosting, and foraging habitat. Though it is assumed that this area historically provided late-successional habitat for white-headed woodpeckers,

large tree structure is now severely limited. With the current rate of mistletoe infection and spread in this area, it is unlikely that sufficient late-successional habitat will develop unless there is a disturbance to arrest the spread or reduce the amount of dwarf mistletoe. The other focal species in this area, the goshawk, also requires large trees for nesting.

Options for reducing the rate of mistletoe spread, promote growth and health of infected residual trees, and to promote the development of desired stand structures for focal species include: 1) pruning infected branches, 2) killing individual host trees (snag creation), 3) thinning in lightly to moderately infected stands to remove the most heavily infected trees, reduce stand densities, and reduce stress on remaining trees, and 4) regeneration of moderate to heavily infected stands.

Other Insects and Disease. The southern extent of the western spruce budworm outbreak from the late 1980's and early 1990's occurred on the northern portion of this Late-Successional Reserve, south to about Trout Creek Swamp. The budworm outbreak set the stage for secondary mortality agents such as root disease and bark beetles which attacked and killed trees weakened by defoliation and by the complex of other factors which are operating in that area.

In the mixed conifer plant associations there has been an increase in insects and disease due to the increase in stand densities with lack of frequent low intensity fires. In many areas the stand densities have recently been reduced by mortality from defoliators, increasing the fuel loading, and leaving behind low vigor and top-killed trees.

In the ponderosa pine plant association the occurrence of insects is relatively low. There are endemic levels of western pine beetle and mountain pine beetle.

In the Lodgepole Pine plant association the mountain pine beetle is the major disturbance factor, and mortality from the beetle is becoming more evident in the mature lodgepole pine stands throughout the Late-Successional Reserve.

In the High Elevation Forest, the key disturbance agents include the mountain pine beetle, laminated root disease, and white pine blister rust. The mountain pine beetle kills the seral lodgepole pines once they reach an age of 100+ years and thereby accelerates the rate of succession to climax vegetation. Laminated root disease affects the mountain hemlock, and by killing its host, introduces diversity in the climax forest. White pine blister rust, an exotic organism, is a very effective agent for removing young western white pine from these forests.

Fire

Fires have historically been a major influence in shaping these landscapes. The suppression of fires in this century, combined with timber harvest, has changed the composition of the forest a great deal, and estimating historical fire regimes can be difficult.

Refer to the Fire Management Plan (Chapter V) for detailed discussion of the fire regimes, effects of fire exclusion, risk and hazard analysis.

Roads

Roads may negatively impact late-successional species and their habitats in a variety of ways:

- Roads can increase direct mortality of animals via both animal/vehicle collisions and by improving access for hunters and trappers.
- Roads can reduce the amount and effectiveness of suitable late-successional habitat. Fragmentation of interior habitat can result in animal avoidance of otherwise suitable habitat. Reudiger (1996) documented displacement of rare carnivores in heavily roaded areas. Habitat fragmentation can result in increased predation on interior habitat species and can disrupt natural movement patterns. Recent studies document that roads can present a significant barrier to movement for many animals (Foster and Humphrey 1995, Meffe and Carrol 1994). For immobile species, roads represent a swath of uninhabitable land; the wider the road the more effective the barrier. Some small mammals rarely cross roads greater than 66' wide, while some spiders and beetles may rarely cross even unpaved forest roads (Meffe and Carol 1994). High road densities (and habitat fragmentation in general) tend to have pronounced effects on amphibians and reptiles (Harris 1984).
- Roads facilitate an increase in the introduction of exotic species that adversely alter species populations and ecosystems (i.e. brown-headed cowbird parasitism and plant weeds) (Forman and Hersperger 1996).
- Roads may increase the potential of human caused fires.

Roads can also provide some benefits to the Late-Successional Reserve, including more efficient and economic access for fire suppression and restoration activities.

The Deschutes National Forest LRMP provides road management guidance based on land allocation, but generally towards road densities of 2.5 miles per square mile or lower. There are currently 105.7 miles of open road in the Late-Successional Reserve. The existing road density across the Late-Successional Reserve is 4.5 miles per square mile. See the Why-chus Watershed Analysis, page 37, for road densities by subwatershed.

B. LATE-SUCCESSIONAL HABITAT CONDITIONS

A late-successional or old-growth forest takes a long time to develop, perhaps several hundred years. The amount of habitat within the Late-Successional Reserve that is considered late successional is relatively low due to past harvest activities and natural disturbances. There is a range of vegetative structural conditions within the Late-Successional Reserve, and many stands, while not possessing all the characteristics of "late-successional" habitat, do possess a number of late-successional habitat components or characteristics.

In general, The Why-chus Late-Successional Reserve landscape has changed from a fairly homogeneous landscape composed primarily of large and medium trees to a heterogeneous landscape with numerous small, early and mid-seral patches. There are significant amounts of edge habitat with high edge contrast. Late-successional interior habitats are highly fragmented and poorly connected.

There are approximately 37 terrestrial and aquatic wildlife species, and 68 plant species associated with late-successional habitat conditions present in the Late-Successional Reserve (Appendix B).

Late-Successional Habitat Definitions

Late-successional forests include mature and old growth age classes. The characteristics of the natural structure and composition of late-successional forests vary among geographical provinces. Historically, fires played a significant role in the structural development, vegetative composition, and maintenance of late-successional habitats in the Why-chus Late-Successional Reserve.

The identification and delineation of late-successional habitats for this Assessment is estimation based on 1996/1997 stand exam data and current late-successional habitat definitions (Region 6 Interim Old Growth Definitions 1993). Data were not refined enough to determine whether or not individual stands in the Late-Successional Reserve possessed all the characteristics necessary to meet the definitions of late-successional habitats. However, stand exam data in combination with field reconnaissance indicated that most stands that had a significant large tree component also possessed many of the other structural components of late successional habitat.

In this Assessment, late-successional habitats that developed under frequent, low to moderate intensity fire regimes are referred to as "fire-climax" habitats. Those late-successional habitats that developed under more infrequent, high intensity fire regimes are referred to as "climatic climax". It is commonly believed that, historically, the fire climax conditions were more prevalent in the ponderosa pine and mixed conifer plant association groups than they are now. Fire exclusion has resulted in the conversion of much of the fire-climax forest into climatic climax habitat. Descriptions of fire climax and climatic climax conditions by plant association are found under the Desired Future Condition discussion in Chapter III, Section B of this Assessment.

Current Late-Successional Conditions

Current late-successional conditions were analyzed from 1996/1997 stand exam data, and indicate the amount of late-successional habitat, or "possible old growth", in the Why-chus Late-Successional Reserve. Possible old growth (Table II-13) is an indicator of late-successional conditions, based on the number of large trees per acre (1 of the 6 criteria used to determine old-growth stands; USDA Forest Service Region 6 interim old growth definition, 1993). The analysis identified stands with the appropriate tree species mix and overstory to be considered possible late-successional habitat (Figure II-9).

Table II-13. Possible Old Growth by Plant Association Group

Plant Association Group	Percent of Late-Successional Reserve that is Possible Old Growth based on Number of Large Trees per Acre*
Ponderosa Pine	0
Mixed Conifer Dry	25
Mixed Conifer Wet	29
Lodgepole Pine	83
High Elevation Mtn. Hemlock	25
TOTAL	35

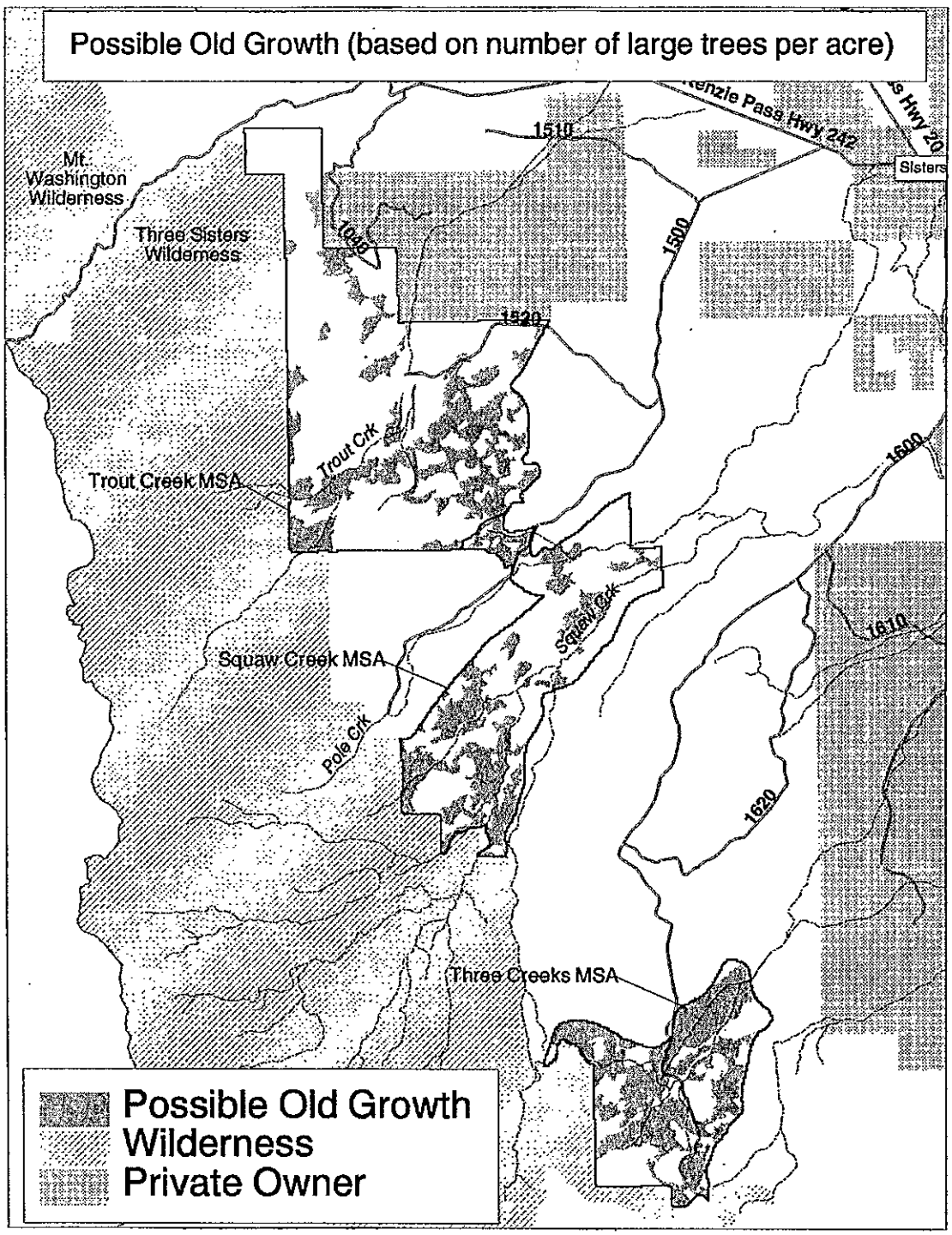
*Possible old growth for Ponderosa Pine = 13 or more live trees/acre $\geq$ 21" diameter,
Mixed Conifer (dry and wet) = 15 or more live trees/acres $\geq$ 21" diameter, and
Lodgepole pine and Mtn. Hemlock = when the majority of the trees/acre are $\geq$ 9" diameter

Due to its inherent instability, the condition of lodgepole pine old growth tends to be relatively short-lived. Consequently, the amount of lodgepole pine old growth is expected to change significantly within a fairly short time frame, perhaps within the next 20 to 30 years (Why-chus Watershed Assessment, 1998, pg. 51).

Succession from Early to Mature Habitats

It is recognized that within any forest system there will be a variety of seral stages from early to late. Both early and late seral stages in lodgepole pine and ponderosa pine plant associations, lodgepole pine and ponderosa pine are the primary species. For mixed conifer associations, determining species composition for long-term healthy conditions is more difficult. In most of the mixed conifer plant associations, ponderosa pine is the major early seral tree species.

Figure II-9. Possible Old Growth



Forest stands across the Late-Successional Reserve are expected to cycle through the following successional stages over time. The first stage is represented by seed, sapling, pole and small size classes. The last three stages are generally represented by medium to large size classes (see Appendix A, page 7, for more information on cycling of forest stands).

1. *preliminary vegetation* stage where large trees are not yet present.
2. *stable fire climax suitable habitat* stage where density management or natural fire maintains forested stands below the upper management zones of stand densities. Suitable habitat for late-successional species associated with large trees in open stands (e.g. whiteheaded woodpecker).
3. *transitional vegetation* stage where stands become less stable as densities increase, but are not yet optimal habitat for late-successional species associated with dense, interior forest conditions.
4. *climatic climax suitable habitat* stage where structural features provide optimal habitat for species like the spotted owl. This stage generally is unstable in this Late-Successional Reserve, and only sustainable for short periods.

An estimate of the "desired amount" of the Late-Successional Reserve being in these successional stages at any one time was developed for the northern portion of the Cache/Trout Late-Successional Reserve (Table II-14). Under this scenario, different structural stages for each plant association would be maintained and managed through time so there would be habitat developing to replace habitat that is lost or becomes non-functional due to disturbance.

Table II-14. Desired Amounts of Successional Stages, based on estimates for Cache/Trout Late-Successional Reserve

Plant Association Group	**Percent of Late-Successional Reserve**			
	Preliminary Vegetation	**Fire Climax Suitable Habitat**	**Transitional Vegetation**	**Climatic Climax Suitable Habitat**
Mtn. Hemlock	0-30%	NA	0-30%	40-70%
Mixed conifer wet	20-40%	5-20%	0-20%	40-60%
Mixed-conifer dry	20-30%	45-75%	5-20%	0-10%
Ponderosa Pine (wet and dry)	10-30	50-80	5-20	0-10
Lodgepole Pine (wet and dry)	20-60	NA	0-20	30-70

Sustainable v.s. Suitable Late-Successional Conditions

As mentioned previously, it is assumed that the historic range of variability of ecosystem conditions are more sustainable than conditions that exist outside that range. Sustainable forest conditions can provide suitable habitat for species over the long-term, even though there would still be variation in successional stages. However, alteration of a part of the system, including alteration of historic disturbance processes, can result in a catastrophic change in the system, or *unsustainable* conditions. The result could be widespread loss of historic habitats and the species that depend on them. It also may result in relatively slow recovery of the system, particularly if soil productivity is severely impacted, such as from intense wildfire.

Forest habitats that are not sustainable can still provide adequate, or *suitable* habitat for certain species in the short-term. For instance, the high tree density and closed canopy in portions of the mixed conifer dry forest areas in the Late-Successional Reserve are now providing suitable habitat for the spotted owls to nest, roost and forage. However, overcrowded conditions and recent drought have put tremendous stress on these forest stands. These stands would not provide suitable long-term habitat for spotted owls.

An analysis by the Deschutes National Forest Science Team (Gerdes, Maffei and Booser, 1996) determined that the optimum stand conditions for 10 indicator species that depend on late-successional structural components (Appendix A) were generally outside of the range of conditions considered sustainable in each of the plant associations. This emphasizes that suitable wildlife habitat and sustainable stand conditions are commonly very different, and that many of the species currently associated with the Deschutes National Forest Late-Successional Reserves are occupying short-term, unsustainable habitat, and that this habitat is at risk of loss.

C. LATE-SUCCESSIONAL ASSOCIATED SPECIES

The following is a discussion of the status and habitat conditions of Threatened, Endangered and Sensitive species, and focal species that are known or suspected to occur in the Late-Successional Reserve. *Focal species* discussed here are those that are associated with late-successional conditions, and are guild representatives. For example, providing habitat for a specific guild (of focal species) will provide habitat for a number of species that have similar habitat requirements (Why-chus Watershed Assessment, pg. 101). There are other species known or suspected to occur in the Why-chus Late-Successional Reserve analysis area, but may not be associated with late-successional conditions. For more information about species found in the Waterhshed, refer to the Why-chus Wathershed Assessment (1998), and to Appendix B at the end of this document. For a discussion on management guidelines for focal species, see Chapter IV, section A.

Focal and TES Species in the Why-chus Late-Successional Reserve

Animals	Plants
Northern Spotted Owl	Peck's penstemon
Bald Eagle	Newberry Gentian
Canada Lynx	Rare Lichens
California Wolverine	Rare Fungi
Northern Goshawk	
Great Gray Owl	
Black-backed Woodpecker	
White-headed Woodpecker	
American Marten	
Species Associated with Snags and Down Logs	
Cascade Frogs	
Long-toed Salamander	
Mollusks	

TERRESTRIAL SPECIES - ANIMALS

Northern Spotted Owl

This species represents those associated with dense, multi-storied, interior forests within the mixed conifer and mountain hemlock plant associations.

Status: The northern spotted owl is a federally threatened species.

Habitat: Spotted owl nesting, roosting, and foraging habitat (NRF) and its sustainability are different in the drier, less productive eastern Cascades forests than in other portions of the species' range. The discussion below describes suitable NRF habitat on the Deschutes National

Forest; identifies potential NRF habitat, (plant associations that have the potential to provide spotted owl habitat at least in the short-term); and discusses sustainable NRF habitat, (plant associations and environmental conditions that are believed capable of sustaining NRF habitat in the long-term). These terms will be used in tables and discussions throughout the remainder of the spotted owl section of this document. In this context short-term means 0-49 years and long-term means 50+ years.

Suitable Nesting, Roosting and Foraging Habitat: Spotted owl nesting, roosting and foraging habitat means forest vegetation with the age class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the owl.

A Deschutes National Forest vegetative sampling project identified the following characteristics of suitable nesting, roosting and foraging habitat on the Forest: stands of mixed conifer, ponderosa pine with white fir understory and mountain hemlock/sub-alpine fir with at least 75% canopy cover, at least 22 large diameter trees per acre (>25" diameter), second canopy layer with densities of at least 280 trees per acre, at least 12 hard snags per acre (>15" diameter), and 15 or more down logs per acre (>15" diameter) (Austin, 1994).

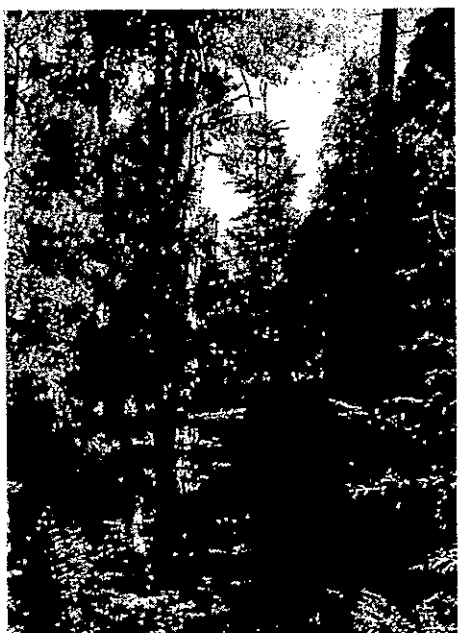


Photo II-3. Spotted Owl Nesting Habitat

Minimum structural characteristics for nesting, roosting and foraging habitat include mixed conifer plant associations, multi-storied stands of at least 40 contiguous acres with at least 60% canopy cover; at least 8 trees per acre >21"diameter; and at least 82 trees per acre in the understory <21" diameter. However, these criteria have been recently updated to more accurately reflect what habitat conditions owls actually use on the Deschutes National Forest, particularly in areas of high mortality where optimum conditions are limited. The following sliding scale for habitat depicts a truer picture of use in these areas.

Table II-15. The Range and Combination of Habitat Conditions That Result in Suitable Nesting, Roosting and Foraging Habitat for Spotted Owls on the Deschutes National Forest

Trees per acre >21" dbh	Canopy Closure Percentage of Trees >6" dbh
11	55-59%
15	50-54%
18	45-49%
22	40-44%

Potential and Sustainable Nesting, Roosting And Foraging Habitat: The mixed conifer wet, riparian, mountain hemlock, and mixed-conifer dry (on north aspects with greater than 20% slope) plant associations represent potential nesting, roosting and foraging habitat on the Deschutes National Forest. These plant associations have the site-potentials to sustain higher tree densities and basal area are most likely to provide the highest quality nesting, roosting, and foraging habitat for the longest period of time. Forested sites in the mixed-conifer dry plant association that are not on north slopes greater than 20% generally do not have the vegetative site potential to sustain nesting, roosting and foraging habitat characteristics over the long-term (Deschutes National Forest White Paper, 1995).

Spotted owl habitat within Why-chus Late-Successional Reserve Assessment area is limited in quality as well as quantity (there are currently 1,796 acres of nesting, roosting and foraging habitat) (Figure II-10). Past harvest activities and insect and disease infestation have removed and fragmented owl nesting, roosting and foraging habitat in the area. Reduced canopy cover and stand structure diversity, (resulting from spruce budworm defoliation, Armillaria root disease, bark beetles and other agents) have lowered the quality of the remaining owl habitat. However, analysis of site conditions indicated that up to 6,764 acres within the Late-Successional Reserve could potentially sustain nesting, roosting, and foraging habitat; about 74% more habitat than currently occurs (Figure II-11). About half of these sustainable habitat acres occur in the Trout Creek Management Strategy Area, where it would be logical to develop and enhance nesting, roosting, and foraging habitat conditions. Table II-16 summarizes existing and potentially sustainable owl nesting, roosting and foraging habitat data in the Late-Successional Reserve.

Table II-16. Existing and Potentially Sustainable Owl Nesting, Roosting and Foraging Habitat

Acres of NRF currently in the LSR	**Acres on which NRF could Potentially be Sustained**	**Acres of NRF now located in Sustainable PAGs**
1,796 acres (12% of LSR)	6,764 acres (45% of the LSR)	1,100 acres (61% of existing NRF occurs in sustainable PAGs)

The Late-Successional Reserve is 14,900 acres

Figure II-10. Current Spotted Owl Dispersal and Nesting, Roosting, and Foraging Habitat

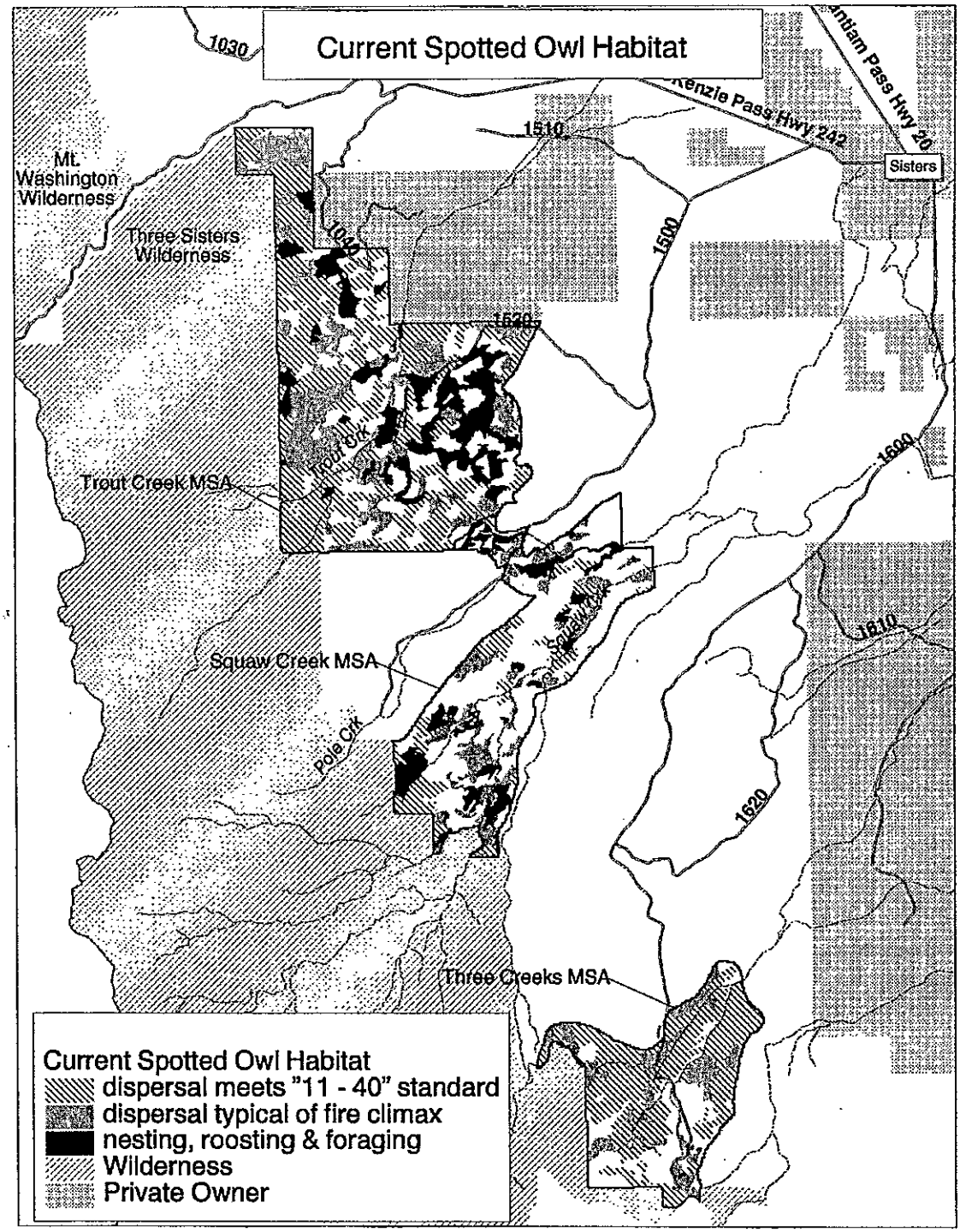
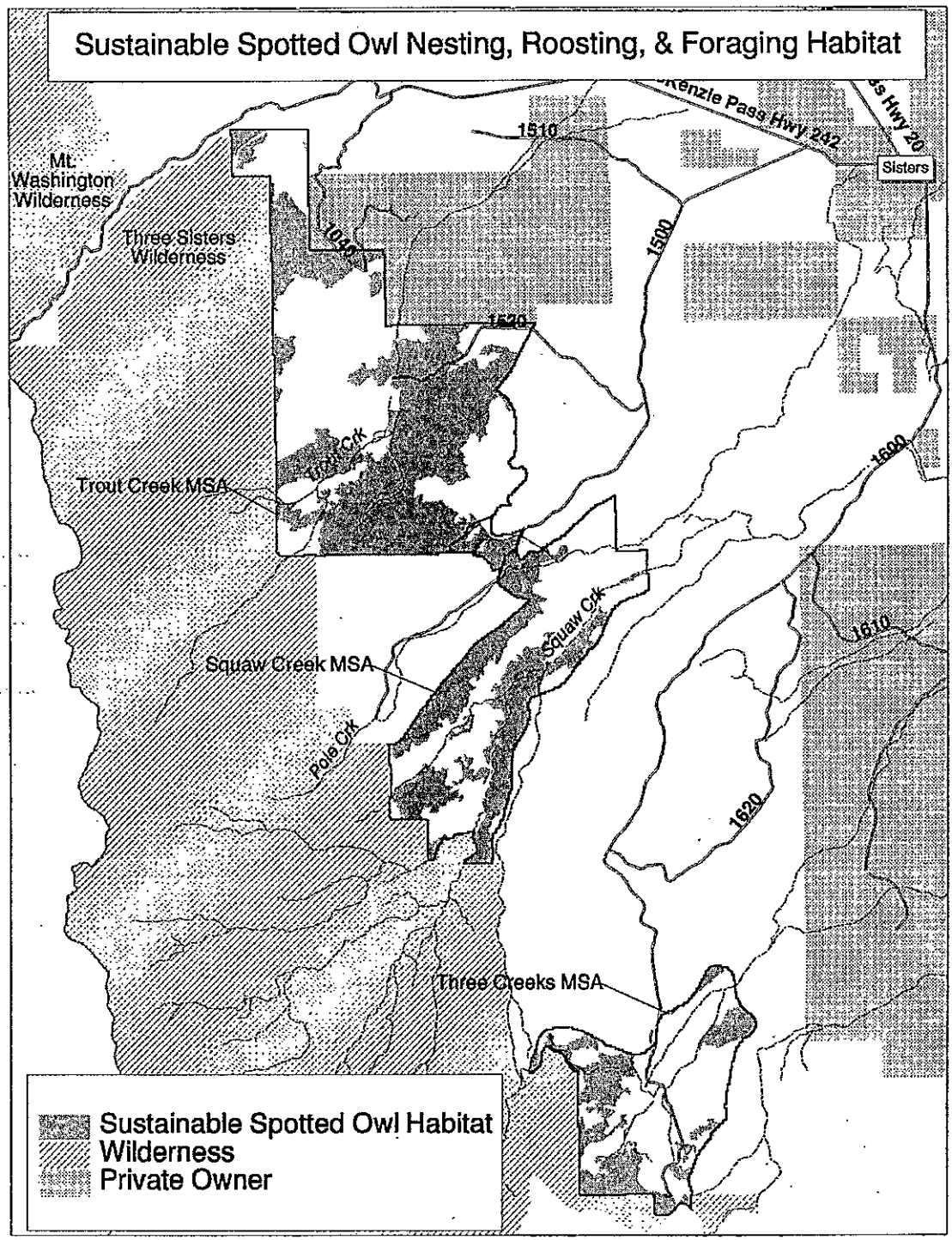


Figure II-11. Sustainable Spotted Owl Nesting, Roosting, and Foraging Habitat



Recorded Owl Occurrence: There are 2 known spotted owl activity centers associated with the Why-chus Late-Successional Reserve (both pairs). Both home ranges contain less than 40% suitable habitat (Table II-17). Over the decade since these pairs have been located, the only recorded reproductive success was for the Bluegrass Butte pair, with one young in 1998 and two in 2000.

Table II-17. Habitat Conditions for the Two Owl Pairs Known to Occur

Spotted Owl Pair	**Acres NRF w/n 1.2 Mile Radius**	**% NRF w/n 1.2 Mile Radius**	**Acres of Sustainable PAG w/n 1.2 Mile Radius**
Trout Creek	762	26%	1930
Bluegrass Butte	348*	12%	113

* - Includes habitat mostly in Cache LSR. Only 6 acres of nesting, roosting and foraging habitat are within Why-chus LSR

Historic and Current Trends: Fire exclusion has altered the species composition and structure of many mixed-conifer dry stands. Consequently, spotted owl nesting, roosting and foraging habitat may exist today in sites that did not historically provide habitat. Conversely, many of the stands that historically were nesting, roosting and foraging habitat have been harvested and no longer provide habitat. Though it is assumed that there was less spotted owl habitat available historically, the quality and quantity of historic habitats, and owl densities, are unknown.

Over the past 5 to 15 years, some of the overstocked mixed-conifer dry stands have experienced heavy mortality. Loss of canopy layers and live tree canopy closure has reduced the quality of habitat for spotted owls in these stands. This trend, in combination with habitat loss from management activities, has resulted in fewer acres of suitable habitat, unevenly distributed across the landscape.

Landscape Overview of the Existing Condition: In order to understand the existing condition of the northern spotted owl and its habitat in the Why-chus Late-Successional Reserve it is necessary to examine how this Late-Successional Reserve currently functions for the species in the context of the network of Late-Successional Reserves, and to describe quality and quantity of owl habitat in the surrounding landscape.

The Why-chus Late-Successional Reserve is part of a regional network of Late-Successional Reserves designed to maintain habitat and viability for late successional and old growth related species including the northern spotted owl. The Late-Successional Reserve network generally overlaps the network of Critical Habitat Units (CHUs) that were designated by the U.S. Fish and Wildlife Service following the federal listing of the spotted owl as a threatened species. CHUs are a legal land allocation under the Endangered Species Act that are designed to provide for the protection and recovery of a listed species.

Why-chus Late-Successional Reserve in Context of Deschutes National Forest/LSR Network. The 1995 Deschutes National Forest Late-Successional Reserve Overview broadly describes the desired ecological function of the individual Late-Successional Reserves and identifies how they interrelate and contribute to the overall function of the Late-Successional Reserve system.

The Deschutes National Forest Overview identifies the northern spotted owl as one of the late-successional related species associated with Cache and Why-chus Late-Successional Reserve (identified as Cache /Trout Late-Successional Reserve in the Overview) and identifies the following deficits in Forest-level habitat connectivity.

> Of particular concern are the Matrix land allocation surrounded by the Metolius Late-Successional Reserve (the Jack Canyon area) and Matrix land between the Cache/Trout and Three Creeks Late-Successional Reserve... A common thread that links these Late-Successional Reserves together is the lodgepole and ponderosa pine stands in the matrix allocation. The lodgepole stands may attain the ISC standard 11-40 but they will not sustain this condition for any period of time before some disturbance agent causes stand decline. The ponderosa pine stands could maintain this standard depending upon soil productivity. Due to past management activities, insect and disease agents, many of the matrix lands are in need of restoration. Restoration goals should include forest health and dispersal habitat objectives. Residual stands that provide dispersal habitat and are not at risk to short term "catastrophic" loss, should be maintained and enhanced (USDA, 1995). Heavy tree mortality in nesting, roosting and foraging habitat within and between Cache/Trout and Metolius Late-Successional Reserves has resulted in substantial habitat loss and degradation. In short, habitat connectivity along a north-south continuum has been compromised by current forest conditions (USDA Forest Service, 1995).

Existing Condition of Owl Habitat on the Sisters Ranger District: Eighteen percent of the Sisters Ranger District was mapped as spotted owl nesting, roosting and foraging habitat in 1996. Significant portions of this habitat have been lost to mortality since then. About 121,570 acres or 38% of the district is comprised of plant associations capable of sustaining nesting, roosting and foraging habitat (USFS 1996).

The majority of known spotted owl activity centers on the Deschutes National Forest are located on the Sisters Ranger District. There are 21 known owl pairs/resident singles on the district. Twenty of the home ranges associated with these spotted owls currently contain less than 40% suitable habitat (40% suitable habitat within a 1.2-mile home range radius represents a habitat threshold for the species). Removal or degradation of suitable habitat from owl home ranges already below the habitat threshold, or where activities result in habitat levels below the threshold, constitute "incidental take" of a federally listed species and require Section 7 consultation with the U.S. Fish and Wildlife Service under the Endangered Species Act.

Three recent projects on the district, Jack Canyon, Santiam Corridor, and Santiam Restoration Vegetation Management Projects, have (or will) remove or degrade 2,585 to 2,841 acres of spotted owl nesting, roosting and foraging habitat (USFS 1997, USFS 1996). Extensive tree

mortality has occurred in much of the nesting, roosting and foraging habitat in these project areas, and most activity centers were already below the 40% habitat threshold. Management for future, long-term nesting, roosting and foraging habitat; protection of existing habitat from wildfire, insects, and disease; and salvage of merchantable timber were all objectives of the vegetation treatments in these areas. Cumulatively, the three projects resulted in the "incidental take" of ten owl pairs (48% of the known owl activity centers). Dispersal habitat may also be impacted within the home range of the Bluegrass Butte pair from the proposed McCache vegetation management project.

Critical Habitat Units: Why-chus LSR includes the majority (88%) of one Critical Habitat Unit (CHU) OR-5, located in Trout Creek Management Strategy Area (Figure II-12). CHU OR-5 (a total of 7,688 acres) was designated to provide and maintain essential nesting, roosting, and foraging habitat situated along the eastern crest of the Cascades within the Eastern Cascades province, and to help maintain the north-south dispersal habitat along the eastern slope of the Cascades Mountains (USDI, 1992).

Table II-18. Spotted Owl Habitat in CHU OR-5

Type of Habitat	Acres of Habitat within the CHU that is within the LSR	Acres (and %) within the CHU
Nesting, Roosting, Foraging	1281 acres	1307 (17%)
West-side Dispersal	2815 acres	2845 (37%)
Eastside Dispersal	1517 acres	1538 (20%)

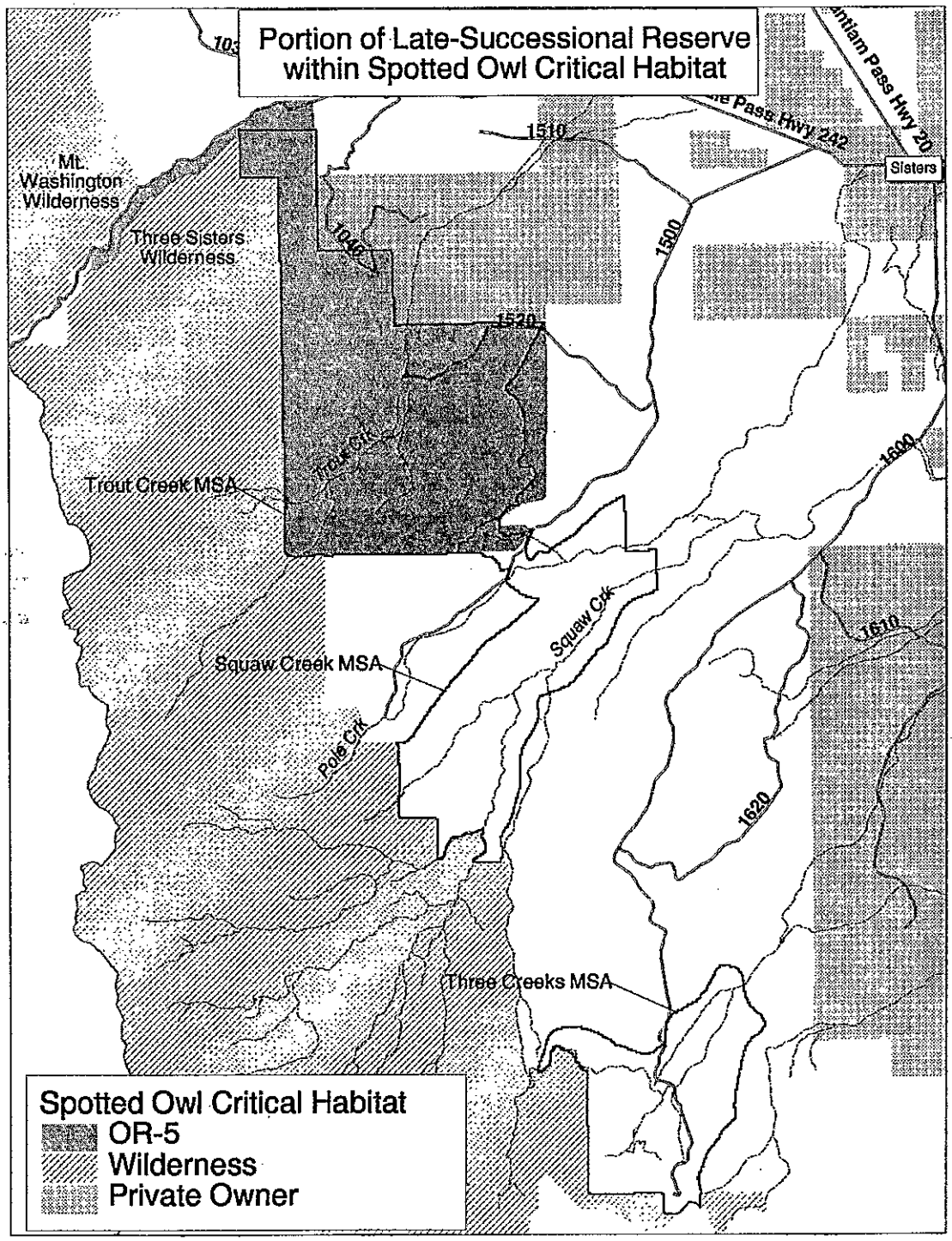
CHU OR-5 = 7,688 acres

Management Guidelines: Why-chus Late-Successional Reserve is located at the eastern edge of the range for the northern spotted owl. Protection of the owl in this fringe habitat is especially important for the viability of the species. Individuals and populations at the edge of a species' range often possess the genetic constitution that expands the adaptive capability of the species. This capability affords the species protection from random catastrophic events and enhances its ability to adapt to large-scale changes such as global warming.

See Chapter IV for specific recommendations for protection and enhancement of spotted owl habitat.

Changes to Habitat/ Threats: Spotted owl habitat in this Late-Successional Reserve and in the surrounding landscape is very limited in quantity, is fragmented, and has been impacted by insect and disease infestation. Not managing nesting, roosting and foraging habitat may leave the habitat vulnerable to loss of desired structural characteristics in the future. However, given the recent risk-reduction treatments in nesting, roosting and foraging habitat elsewhere on the district, and the minimal amount of habitat currently available to this species, further loss/degradation of existing nesting, roosting and foraging habitat and high quality dispersal habitat via management activities is not appropriate in the short-term (Biological opinion, Sherri L. Chambers). Consider silvicultural and fuels treatments in areas that are not nesting, roosting and foraging habitat and are not critical dispersal habitat for this species.

Figure II-12. Spotted Owl Critical Habitat Unit within the Late-Successional Reserve



Bald Eagle

This species represents those associated with large tree structure in open ponderosa pine and mixed conifer plant associations.

Status: The bald eagle is a federally threatened species, though was not identified as a focal species for this Late-Successional Reserve since there no known bald eagle nest trees or known or potential territories in the Late-Successional Reserve. The Why-chus Late-Successional Reserve is within the High Cascades Bald Eagle Recovery Zone 11 (Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington, Bald Eagle Working Team, 1990).

Habitat (Including Changes and Threats): Habitat is limited both within the Late-Successional Reserve and on adjacent lands. There are few large lakes or streams in the Late-Successional Reserve or on adjacent lands that can provide an adequate food supply of fish, though there are fish in both Three Creeks Lake and Squaw Creek. In addition, large tree structure for roosting is limited (tree limbs need to be able to support nests weighing up to 2,000 pounds). Heavy timber harvest and selective removal of large trees over the past century has removed many of the largest trees.

Special Considerations: Because potential habitat for this species is limited in the Late-Successional Reserve, management for current and future bald eagle habitat should be considered along Squaw Creek as long as no conflict exists with other late-successional related species. Look for opportunities to develop and maintain ponderosa pine and Douglas fir trees that are dominant or codominant trees >35" diameter with limb structure that will support a nest and provide a view of the foraging area.

Canada Lynx

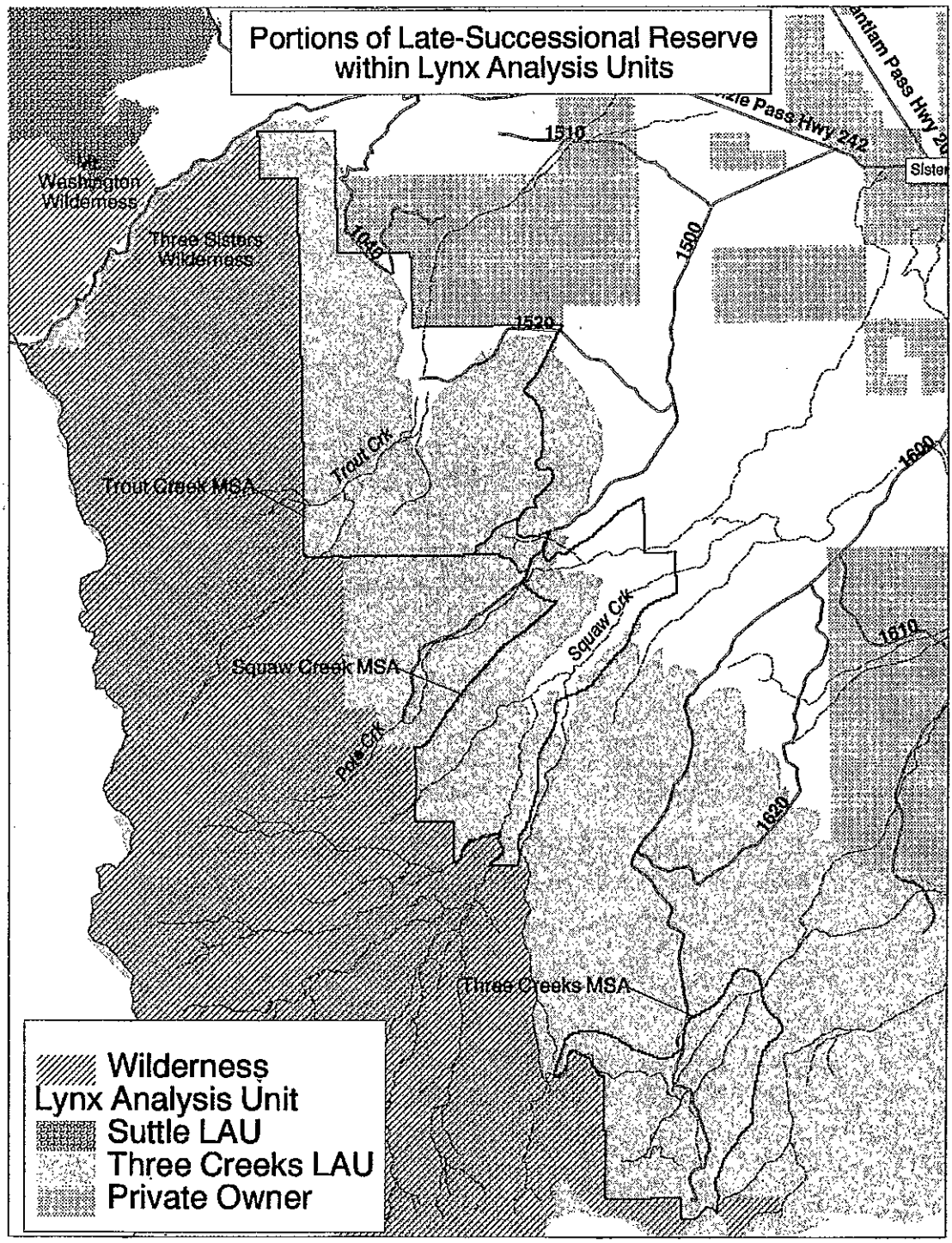
This species represents those associated with mountain hemlock, lodgepole pine and mixed conifer plant associations, in a early, middle and late-successional stages.

Status: The Canada lynx is listed as a threatened species in Oregon. The lynx is not heavily dependent on late-successional habitat conditions, but is included as a focal species because much of the Late-Successional Reserve is within a Lynx Analysis Unit (Lynx Analysis Unit). There have not been any sitings within the Late-Successional Reserve, though there have been two probable (unconfirmed) sitings near the Late-Successional Reserve: approximately 4 miles northeast of the boundary (1986), and approximately 9 miles south of the boundary (1996).

Habitat: Why-chus Late-Successional Reserve is located partially within the Three Creeks Lynx Analysis Unit (Lynx Analysis Unit) (Figure II-13). Potential habitat exists, especially within the lodgepole pine and mixed conifer plant associations. The lynx requires a mix of habitats to support its primary prey species, the snowshoe hare. This species requires dense young stands that provide a forage base both in summer and winter months. The lynx also requires old or mature stands with high canopy closures and if possible, large accumulations of down woody material. This provides security sites for denning. Travel cover between denning and foraging

areas and between other suitable sites is usually located on prominent ridges, through saddles and along riparian zones.

Figure II-13. Portions of Late-Successional Reserve within Lynx Analysis Units



Habitat mapping occurred across the Deschutes and Ochoco National Forests in February 2000. Each LAU contains lands capable of producing the necessary lynx components: denning and foraging habitat comprising the majority of the area contained within the boundary. However, LAU's were not designed to represent an actual home range of lynx.

Habitat analysis for the Three Creeks LAU (Table II-19) shows that the grass/forb/shrub and medium/large component are within the desired range for these two structural stages. Seed/saplings and pole structure classes are deficit within the LAU and the small size class is surplus several hundred acres.

Table II-19. LAU Totals by Structure Class for the Three Creeks LAU

Structure Class	Existing %	Desired %	Desired Range %	Surplus or Deficient Acres
Grass/ forbs/ shrubs	8%	11%	6% to 16%	Within range
Medium/ Large	10%	13%	8% to 18%	Within range
Pole	3.5%	20%	15% to 25%	-6782
Seedling/ Sapling	5%	12%	7% to 17%	-1328
Small	30%	24%	19% to 29%	+725

Suitable existing spotted owl nesting, roosting, and foraging habitat may serve as lynx denning and/or travel cover. However, most of this habitat lies below 4500' and is highly fragmented due to mortality and past harvest. The majority of lynx use occurs above the 4500' elevation level.

Special Considerations: Analysis shows that foraging habitat is deficit in both the seed/sap and pole size classes. However, creating foraging habitat in an Late-Successional Reserve is not an objective for the sake of creating forage. Take advantage of management activities that may result in the creation of foraging habitat and develop these areas into foraging as the opportunity arises. Vegetation manipulations, primarily in the mountain hemlock dry, mixed conifer wet, and lodgepole pine wet plant associations, should focus on creating favorable foraging habitat where applicable, especially in the pole size class. Favor regeneration of shrubs and herbaceous cover to provide forage for snowshoe hare and favor regeneration of aspen stands to provide additional habitat in the summer months. Determine conditions of designated denning habitat and manage towards meeting or maintaining suitable denning habitat across the watershed.

Management actions shall not change more than 15% of lynx denning and foraging habitat within a LAU to an unsuitable condition within a 10-year period. Management activities should not result in an increase in groomed or designated over-the-snow routes or snowmobile play areas in the LAU. Manage open road densities for a goal of a minimum of 2 miles per square mile.

Outside of fuelbreaks, avoid creating openings greater than 300 feet in width where connectivity is important. Fuelbreaks would help maintain desired habitat for late-successional species in a wildfire event, and would aid in maintaining both denning and foraging habitat for the lynx. The fuelbreaks do not generally compromise north-south connectivity.

Management Recommendations: Management for the protection and enhancement of spotted owl nesting, roosting and foraging habitat is compatible with denning habitat management objectives for the lynx. See Chapter IV for specific management guidelines.

California Wolverine

This species represents those that use mountain hemlock, lodgepole pine and Mixed Conifer plant associations, such as the fisher.

Status: The wolverine is a federal candidate species and is on the Regional Forester's Sensitive species list.

Habitat: Wilderness or remote country where human activity is limited appears essesntial to the maintenance or viable wolverine populations. Habitat use is probably dictated by food availability; wolverines are primarily scavengers, but also depend on a variety of prey items (Honocker and Hash, 1981). In winter, they tend to den underground in snow, in rocky ledges or talus slopes (Ingram, 1973; Banci, 1994). Recent studies in Montana have shown wolverines prefer high elevation cirque basins on north and east slopes with high talus surrounding the area for denning. Physical structure including large down wood is also important for denning and kit survival.

A helicopter survey in March 1998 identified a potential den site in the wilderness approximately one mile from the Trout Creek Management Strategy Area boundary. Several sightings (one in 1993) have been reported adjacent to the Three Creeks Management Strategy Area, but some have occurred west of the Trout Creek area also. One report was located in the Three Creeks Management Strategy Area, however these reports occurred over 20 years ago. The lack of current sitings corresponds with the onset and continuance of high recreational use in the Three Creeks area. It is not known whether the Why-chus Late-Successional Reserve supports any resident wolverines. However, it is likely that dispersing and migrating individuals, especially individuals from the adjacent den site area, pass through this area.

Prior to timber harvest and recreational activities, the wolverine may have been found throughout the Late-Successional Reserve, although they were probably always rare and uncommon. Currently, the high elevation mixed conifer, lodgepole pine and mountain hemlock plant associations have the highest potential for wolverine occurrence because of the large unfragmented nature of these areas.

Changes to Habitat/ Threats: Hornocker and Hash (1981) showed that wolverine avoid areas of human use, including roads and clearcuts. They also avoid high temperatures which may be one reason they tend to occupy alpine and subalpine areas in the summer. Both the Trout and Squaw Creek Management Strategy Areas contain high road densities; 5.18 mi/mi2 and 5.89 mi/mi2 respectively. Opportunities should be sought to close roads, especially near the wilderness boundaries to increase roadless conditions. Human access and presence may negatively affect

natal areas of wolverines. Restricting use into these areas during the spring and summer may increase kit survival.

Adjacent Late-Successional Reserves (Cache and Metolius) provide some habitat for wolverine. Both Late-Successional Reserves have experienced greater mortality which may lead to increased down woody material levels. Proposed road closures may also lead to increased habitat suitability over time. Adjacent lands in Pole Creek are highly fragmented with recent timber harvest and roads. Land between Squaw Creek and Three Creek Management Strategy Areas are less fragmented. An approximate one mile strip of unfragmented forest lies between the wilderness boundary and the current road network. Movement out of the Late-Successional Reserve in a more easterly direction to disperse to Black Butte and along Green Ridge is hampered by high road densities, fragmentation, and scattered private inholdings. The wilderness abuts the Late-Successional Reserve and provides suitable habitat for both species. Recreational activity is the only activity to occur within the wilderness. Encroachment during the winter season from snowmobiles and other winter sports is a concern. Tam McArthur Rim is highly suitable wolverine habitat. However, winter recreation use is increasing in this area, resulting in the potential for disturbance during critical times.

Special Considerations: Within the Three Creeks Management Strategy Area, snowmobile use should be maintained to existing use areas and should not be expanded, in order to limit the amount of disturbance in the winter months.

Potential Management Conflicts: The goal of developing late-successional habitat may reduce open habitats suitable for the large ungulates, which are a primary prey base for wolverine. This may limit wolverine presence in these areas but may increase suitability for species like fishers.

High recreational use (OHV use, horse use, hikers, etc.) in suitable habitat, primarily natal areas, could negatively affect kit survival during spring and summer months. Loss of large structure (down wood, hollow logs, snags) could limit wolverine female/kit use of areas due to decreased availability of suitable rendezvous sites and decrease habitat suitability for fishers as well as not providing habitat for primary prey species.

Northern Goshawk

This species represents those associated with mature mixed conifer, lodgepole pine, and ponderosa pine plant associations

Status: The goshawk is listed as a State Sensitive Species, is a federal candidate species, and is proposed for listing on the Region 6 Regional Foresters Sensitive Species list. Goshawks are a Deschutes National Forest Management Indicator Species for old-growth ponderosa pine forests.

Habitat: Goshawks prefer moist areas on north slopes, often near water. Mature and late successional (fire and climatic climax) habitats in the mixed conifer and ponderosa pine plant associations are considered potential nesting habitat for this species. Several nest sites have also been located in lodgepole pine stands on the DNF. Single nest territories may have 2-4 nest stands. The nest areas are usually the stands with the highest density of large trees, high tree

canopy cover and high basal areas. Optimal habitat in the post-fledgling area (420 acres) and foraging areas (5,400 acres) include a mosaic of vegetation structural stages (Reynolds et al. 1992).

The entire Late-Successional Reserve has not yet been surveyed for goshawk, though surveys according to protocol have been conducted in the Trout Management Strategy Area as well as matrix lands between Trout and Squaw Management Strategy Areas. No surveys have occurred in the Squaw or Three Creeks Management Strategy Areas since 1995. There are two known nest territories within the Late-Successional Reserve and four territories adjacent occurring between the Squaw and Three Creeks Management Strategy Areas.

Currently, 32% of the Late-Successional Reserve (4738 acres) provide suitable habitat, including both nesting and foraging habitat (Figure II-14). See Table II-20 for suitable habitat acres by Management Strategy Area.

Table II-20. Suitable goshawk acres by Management Strategy Area.

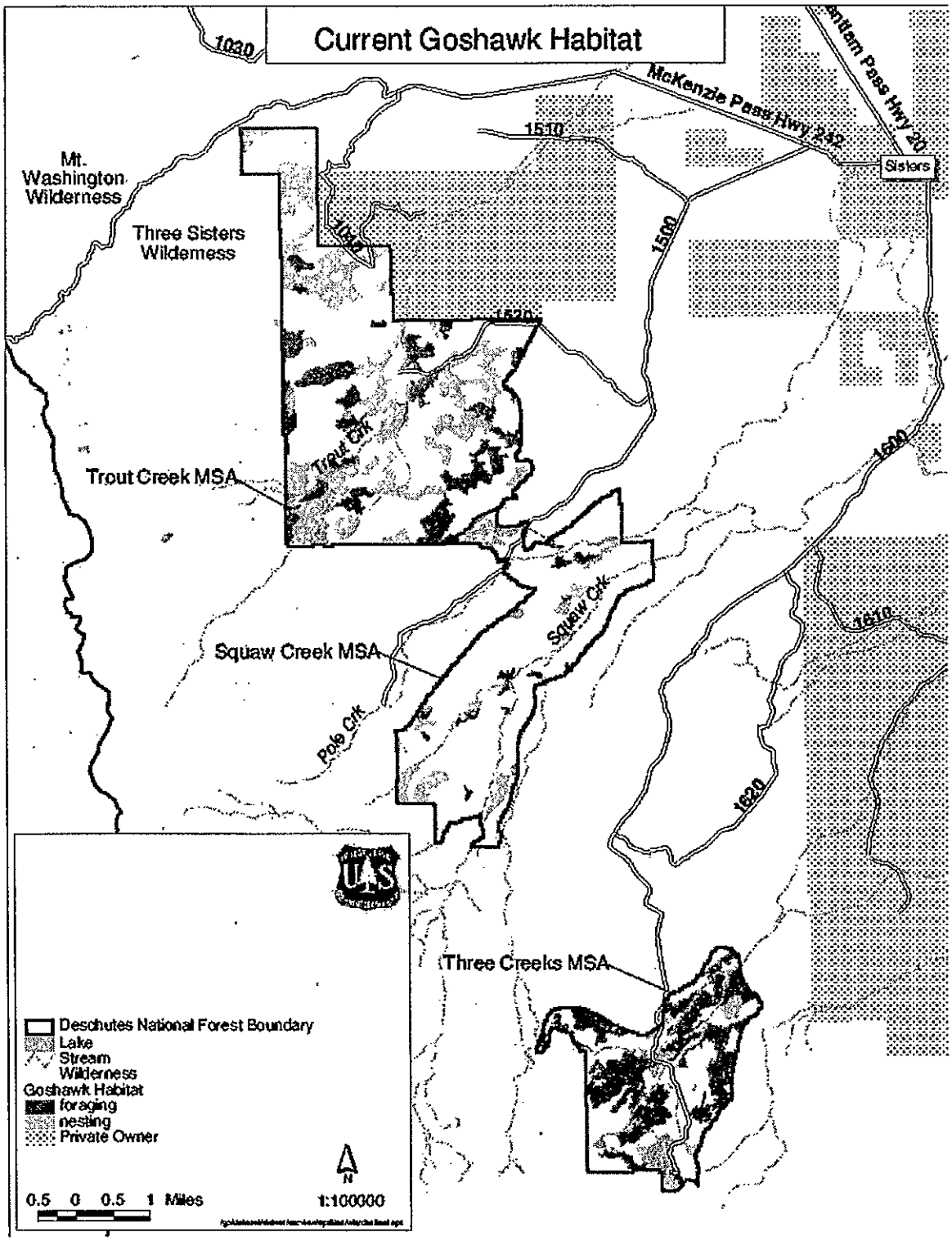
Management Strategy Area	Suitable goshawk habitat acres	% of MSA that is suitable
A	2843	37%
B	525	12%
C	1370*	45%
Total	4738	32%

Three major concentrations comprise the majority of nesting habitat: 1) around Trout Creek Butte; 2) Trout Creek "neck" and block adjacent to private lands; and 3) western corner of Trout Creek Management Strategy Area. There are also a few isolated stands west of Trout Creek swamp. Only a few isolated stands of nesting habitat can be found in Squaw Creek and Three Creek Management Strategy Areas.

Very little foraging habitat exists in the "neck" area and block adjacent to private land in MSA A. Some of these stands identified as nesting habitat have suffered moderate mortality (30-50%). Three Creeks has very little nesting habitat (160 acres) compared to foraging habitat (1210 acres). This may serve as part of the Walla Bear or Three Creek Butte pairs' home ranges since their nest areas are only about one mile from the Late-Successional Reserve boundary.

Connectivity between Trout and Squaw Management Strategy Area through the Pole Creek area is possible through timbered stringers between harvest units, though the area is relatively fragmented. A new nest found in 2000 was located in this area. Ample habitat exists to provide connectivity between Squaw and Three Creeks Management Strategy Areas in the higher elevations. Lodgepole pine in this area may limit nesting habitat, but dispersal and foraging habitat are plentiful.

Figure II-14. Current Goshawk Habitat



Surrounding Late-Successional Reserves provide varied habitat quality and quantity. No goshawks were found in Cache Late-Successional Reserve, and only 11% of the area was estimated to provide suitable habitat due to habitat loss from insects and disease. The Metolius Late-Successional Reserve has also suffered from insects and disease but suitable habitat still exists. Historic nest sites were monitored in 2000 but none were found to be nesting. Connectivity through Cache to the Metolius Late-Successional Reserve is hampered by mortality, private inholdings, and fragmentation. It's important to retain suitable habitat now and develop areas for future habitat due to the condition of the surrounding lands and Late-Successional Reserves.

Changes to Habitat/ Threats: The amount of suitable goshawk habitat in the Late-Successional Reserve was probably higher historically than it is today. The large patches of mature and old growth mixed conifer and ponderosa pine habitats that covered a majority of the Late-Successional Reserve were ideal habitat for goshawks. In recent decades, timber harvest practices have reduced the amount of suitable habitat, and probably the number of goshawks nesting in this area.

Loss of large structure will limit nesting habitat. Loss of snags, down woody material, and clumpiness may degrade foraging habitat and decrease fledgling survival. Continued fire suppression may lead to degradation of habitat due to increased stand densities in the mid canopy.

Potential Management Conflicts: The area surrounding Trout Creek Butte coincides with nesting, roosting and foraging habitat for spotted owls. This may present a conflict between these species, as goshawks have been known to prey on spotted owls. However, the new goshawk nest site is approximately 1.5 miles northwest from the historic spotted owl site, which may be far enough apart to accommodate both species.

Special Considerations: Management for the protection and enhancement of spotted owl NRF in the LSR is compatible with habitat management objectives for the goshawk. Provide for several nest stands and foraging areas within a home range (3 nest areas and 3 alternative stands of 30 acres, a post fledgling area of 420 acres and 5400 acres of foraging habitat are needed for each home range).

Great Gray Owl

This species represents those associated with ponderosa, lodgepole pine and mixed conifer plant associations adjacent to open meadows or very young stands.

Status: The great gray owl is considered a sensitive species in the vulnerable category by Oregon Dept. of Fish and Wildlife due to the loss of nest and roost sites from logging activities. Great gray owls are a survey and manage species under the Northwest Forest Plan.

Habitat: Suitable habitat areas for this species are those with a high density of small mammals in deep-soiled open forests or deep-soiled meadows with forest edges (Bryan and Forsman 1987, Bull and Henjum 1990). The great gray owl uses a variety of forest types within the mixed conifer and lodgepole pine plant associations. Studies in northeast Oregon indicate that the

species utilizes ponderosa pine plant associations as well (Bull and Henjum, 1990). For nest sites, great gray owls utilize old hawk and raven stick-nests or natural depressions on broken-topped snags or stumps (Nero 1980, Mikkola 1983). They also have been found to nest on dwarf mistletoe platforms (*Arceuthobium* spp.) (Mikkola 1983, Duncan 1992) and readily accept artificial nest platforms (Bull and Henjum 1990). The vast majority of great gray owl nests are found within 0.25 mile of meadows or other openings. Leaning, small diameter lodgepole and ponderosa pine snags (used by flightless owlets) are considered important habitat features for the reproductive success of this species (Bull and Henjum 1990, Franklin 1988).

There is one documented great gray owl sighting (1992) between the Trout and Squaw Creek Management Strategy Areas near Pole Creek. However, no great gray owls were detected during 2000 surveys. A potential response was heard during spotted owl surveys near the 1018-800 junction and a possible visual was reported by a Forest Service crew near the 1018-1026 junction. No birds were found during the follow-ups. Potential habitat with the highest likelihood of occupancy occurs in Trout Creek headwaters, Twin Meadows, meadows along the 1526 and 1514 roads, Trout Creek Swamp, and Trapper meadow. Additional habitat may exist in the more open mixed conifer and ponderosa pine stands in the Late-Successional Reserve and adjacent to cleared areas with mature and old growth stands in proximity.

Habitat exists in surrounding Late-Successional Reserves. The Dugout Lake area and past harvest units adjacent to mature/late-successional stands in the north Cache Late-Successional Reserve provide habitat. A potential nest site was reported by a member of the public near Dugout Lake but has not been verified. The Metolius Late-Successional Reserve does not contain a lot of meadow habitat except on private lands. Most habitat in the Metolius Late-Successional Reserve is associated with open ponderosa pine stands and old harvest units adjacent to mature/late-successional stands. Scattered habitat exists in all the Late-Successional Reserves. However, limited habitat exists in the Cache Late-Successional Reserve due to heavy mortality suffered from the recent insect/disease outbreak. This is also true in the Metolius Late-Successional Reserve to a degree, however connectivity still exists within these areas.

Sitings have occurred on adjacent lands in the Pole Creek area between Trout and Squaw Management Strategy Areas. Limited meadow habitat exists there but recent harvest units surrounded by mature and late successional habitat strips may replace meadow habitat. Higher elevations in a north-south band along the wilderness boundary between Squaw and Three Creeks Management Strategy Areas may provide habitat. There is no habitat to the east of the Late-Successional Reserve.

Changes to Habitat/ Threats: The historic and current population and habitat levels for this species within the Late-Successional Reserve are unknown. However, it is likely that the fire-climax forests that were more prevalent in the past provided significant amounts of suitable great gray owl habitat. Recent management activities (including regeneration harvests and selective harvest of large diameter snags and trees) that negatively impact nest-building hawks and corvids may have decreased available nest platforms for the great gray owl below historic levels.

Loss of nesting structure in central and eastern Oregon has been identified as the most immediate threat to great gray owl persistence. Therefore, management of nesting habitat should be a

priority. Natural meadows and grassland communities are being lost due to fire suppression. Though partial cutting can increase foraging habitat it is important to leave residual forest, snags and hunting perches. Small openings are much more desirable (30-60 m openings). However, these types of openings are usually short-lived due to regeneration of stands. Harvest activities may reduce nesting habitat but small patches of mature forest may act as suitable habitat if adequate nesting structure is available. Gopher baiting activities near potential or known habitat may indirectly result in poisoning great gray owls.

Potential Management Conflicts: Great gray owls will prey on spotted owls, so caution should be used when designing projects to develop or maintain suitable great gray owl habitat near spotted owl activity centers. Surveys for occupancy by great gray owls should continue. If, after habitat has been enhanced and there is still no use by great gray owls, then allow the areas may be managed for other species.

Black-backed Woodpecker

This species represents those associated with lodgepole pine and mixed conifer plant associations with moderate to high mortality.

Status: The black-backed woodpecker is considered a sensitive species in the critical category by Oregon Dept. of Fish and Wildlife. Black-backs are a Deschutes National Forest Management Indicator Species for old-growth lodgepole pine forests and have also been identified in the Northwest Forest Plan (Appendix J-2) as needing special mitigation provisions (C-47 & 48).

Habitat: There are no documented sightings of black-backed woodpeckers in the Why-chus Late-Successional Reserve. No formal surveys have been completed. Black-backed studies conducted on the Deschutes National Forest showed habitat preference for mature and overmature lodgepole pine and mixed conifer stands (Goggans et al. 1989). This species generally nests in live trees with heartrot (mean nest-tree size 11'dbh) at elevations above 4300'. Bull et al. (1986) and Goggans et al. (1989) found that foraging was centered on live and dead lodgepole pine trees; however, all forest types were used for foraging by this species. Black-backs roost in concave western gall rust cankers, in deep trunk scars or indentations, and in mistletoe clumps in live/dying trees (Goggans et al. 1989).

The Forest black-backed study recommended 956 acres of mature and overmature lodgepole pine or lodgepole pine-dominated mixed conifer forest, at a minimum elevation of 4300' (Goggans et al. 1989) for one pair of woodpeckers.

The mature lodgepole pine or mixed conifer with lodgepole pine habitats (most located in the Three Creeks Management Strategy Area) provide current and potential habitat for this species. The Late-Successional Reserve has a potential to support 3 pairs of black-backed woodpeckers, 2 of the pairs in the Three Creeks Management Strategy Area. The historic and current population trends within the Late-Successional Reserve are unknown.

Potentially suitable habitat on adjacent lands and adjoining Late-Successional Reserves, and connectivity to these lands is mainly along and within the wilderness areas dominated by lodgepole pine.

Changes to Habitat/ Threats: Until the mature stands of lodgepole pine begin to decline, habitat suitability for black-backed woodpeckers is limited. Thinning of lodgepole pine stands on adjacent National Forest System lands has delayed or intervened in disturbance events that would continue the cycling of these stands to mortaltiy and early searal stages, further limiting suitability for black-backed woodpeckers. Currently, little early seral habitat exists to cycle through and the potential for a catastrophic event to occur is growing.

Special Considerations: Lodgepole stands above 4300' have the highest potential to provide suitable nesting, roosting, and foraging habitat for this species in the LSR. The Lodgepole PAG occurs primarily in the Three Creeks area. There is also little opportunity to perform fuel treatments in the Late-Successional Reserve due to the roadless nature and the heavy recreational pressure. Therefore a shaded fuelbreak may be established along the Forest Road 16 to provide an opportunity to stop or deter an approaching fire. If such an event occurs, do not salvage burned trees in order to provide foraging habitat for black-backs. Suitable habitat exists inside the wilderness for nesting and this could provide needed forage areas. Additional habitat for this species would be provided in areas of spotted owl nesting, roosting, and foraging habitat and in goshawk nesting habitat in the remaining two management strategy areas.

White-headed Woodpecker

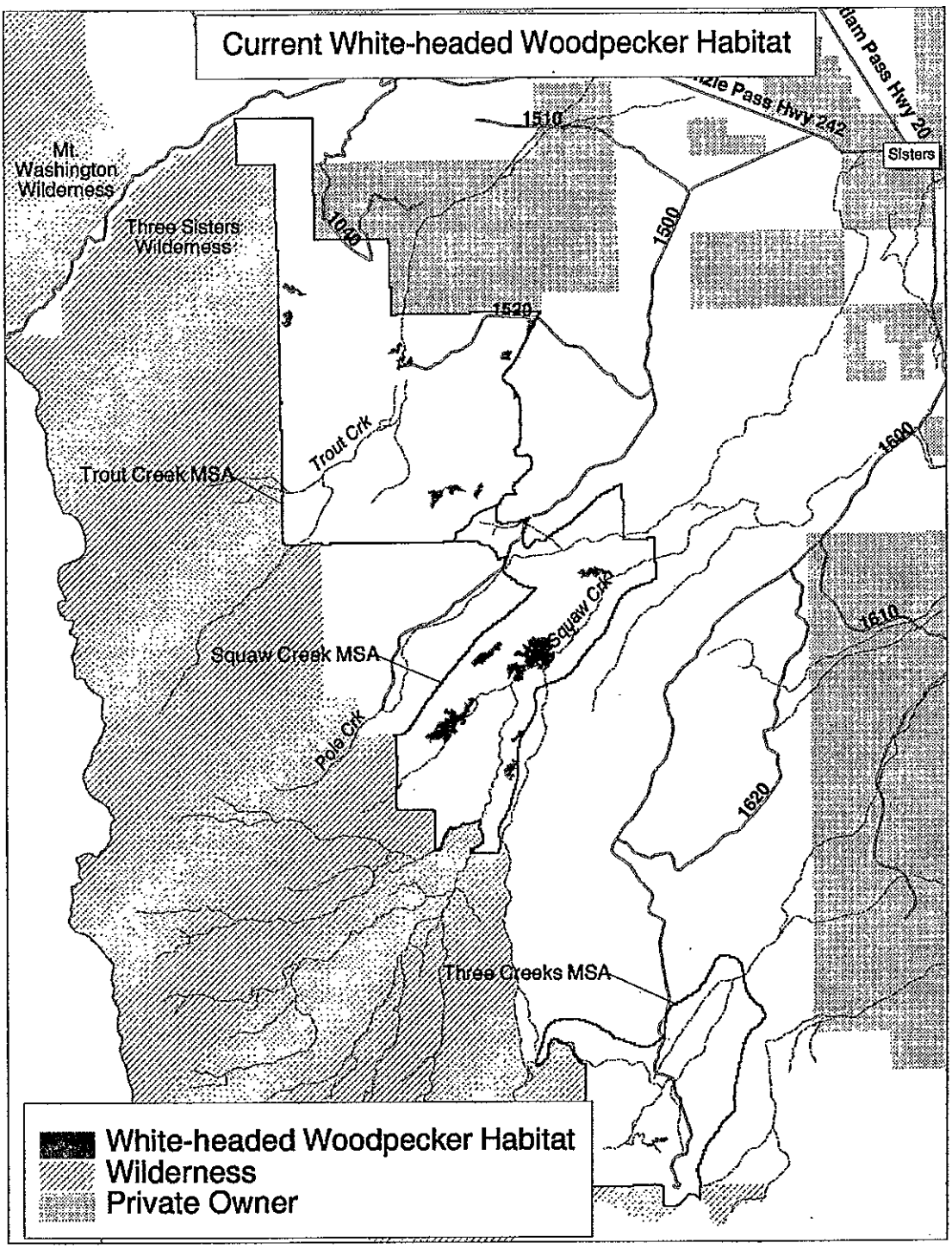
This species represents those associated with mature, open, single-story ponderosa pine and mixed conifer plant associations.

Status: The white-headed woodpecker is considered a sensitive species in the critical category by Oregon Dept. of Fish and Wildlife. This species is also identified in the Northwest Forest Plan as needing special mitigation provisions (C-47 & 48).

Habitat: There is one documented sighting of white-headed woodpeckers in the Late-Successional Reserve. No formal surveys have been conducted. Potential habitat exists within the mixed conifer and ponderosa pine plant associations of the Late-Successional Reserve (Figure II-15) and the likelihood of occupancy is high. However, the loss of open, mature ponderosa pine stands has reduced the amount of suitable habitat and fire suppression may have degraded some of the remaining areas.

Photo II-4. White-headed woodpecker habitat on the Sisters Ranger District

Figure II-15. Whiteheaded Woodpecker Habitat



A study of white-headed woodpecker in central Oregon (1995), included 8 study sites on the Sisters Ranger District, found that the majority of nests and roosts were in ponderosa pine forests with ≤57% canopy closure. Nesting, roosting and foraging habitat occurs mostly in large ponderosa pine (live or dead) from 24" to 27" diameter and 46' to 66' tall (Dixon 1995).

Whiteheaded woodpeckers use larger (> 21" diameter) snags in a variety of decay classes, and have an average home range size of 523 acres in unfragmented habitats, and 845 acres in fragmented habitats. The highest woodpecker density recorded was approximately 1 pair/100acres of habitat (Dixon, 1995; Frenzel, 1999).

Lower elevations on adjacent lands provide the greatest amount of potential habitat for white-headed woodpeckers. These areas are comprised primarily of ponderosa pine. A large thinned area lies adjacent to the Trout Creek Management Strategy Area to the east and could become future habitat. At the present time, this area may be too open for occupancy. The Metolius Late-Successional Reserve provides the greatest amount of potential habitat. An ongoing research study is occurring within portions of this Late-Successional Reserve in hopes of obtaining more information on white-headed woodpeckers. The Cache Late-Successional Reserve has very little potential habitat, occurring on the eastern fringe. Habitat here has become very brushy and stand densities are high. Connectivity is provided by matrix lands and lands east of the owl line.

Changes to Habitat/ Threats: This species was probably more abundant historically than it is today. Habitat quality may be decreased due to several factors including past harvest practices that have led to decreased stand sizes, fire suppression which has produced brush fields, increased stand densities which favor predators, fragmentation, and loss of large snags. Fragmentation from recent harvest practices is a concern between the Squaw and Three Creeks Management Strategy Areas. Little contiguous habitat remains today. The selective harvest of mature ponderosa pine within the ponderosa pine and mixed conifer plant associations has reduced the amount of suitable habitat for this species. The role that low to moderate intensity fires played in maintaining snag densities is unclear. When compared to current conditions, it is likely that snag levels were much higher under natural fire regimes.

Potential Management Conflicts: Creation of enhancement of suitable habitat for the woodpecker (open, single story pine stands) conflicts with the habitat needs of the goshawk, which currently occupies some of the potential whiteheaded woodpecker habitat.

Special Considerations: White-headed woodpeckers may not necessarily occupy old growth stands if the understory is dense and there are no openings near potential nest sites. Since nest entrances may be low on nest trees, these birds need an area in front of the tree somewhat open in order to approach without obstructions or fear of predators. Therefore, prescribed burning or mowing may be appropriate in some areas to reduce the amount of dense understories. In order to continue to have large trees occurring on the landscape, overstocked ponderosa pine stands may need thinned. Stands near water would be a priority since Dixon found that these birds may need a water supply during the late summer and early fall months.

The Squaw Creek Management Strategy Area is dominated by ponderosa pine and the white-headed woodpecker is a focal species for this area. The majority of the Squaw Creek MSA

(about 4,284 acres) could function as potentially suitable habitat, though the mixed-conifer wet plant association would require more frequent maintenance to prevent a mid-story canopy from developing. This would allow for approximately 5 territories to be managed in this Management Strategy Area.

Mixed-conifer plant associations in the Trout Creek Management Strategy Area could serve as white-headed woodpecker habitat, although it is not a focal species for this Management Strategy Area. Using Dixon's calculations for home range size in a fragmented forest, there is the potential to manage for 4 territories in Trout Creek Management Strategy Area. Priorities for management would occur along the eastern edge of the Trout Creek Management Strategy Area. Currently, only 389 acres across the Late-Successional Reserve qualify as white-headed woodpecker habitat. The goal is to develop and manage habitat for 5 to 10 pairs.

Dwarf mistletoe is prevalent in the Late-Successional Reserve, especially in Squaw Creek Management Strategy Area where the greatest potential for white-headed woodpecker habitat exists. Mistletoe is jeopardizing the creation of future habitat by infecting young stands, and is contributing the to mortality of existing large trees. The result is very open stands with a heavy shrub component. These stands are identified as having high to very high fire risk. Maintaining what little habitat remains is critical and development of habitat is needed.

Potential Management Conflicts: Though the Northwest Forest Plan recommends softer decay class trees for white-headed woodpeckers, literature shows that larger trees are required and most nest trees are in trees with hard exteriors. By leaving softer snags for this species and re-introducing fire into these stands, we risk losing nesting habitat. Leaving harder snags may allow for retention after burning activities are complete. Reducing stand densities will enhance habitat by opening up stands allowing use and reducing the risk of predation, reducing fire risk, and possibly increasing growth of the trees.

American Marten

This species represents those associated with mature forests in mixed conifer, lodgepole, and mountain hemlock plant associations.

Status: The marten is considered a sensitive species in the critical category by Oregon Dept. of Fish and Wildlife due to loss and fragmentation of late successional mixed conifer habitats. Marten are a Deschutes National Forest Management Indicator Species for old-growth mixed conifer forests.

Habitat: There have been no formal surveys for martens in Why-chus Late-Successional Reserve, but individuals have been observed in several locations within and adjacent to the Late-Successional Reserve. It is likely that this species can be found throughout the Late-Successional Reserve in mature and late successional mixed conifer, lodgepole pine and mountain hemlock plant associations.

Marten demonstrate preference for large late-successional stands of coniferous forests with complex physical structure near the ground (Buskirk and Powell 1994), which provide protection

from predators, access to subnivean (under the snow) space where most prey are captured in winter, and protective thermal cover. Soutiere (1979) found that clearcut harvest reduced marten densities for several decades. Red-backed voles, pine squirrels, and meadow voles are important prey species.

Changes to Habitat/ Threats: Loss of large structure may limit marten presence in the Late-Successional Reserve and loss of old growth structurally diverse sites may limit reproductivity for years.

Special Considerations: The habitat needs of marten are compatible with the habitat needs of several of the other LOS species including spotted owls, pileated woodpeckers, goshawks, and Vaux's swifts. Martens need overhead cover for safe dispersal and foraging.

Management Guidelines: Manage for this species in the Three Creeks Management Strategy Area, and in spotted owl nesting, roosting and foraging habitat areas of the northern Management Strategy Areas. Lodgepole pine areas are able to produce adequate levels of down woody material while maintaining canopy closure. In areas where it is desirable to manage for marten, it is not recommended to salvage heavy concentrations of blowdown. Ensure that the structural characteristics described above are protected and enhanced.

Late-successional Species that Use Snags, Down Logs, and Diseased/Deformed Live Trees

More than 80 species of birds, mammals, reptiles, and amphibians use living trees with decay, trees with brooms, hollow trees, snags, and logs in the interior Columbia River basin (Bull et al., 1997). Some of the species not previously discussed that use these structures and are known or suspected to occur in Why-chus Late-Successional Reserve include: bushy-tailed woodrat, golden-mantled ground squirrel, snowshoe hare, northern pygmy owl, northern flying squirrel, osprey, pygmy nuthatch, brown creeper, and wood duck. Discussion of the roles these structures serve for a wide diversity of species is beyond the scope of this document. However, it is important to note that the characteristics and components that constitute "unhealthy" trees contribute significantly to healthy, functioning late-successional forests.

Primary cavity excavators depend on snags and logs for nesting, roosting, and foraging. Primary cavity excavators include pileated woodpecker, black-backed woodpecker, northern flicker, hairy woodpecker, Williamson's sapsucker, three-toed woodpecker, and Lewis' woodpecker. Most of these species are associated with late-successional habitats in various plant association groups. Black-backed and three-toed woodpeckers are associated with lodgepole pine, while Lewis' woodpeckers prefer ponderosa pine associations. Pileated woodpeckers and Williamson's sapsuckers prefer mature and late-successional habitats in mixed conifer associations while northern flickers and hairy woodpeckers are found in a mix of habitats, especially those associated with edges.

Many aspects of snags and down woody material have been noted in recent studies to be of more importance for associated species. Hollow trees and logs are important structural components across the landscape and should be retained wherever possible. This habitat component is used by many species for night roosts, denning, resting, nesting, cover, and foraging habitat.

Ponderosa pine, western larch, and aspen are preferred species for cavity excavators in most areas. Douglas-fir snags may also be important especially where larch and aspen are limited. Larger diameter snags are also preferred (>20"dbh). These tend to stand the longest, can accommodate cavities of any woodpecker species, and provide the most stable microclimate because of wood thickness. Taller snags can also provide a wider range of nesting and roosting structure across the landscape. Some woodpecker species may stratify snag use where snags are limited. Decay class is important as well. Most recent dead snags, those that still have their bark and limbs and have little decay are used primarily for foraging. However, Class 2 snags, those that show some decay and have lost some bark and branches, are used the most for nesting and foraging both. This class also provides additional habitat for species like the brown creeper and bats due to sloughing bark. Class 3 snags are used by secondary cavity excavators and primary cavity excavators that prefer softer wood. Snag distribution seems to be an important aspect. Most woodpecker species have been found to prefer clusters of snags over evenly spaced trees (Saab and Dudley 1997). Bate (1995) recommends to manage snags on every 5 to 25 acres due to territoriality. This also tends to evenly distribute snags across the landscape and provides for the maximum level of cavity excavators. Snags should be left adjacent to green trees to provide cover. However, those left in the open will likely be utilized by species such as bluebirds and flickers. It is important to leave green tree replacements for future snag recruitment and current foraging substrate.

Down logs are important components of the landscape. They provide organic and inorganic nutrients in soil development, contribute to water economy, provide microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and provide structure for riparian associated species in streams and ponds. It has been shown that size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. Jack-strawed piles are used by many species, like the lynx for hunting, cover, and rearing of young. It is still unknown what levels of down woody material are needed to provide quality habitat for associated species. Too much may impede travel by big game and present a fire hazard. However, increased levels also provide cover for small vertebrates and may protect seedlings from browse or scorching. So leaving adequate levels across the landscape is important. Orientation has also been shown to be important. Logs that lie along a contour are used more than those lying across contours. Larger sized logs are also used more and by more species than smaller logs.

Snag and Down Log Densities in Why-chus Late-Successional Reserve: Snag densities vary on a stand by stand basis. Overall, snag densities in the Why-chus Late-Successional Reserve are highest in the mixed conifer and lodgepole pine/mt hemlock plant associations and lowest in the ponderosa pine plant association. The number of snags in mixed conifer habitats has increased in the recent past because of insect and disease. In general, snags are absent or densities are low in areas of past harvest. The old practice of removing snags that could serve as lightning conduits has also reduced snag densities in some areas.

The following information was generated from 1996/1997 stand exam data (Table II-21). Data reflects hard and soft snags over 10 feet tall in "mature" forested stands and did not include snag densities of young regenerating stands. These numbers may be inflated as stand exams count all

"cull" trees as snags, while not all cull trees necessarily function as snag habitat. However these are the trees most likely to die or develop snag habitat characteristics sometime in the future.

Table II-21. Average Snag Densities (Per Acre) by Plant Association

Diameter Class (inches)	Ponderosa Pine PAG	Mixed Conifer Wet PAG	Mixed Conifer Dry PAG	Lodgepole Pine/Mt Hemlock PAG
9 - 14	0.4	19.6	21.6	28.1
15 - 20	4.6	6.2	8.2	5.7
21 - 31	2.0	2.6	3.3	1.6
32+	0.2	0.3	0.5	0.1

No data were available on down log densities. It is assumed that the trends in down log densities are similar to snag trends. Down log densities are expected to be highest in the mixed conifer and lodgepole/mountain hemlock plant associations and lowest in the ponderosa plant association. Tree mortality from insects and disease is a significant contributor to down logs. The logging debris from past timber activities contributes some amount of woody debris in harvested stands.

In unmanaged and lightly harvested ponderosa pine, dry and wet mixed conifer stands, snag and down log levels may be higher than in the past because of less frequent fires. In the lodgepole pine and high elevation mountain hemlock plant associations, snag and down log densities may be similar to historic conditions. However, in other stands, regeneration harvest and selective removal of large trees have lowered snag and down log densities below historic levels. The effects of changes in historic and current dead wood levels on dead wood associated species in Why-chus Late-Successional Reserve are unknown.

Special Considerations: Utilize information in Bull et al. (1997), and Park et al. (1997), to ensure that important habitat structures are maintained in the Late-Successional Reserve over time. Strive to manage for 100% MPP levels in the Late-Successional Reserve except for within fuel breaks, along travel routes, and in recreation sites. See Appendix C, Snag and Green Tree Replacement Recommendations.

Crater Lake Tightcoil

The mollusk, Crater Lake tightcoil (*Pristoloma articum crateris*), is listed as a survey and manage species in the Northwest Forest Plan (FEIS, 2000; ROD, 2001). Revised management guidelines require equivalent-effort pre-disturbance surveys for this species.

Habitat for this species is defined in broad terms due to the little known information. Mosses and other vegetation near wetlands in conifer forests generally above 2000' and east of Interstate 5 defines the habitat. Surveys have been conducted in Trout Creek swamp (1999). Though no Crater Lake tightcoils were found, two slug species (*Prophysaon andersoni* and *Hesperavion*

niger) and several snail species (Discus spp., Vallonidae spp., *Euconculus fulvus*, Pupillidae spp., and *Nesovitrea electrin)* were found.

TERRESTRIAL SPECIES - PLANTS

There are no Threatened or Endangered plants known to occur in the Late-Successional Reserve, and only one sensitive plant, Newberry's gentian (*Gentiana newberryi*). Peck's penstemon (Penstemon peckii) has been found within one mile of the analysis area, and there is a high likelihood that it occurs within the planning area. The sensitive plant, Green tinged paintbrush (*Castilleja chlorotica*), has been recorded from a historic siting, but has not been relocated and may have been be mapped incorrectly. There are 7 Survey and Manage Plants (Northwest Forest Plan) known to occur: 5 fungi and 2 lichen.

Peck's penstemon (*Penstemon peckii*)

This species represents those that are associated with open canopied pine and dry mixed conifer forests and meadows, fire maintained habitats, seasonally moist areas with high water table or channels. Peck's penstemon functions as an colonizer of bare mineral soil created by disturbance. It may have similar habitat requirements as other fire-adapted species such as fungi, other sensitive vascular plants, and other species found in seasonally wet areas of dry forests.

There are numerous late successional and other species of concern with potential to occur in ponderosa pine forests, see Appendix B.

Photo II-5.

Status. This rare endemic wildflower is classified as "sensitive" on the Regional Forester's Sensitive Plant List. It is only found on approximately 325 square miles centered around Black Butte on the Sisters Ranger District. Most known populations are on National Forest Lands. There are no known populations in the Why-chus Late-Successional Reserve, however, high probability habitat exists associated with floodplains of Squaw, Pole and Trout Creek. A small population is found 1 mile east of the Late-Successional Reserve near Squaw Creek. Any populations found here would be particularly important to the global population because they would represent the southern extent of the range of the plant and may contain important ecotypic variation.

Photo II-5. Peck's Penstemon

Habitat. Peck's penstemon is an indicator of fire maintained habitats, including open canopy patch patterns, meadows, and the integrity of seasonally moist habitats or channels. It is closely associated with pine-dominated, open-canopied forests with early seral understories. Several meadow populations exist. These habitats were historically maintained by a low intensity fire regime. The plant has wide genetic amplitude and can be found persisting in a variety of habitats, including early seral habitats such as plantations, skid trails, and roadsides.

The plant often occurs in high watertable areas or in intermittent and ephemeral stream channels. Populations display a patchy distribution, with greatest concentrations of plants found at lower ends of watersheds on level ground with relatively high water retention. Geomorphologic maps show most population areas are coincident with areas of young outwash, young till or floodplain. This geomorphologic type holds more water than the surrounding areas of andesite and basalt. Peck's penstemon is found primarily on sandy and loamy soils, which are finer textured and retain higher moisture contents through the season. Larsen Soil Types 8 or 10 may often indicate potential habitat.

The Peck's penstemon Conservation Strategy (O'Neil, 1992) identifies the five most important abiotic and biotic variables involved in the plant's viability as abundant moisture, light (required for flowering), abundant pollinators, periodic fire, and flooding (seed dispersal).

Changes to Habitat/Threats

Exclusion of fire from pine and dry mixed conifer forests has reduced potential habitat for the plant. Management Treatment studies have shown that the plant benefits from low intensity prescribed fire with increased flowering and seed production. Disturbance patches of mineral soil created by fire or rodents provide seedling establishment areas.

Severe ground disturbance, can uproot plants and destroy populations. Pogson (1979) observed populations in otherwise contiguous habitat ending at private land boundaries where the soil was severely disturbed. Mowing has been observed to have little effect on flowering plants.

The effects of *timber harvest* on Peck's penstemon were studied in the Lake Creek Monitoring Study. Ingersoll (1993) found the abundance of Peck's penstemon declined significantly between 1980 and 1992 at all harvest sites. The study had no control areas and a period of drought was a confounding factor. No seedlings were found at any site and juveniles were rare, although flowering stems increased. The conclusions state:

> Despite Field's characterization of PEPE as an early seral species well-suited to colonizing open sites, this study provides no evidence that timber harvest, by reducing overstory cover and creating open microsites, stimulates expansion of populations . . . Detrimental effects of soil disturbance or altered hydrology resulting from timber harvest may outweigh any benefits of reduced overstory cover on growth and recruitment of PEPE. Timber harvest dramatically influenced vegetation at all sites, more through its effects on soil than through overstory removal (Ingersoll, 1993).

Noxious weed invasion. Weed populations are spreading into forest areas along major roads and are introduced by vehicles and equipment. Few populations are known from within the LSR but a high potential for introduction and spread exists with activities which open forest canopies, use prescribed fire, and utilize haevy equipment.

Permanent *habitat loss* is of concern because of the finite amount of habitat for this endemic species. This needs to be discussed under project level cumulative effects. Several populations outside the LSR have lost federal protection through land exchanges or have been altered by adjacent gravel mining and others are likely to exchanged at some point in the future. Several large habitat areas on private lands that are housing developments or golf courses (Metolius Meadows, Black Butte Ranch) retain traces of the plants and it can be assumed they supported larger populations, which have been lost. The Conservation Strategy recommends efforts be made in increasing awareness and voluntary protection of the plant on private lands.

Potential Management Conflicts. A potential management conflict is that many other late successional plant species, such as bryophytes, fungi, and lichens, that occupy these same habitats, may have very limited dispersal capabilities and have less ecological amplitude (require more specific habitat conditions) than Peck's penstemon. These species may be restricted to protected micro sites in previously treated stands and be limited in their ability to recolonize areas due to fragmentation of forest habitats, ie. large cleared areas of unsuitable habitat. Managing for fire adapted species such as Peck's penstemon may reduce viability and habitat in remnant populations of these species.

RIPARIAN/ AQUATIC SPECIES - ANIMALS

Cascades Frog

This species represents amphibians associated with mixed conifer and riparian plant associations.

Status: This species is an Oregon State Sensitive Species in the critical category.

Habitat: The most common habitat for this species is small pools adjacent to streams flowing through subalpine meadows. Cascades frogs also inhabit bogs and fens, seasonally flooded forested swamps, small lakes, ponds, and marshy areas adjacent to streams. Down woody debris, grass and shrub cover, and high levels of tree canopy in these aquatic habitats are desirable micro-habitats for this species (Leonard et al. 1993).

Cascades frogs have been sited in all three Management Strategy Areas. Research (OSU 1995??) of habitat structure and occupancy patterns of Cascades frogs in the Three Creeks area show that the shallow ponds/potholes and shallow shorelines may provide warmer water temperatures which is desirable for the development of tadpoles in the area where development time is limited. Emergent vegetation is also important in breeding sites and serve as sources of food and cover in the case of predation. However, in Big Three Creeks Lake, little to no emergent vegetation exists but frogs are known to breed there. In this case, the large rocky substrate may serve the same purpose. This project also showed that the frogs move from site to

site via connecting creeks and that they spent the majority of the summer in these areas. This suggests that long-lasting water supplies throughout the summer are important in both dispersal and movement to and from suitable habitat.

Other areas that Cascades frogs were found in include Twin Meadows, Trout Creek Swamp, along Squaw Creek and a wet meadow in T.15S., R.8E., Section 36. It appears that Trout Creek is an important connective corridor between the wet meadow and Trout Creek Swamp. Connectivity also needs to be maintained between Squaw Creek and Twin Meadows. Frogs can travel over land for long distances to disperse into adjacent areas if conditions are suitable.

Special Considerations: Habitat for the Cascades frog is limited in the Late-Successional Reserve to riparian areas. However, connectivity, characterized by intact riparian reserves that can maintain moisture for most of the year (includes denser overhead canopy, down woody debris, and shrubs and forbs) should be maintained to provide adequate dispersal corridors across the Late-Successional Reserve. Communication with Oregon Department of Fish and Wildlife should be initiated to discuss fish stocking in the Three Creeks area and whether we can limit stocking to one area (Big Three Creeks lake). Consideration should be given to close the road south of Twin Meadows (630 spur) as this is a seasonal wet area and vehicular traffic is destroying Cascades frog habitat. The road may not be shown accurately on the map.

Long-toed Salamander

This species represents amphibians associated with mixed conifer and riparian plant associations.

Status: No special status

Habitat: Three Creeks Management Strategy Area hosts a unique morph of the long-toed salamander which grows a different type of skull and jaw structure under certain circumstances and becomes cannibalistic. One pond, in particular, in the Three Creeks Management Strategy Area is especially important as it is the primary breeding pond for this species. This pond is located off forest road 1600-370, adjacent to an area very popular for dispersed camping. Surveys have not been conducted in other parts of the Late-Successional Reserve for this species so its unknown if it occurs elsewhere.

Habitat for this species is varied including semi-arid sagebrush desert, dry woodlands, humid forests, and alpine meadows. It lives under bark and rocks near ponds, lakes, and streams. It retreats underground during hot, dry, or cold weather (Csuit et al. 1997). These salamanders lay their eggs in water and attach them to fine stems, leaves, or pebbles in water less than 0.5 meters. Hatchlings and larvae live in surface sediments or under rotting leaves, logs, or rocks in shallow water. Juveniles can be found under rocks at edges of ponds in mid summer. Adults stay underground, and may be found under rocks and logs during the rainy season (Cockran and Thoms 1996).

Special Considerations: Habitat for long-toed salamanders is very limited in the Late-Successional Reserve. Special attention should be given to riparian areas in the Three Creeks Management Strategy Area where this species is known to occur. Connectivity should be maintained along riparian corridors to provide adequate dispersal corridors across the Management Strategy Area. It is recommended that a management plan be developed for the

Three Creeks Management Strategy Area to address recreation pressure on sensitive habitats and devise a strategy to maintain down woody material along riparian areas as well as provide firewood. Initiate communication with Oregon Department of Fish and Wildlife to discuss fish stocking and whether stocking can be limited to just the main Three Creeks lake.

RIPARIAN/ AQUATIC SPECIES - PLANTS

Lichen Group

- *Cladonia norvegica*
- *Caliciales sp.*

These species represent those associated with riparian and moist, late successional forests. Lichens are important as food, shelter, and nesting material for wildlife, including invertebrates. Lichens also play a role in mineral and nutrient cycling, several of these species are nitrogen fixers These species may have similar habitat requirements as other rare lichen species and forest invertebrates.

Cladonia norvegica is known from 1 other site on Sisters, but no here else on the Deschutes National Forest.

Caliciales sp. have been found on 5 sites in Bend, 3 sites on Crescent, and 2 other sites on Sisters.

Three lichen species recently removed from the list of survey and manage species, but which are know to occur on the Sisters Ranger District of the Deschutes National Forest are *Lobaria pulmonaria* , *Peltigera collina*, and *Pseudocyphellaria anomala*

There are numerous late successional and other species of concern with potential to occur in forested riparian areas, see Table 2. Forested riparian habitats are the highest probability habitat for most rare lichens, bryophytes, some fungi, and many sensitive vascular plants.

Habitat. Specific habitat requirements are not well understood but in general they are found in late-successional forests in areas with sheltered microsites, complex canopy structure, leaning tree boles, increased humidity and sometimes the presence of hardwoods. The known populations are largely associated with rocks, rotting wood, and snags in moist riparian habitats. Potential habitat for rotting wood lichen species is more likely in riparian areas with abundant down wood material (McCune and Geiser, 1997). Other potential habitats include large old Black Cottonwood trees and other old trees in riparian areas. *Lobaria pulmonaria* appear to have a strong association with black cottonwood trees although they also occur on other tree species growing near the canopy of black cottonwoods. In eastside watersheds black cottonwood are found mainly in riparian areas, drainages, high watertable areas, or floodplains.

Changes to Habitat/Threats. Many moist forest habitats have been altered by harvest, which reduces shading and warms and dries microclimates. Thinning of riparian areas can also alter stand microclimates. Lichen species may disperse only over small distances (e.g. 6 feet). Fragmentation within riparian habitats may affect lichen dispersal to suitable adjacent habitats, since they are known to be dispersal limited. Some species may be restricted to remnant habitats. Some cottonwood sites are maintained by beavers, so reduced numbers of beaver may be limiting

the establishment of new potential habitats. Several of these species are known to be nitrogen fixing lichens sensitive to air pollution.

Newberry's Gentian (*Gentiana newberryi*)

This species represents those associated with high elevation wet or moist meadow habitat. Meadows are naturally rare on the landscape and often are hot spots of biological diversity. These habitats are associated with and influenced by surrounding late successional habitats. May have similar habitat requirements as other late successional and species of concern such as rare sedges, rare vascular plants, and fungi.

Status. Newberry's Gentian is classified as "sensitive" on the Regional Foresters Sensitive Plant List. Trapper Meadow, Little Three Creeks, Three Creeks Meadow, and the unnamed "salamander pond" are the northern-most occurring population of Newberry's gentian on the Deschutes National Forest. The species is a regional endemic found in Oregon and California

Habitat. Newberry's gentian is found in mesic to moderately well drained meadows or mesic grassy borders adjacent to streams and lakes. It is not found in boggy areas. The lesser bladderwort is found in shallow or standing water of meadows or bogs.

Changes to Habitat/Threats: Many meadow habitats have altered hydrological regimes because they were channelized and drained to facilitate cattle grazing and increase waterflows downstream. Grazing changed species composition. Managers sometimes introduced non-native species such as Kentucky bluegrass or reed canary grass to increase forage potential and accidentally introduced noxious weeds. Meadows are favorite recreational areas for camping and vulnerable to off road vehicle use. Flower picking is a problem in the Three Creeks area. Excessive use can cause trampling and devegetation and changed species composition. Some meadows were kept more open by periodic fires and are now being invaded by trees.

Rare Fungi Group (this group may change when we get specific locations)

- *Elaphomyces subviscidus*
- *Helvella crassitunicata*
- *Nivatogastrium nubigenum*
- *Rhizopogon flavofibrillosus*
- *Rhizopogon evadens var.subalpinus*

These species represent those associated with late successional high elevation or lodgepole forests. *Elaphomyces subviscidus* and both *Rhizopogon* species may form symbiotic, mutually beneficiual relationshiops with trees, providing nutrients and water. *Helvella crassitunicata* is a presumed saprophyte or mycorrhiza-former. *Nivatogastrium nubigenum* is a saprophyte that associates with roots of Abies logs. All species are presumed dependent on mycophagy (consumption of fungi by animals) for dispersal of spores. *Helvella crassitunicata* may also

depend on wind or arthropods for spore dispersal. Other late successional and species of concern may have similar habitat requirements such as other rare fungi and rare vascular plants.

Status. The siting for *Elaphomyces subviscidus* is 1 of only 2 sites known from within the range of the spotted owl.

Helvella crassitunicata is an Oregon/Washington endemic, known from 20 sites in owl range, and this is the only site on the Deschutes National Forest. This site is a disjunct population identified by management recommendations where it is particularly important to maintain population viability.

Nivatogastrium nubigenum is an Oregon/Washington endemic, known from 13 sites in owl range and this is one of 3 sites on the Deschutes. Management recommendations identify the Deschutes sites as particularly important because they are on the edge of the taxons range.

Rhizopogon flavofibrillosus was reported to occur at Three Creeks lake in Appendix J2 of the Northwest Forest Plan. It is not reported from later documents and it is unclear whether it exists in the area or was mistakenly omitted. There are 6 known sites within owl range.

Rhizopogon evadens var.subalpinus is one of 15 known sites in owl range and this is one of 2 sites on the Deschutes.

Habitat. All species are found in forested habitats and are associated with various tree species. See Castellano & O'Dell 1997 for more information.

Changes to Habitat/Threats. *Elaphomyces, Nivatogastrium, Rhizopogon* sp. –These species are at risk from activities that remove mycorrhizal or saprophytic tree hosts or disturb soil. Of concern are actions that disrupt stand conditions, particularly those which damage host tees and soil occupied by host tree roots. Logging that removes host trees is reported as the most serious threat. Soil disturbing activities include road, trail, and campground construction. Fires that destroy host trees are also a potential threat, depending on fire severity. Saprophytic fungi are also affected by removal of large woody debris (Castellano & O'Dell 1997).

Data needs. Data are lacking regarding specific response of these taxa to management practices, especially logging, road and trail construction, prescribed fire, and collection of special forest products. Basic ecological information on the species reproductive biology, population structure and other relationships is also lacking.

Other Locally Rare Riparian Plants

An unusual assemblage of small carnivorous plants are found in the swamps and wet meadows (Trout Creek Swamp, Alder Creek Bog, and UpperAlder Creek/Trout Creek interface) of the Late-Successional Reserve. These species, including round-leaved sundews, great sundews, lesser bladderworts, and flat-leaved bladderworts, are uncommon and are only known to occur in the Late-Successional Reserve on the Sisters Ranger District.

Changes to Habitat/Threats – These species are sensitive to changes in moisture and can benefit from stable hydrology in the meadows and swamps. The other primary risks are from disturbance (either vehicles, horses or pedestrians in their habitat) and from invasion of noxious weeds. Reed

canary grass is present and expanding at Trout Creek Swamp, and competes with these rare plants.

EXTIRPATED AND LOCALLY EXTINCT SPECIES

Animals. Wolves, grizzly bears, white-tailed deer, and pronghorn antelope may have occupied portions of the watershed in the recent past. Wolves were occasionally seen in the late 1800's (Williams 1992). Jesse Scott, a trapper from Sisters reported seeing a wolf in 1926 near Big Lake (Wilson and Scott 1976), local resident Jess Edgington saw one near Sisters in the 1930's.

Grizzly bears disappeared from Oregon about 1933 (Ingles 1965). Judge Waldo reported seeing one at the base of Mt. Jefferson, several miles north of this area in 1881 (Williams 1992).

White-tailed deer were reported by several trappers and explorers in the 1800's and as recent as 1915 in willow areas in the Metolius and Deschutes Basins (Bailey 1936, Thomas 1873). Most of these habitats were lost to agriculture, livestock grazing, and possible from the loss of beaver trapping.

There are several reports of pronghorn antelope using portions of the Deschutes basin and the Deschutes National Forest in the early 1900's (Bailey 1936). Competition with grazing, conversion of grasslands to shrublands, and hunting has reduced their numbers and distribution.

Although not extirpated, there is some evidence that mountain goats may have occupied habitats in the high Cascades in Oregon. It is assumed they did because John Merriam discovered bones on Mt. Shasta in California. For goats to have gotten that far south of the Canadian and Washington Cascades, where they are known to inhabit, they would have had to use the Cascades of Oregon (Bailey 1936).

Plants. There is no information about late successional plant species that have been extirpated from the Late-Successional Reserve.

EXOTIC SPECIES.

Noxious weeds such as diffuse knapweed and dalmation toadflax are found in low levels scattered along roads in the LSR. Weed populations from adjacent lands closer to population areas are slowly expanding into the Late-Successional Reserve (Rd 16, Rd 15, McKenzie Highway), continuing control efforts are critical. Management activities that open stands, such as thinning and prescribed fire, have a risk of creating more habitats for weed invasion.

Invasive non-native weeds, such as Reed canary grass (Trout Creek Swamp) and noxious weeds like Bull Thistle (Twin Meadows), complicate meadow and wetland restoration.

D. SOIL AND HYDROLOGY OVERVIEW

Current Condition

The Why-chus Late-Successional Reserve Assessment area occurs on a volcanic landscape shaped by glaciation and repeated volcanic activity. The landscape formed on the rocky slopes of large shield and composite volcanoes to the west. Larger glaciers once covered slopes within the Why-chus Late-Successional Reserve. Geology in this Late-Successional Reserve consists of ash soils over areas of glacial till or glacial outwash and other areas of ash soil directly over volcanic rock. There are two volcanic cones in the Late-Successional Reserve, Trout Creek Butte and Black Crater.

Due to the relatively young geologic age of most surfaces in the Late-Successional Reserve, soil development is limited to soil horizons with low amounts of organic material and weathered minerals. Due to their inherent porosity, these soils are not normally prone to water erosion except along steep slopes. However, actions that result in soil compaction may make these soils more prone to surface erosion. See Why-chus Watershed Assessment (1998, pp. 11-43) for more details on Soils and Hydrology.

Precipitation in the Late-Successional Reserve ranges from 60 inches in the higher elevations down to 30 inches at lower elevations. All surface and ground water in the watershed is from precipitation. Basalt bedrock and glacial till, both above and below the Sand Mountain ash deposit, influence water flow in the area. Glacial till acts as a barrier to water that has infiltrated into the ash soil above. Precipitation drains into the ash soil and is perched by the till causing it to move down slope laterally through the soil profile. Soil mottles that indicate seasonal wetness can be found in some ash till soil layers.

The primary streams in the Late-Successional Reserve are Squaw Creek, with the largest and flashiest flow, Trout Creek, Pole Creek and Three Creeks. Stream flows depend on combinations of snow melt, springs or lake release, and are also influenced by riparian meadows. There is a history of diverting water from the Why-chus Watershed for irrigation and grazing. A series of old ditches and diversions, in combination with an extensive road system, have altered the hydrologic regime, including draining of meadows (particularly affected was Trout Creek Swamp) and diversions of stream channels (e.g. Pole Creek historically was a tributary of Squaw Creek, but a diversion has altered its course). About 432 acres (3%) of the Late-Successional Reserve are classified as water, riparian or meadow.

Overland flow is limited due to the nature of the porous soils. As such, the influences of human-caused and natural openings may not be as significant a processes in this watershed as they would be in a watershed without porous soils (Why-chus Watershed Analysis, 1998). There is debate whether the measure of cumulative harvest acres (CHA) is an appropriate indicator of watershed effects from created openings. These openings may increase ground water flow, which may increase in-channel flow and thus in-channel erosion.

The section of Squaw Creek that flows through the Late-Successional Reserve has been Congressionally designated as a Wild and Scenic River. Neither a resource assessment nor

management plan have been completed. Both Squaw Creek (Tier 1) and Three Creeks (Tier 2) Watersheds are identified as Key Watersheds under the Northwest Forest Plan.

Risks and Threats to Soil

Existing condition of the soil resource within the analysis boundary has been influenced by past management activities such as harvest and road building. Recent harvest activities have included salvage, harvest by clear-cut, and uneven-age management prescriptions. Recent management operations have used primarily mechanized harvest and yarding systems. In areas of more complete harvest treatments much of the fuels were treated post harvest by machine piling; regeneration units were planted both by machine and hand planting. In these harvest units, varying degrees of soil compaction, displacement, and other soil impacts have been observed.

Detrimental soil impacts are impacts to the ground that cause the soil quality to be adversely impacted. Region 6 Soil Quality Standards are found in the Forest Service Manual, FSM 2521.1 and provide definitions for detrimental soil compaction, puddling, displacement, burn intensity, and erosion. Table II-22 is an estimate of the amount of detrimental soil impacts in the watershed and was generated using several GIS layers to make assumptions based on different activities. In summary, 87% of the Late-Successional Reserve has less than 20% detrimental soil (Figure II-16). However, the majority soils are considered sensitive and are vulnerable to the impacts listed above.

Table II-22: Existing soil condition in the watershed.

Soil Condition Class	% of Late-Successional Reserve
0-10%detrimental	75
11-20% detrimental	12
21-40% detrimental	13
>40% detrimental	0

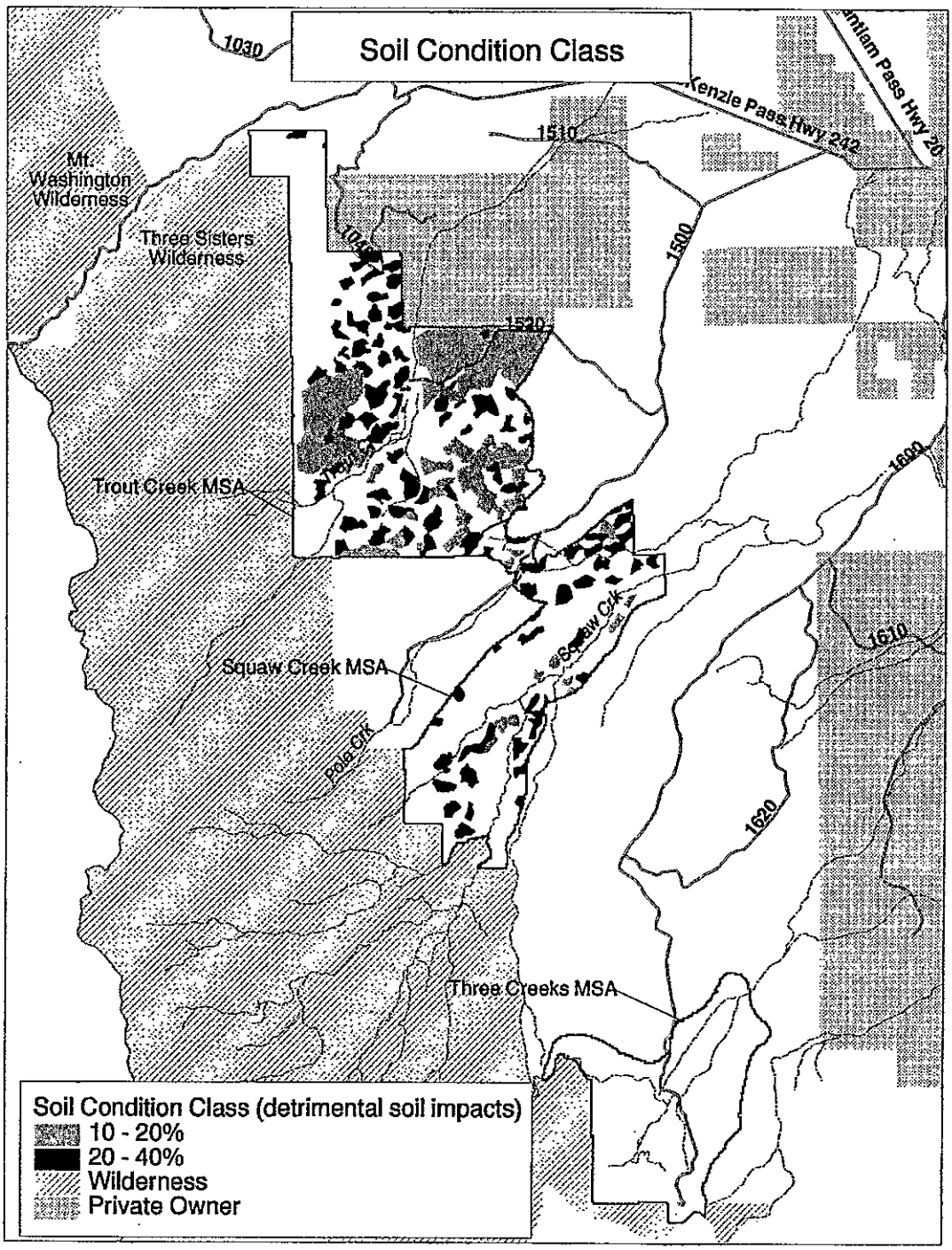
Several trends were identified in the Why-chus Watershed Analysis which identify risk to soil and water resources. These include an "increase in detrimental soil impacts, mainly detrimental soil compaction", an "increase run-off due to roads and decreased road maintenance" and an "increase in road densities".

Soil erosion. Soils in the Late-Successional Reserve have low bulk densities, low organic carbon, and soil chemical properties unique to volcanic ash materials. Though these soils are normally not prone to water erosion, management induced changes such as roads, skid trails and landings associated with timber management may alter infiltration and increase surface erosion.

Soil compaction sensitivity. The Deschutes Forest has a variety of different soil parent materials due to different volcanic eruptions and resulting ash, pumice and cinder deposits. The dominant soil parent material in the Why-chus LSR is a deposit referred to as Sand Mountain Ash. Of the different parent materials evaluated for sensitivity to soil compaction by ground based harvest

equipment (Craigg 2000), Sand Mountain Ash was found to be the most sensitive making it at high risk for becoming compacted in harvest operations.

Figure II-16. Soil Condition Class



Risks and Threats to Water

The risks to hydrology, water quality and fish habitat are primarily from 1) ditches, diversions and impoundments; 2) recreation and roads, 3) and timber harvest. Squaw Creek is listed under section 303(d) of the Clean Water Act as water quality limited for temperature and flow modification from Alder Spring to the mouth. Even though the upper stream section within the Late-Successional Reserve is not listed, management of this upper section can affect the lower, reaches.

Flow in Three Creek is controlled by an irrigation dam built on Three Creek Lake. The dam is in poor condition and will require major renovation to make it safe. The meadows below the dam have been ditched in some locations and this has changed the hydrological function of the area.

Recreation use in the Three Creeks area is very high and there is considerable damage to the streambanks from horses. Trampling of the banks has caused erosion, changed the character of the stream, and increased width/depth ratios. The increase in recreational use combined with the fragile high elevation ecosystem could pose a risk to the future hydrological function of the meadow systems. Erosion from roads is entering the stream system at several locations..

Roads, recreation, and timber harvest, are the main human caused mechanisms of hydrological change within the Squaw Creek portion of the Late-Successional Reserve.

Trout Creek is at risk from roads and dewatering of Trout Creek Swamp. The threat of catastrophic fire is a risk to the watershed as is the increasing recreational use of the area.

Undersized culverts in the stream systems of Three Creeks and Trout Creek have been identified as fish passage barriers.

Riparian Reserves

Riparian reserves are designed to best meet the ACS objectives and to provide habitat connectivity for terrestrial and late successional species.

Riparian Reserve boundaries have been recommended by the Why-chus Watershed analysis (pg. 155) as follows:

- Permanent streams with fish, natural ponds and lakes.....300 ft
- Wetlands, intermittent streams, permanent streams without fish.....150 ft
- Created ponds and reservoirs.....150 ft

These widths are based on site-potential tree heights as specified in the NW Forest Plan ROD C-30, and may be adjusted during site specific project analysis where rationale for appropriate widths is presented in the decision making process (ROD, B-13 - B-17). Special features to be included in the riparian reserves are: floodplains, riparian vegetation, unstable areas, habitat connectivity corridors, inner gorge or terrace and aggregations of special features. Riparian reserves may be expanded to include these special features.

E. HISTORY AND DESCRIPTION OF CURRENT LAND USES

This section summaries the historic and current human uses in the Late-Successional Reserve, and is tiered to the Why-chus Watershed Analysis. Refer to the Watershed Analysis, pages 159-184, for more details.

Settlement

Native Americans traveled through and occupied areas within the Why-chus Watershed for thousands of years. The water and fishery (which was historically anadromous) in Squaw Creek, and native food plants, such as huckleberries, were important values that attracted early cultures to the area.

European Settlement is summarized in the Why-chus Watershed Analysis:

> The town of Sisters was started from soldiers building nearby Camp Polk in 1865. By the 1870's, the area was more settled and the first water diversions were being built for irrigation. In the early 20th century, the town of Sisters grew and the nearby area saw an increase in farming, timber cutting, grazing of sheep and cattle, and water diversion for irrigation. By the 1920's, roads, trails and irrigation ditches crossed most of the watershed and both communities and scattered houses dotted the landscape. More people came into the area with the completion of Santiam Pass in 1938. By the 1940's, railroad logging and pushed from Bend into the area and beyond (pg. 164).

There is no record of long-term settlements (either Native American or European) within the Late-Successional Reserve, though there was likely short-term and seasonal occupation.

The community of Sisters is currently a rapidly growing area with both year-round and seasonal residents. An increase in recreation use by both locals and visitors in the Late-Successional Reserve is expected to continue as the popularity of Sisters and Central Oregon grow as state and Region tourist destinations.

Recreation Facilities and Activities

Recreation use ranges from heavy to light in different parts of the Late-Successional Reserve. The most popular recreation destination is the Three Creeks Lakes area. The lakes, campgrounds and trails receive heavy use during a relatively short summer (snow-free) season, and area snowmobile and cross-country ski trails receive heavy use during the winter. In the Deschutes LRMP, this area has been designated as Intensive Recreation around the lake and campgrounds, and Dispersed Recreation in the surrounding areas.

Following is a list of the recreation facilities and uses in the Late-Successional Reserve:

<u>Campgrounds</u>

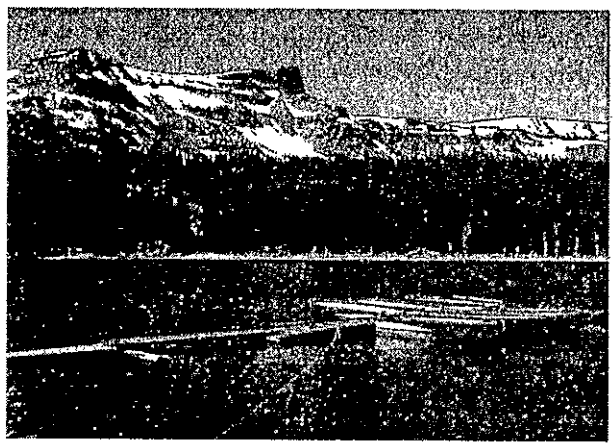
- Three Creeks Lake
- Three Creeks Meadow and Horse Camp

- Driftwood
- Whispering Pines

Trails and Trailheads

- Little Three Creeks Lake Trail and Trailhead
- Windigo-Metolius Trail
- Cross District Snowmobile Trail
- Snow Creek Nordic Trail
- Tam-McArthur Rim Trailhead
- Squaw Creek Falls Trailhead
- Park Meadow Trailhead

Photo II-6. Three Creeks Lake



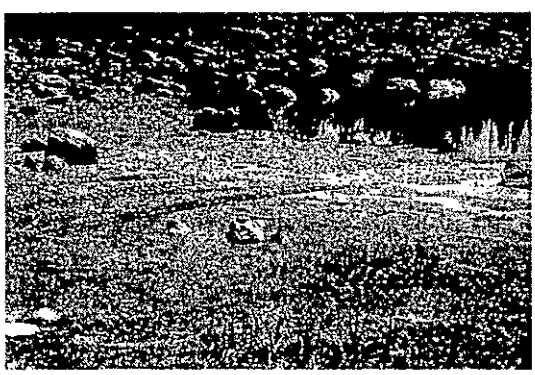
Dispersed Recreation Use Areas

- Along Squaw Creek
- Hiking, lake fishing, biking, driving for pleasure, sightseeing, picnicking, gathering forest products during the snow-free seasons, hunting in the fall, and snowmobiling and cross-country skiing in the winter. Most of these uses occur on established roads or trails, and relatively close to forest roads.

Recreation Special Uses

- Three Creeks Store, at Three Creeks Lake
- Winter Outfitter and Guide use along snowmobile trails into the Three Creeks Management Strategy Area
- Permit for outdoor education activities in the Trout Creek Management Strategy Area

Photo II-7. OHV tracks through salamander pond



Potential Risks/ Threats. Many components of the Three Creeks ecosystem (meadows, shallow lakes, thin soils, fragile alpine vegetation) are sensitive to impacts. There is evidence of resource impacts from concentrated recreation use in Three Creeks Lake area, primarily trampling of riparian vegetation and disturbance of riparian habitat. Observations indicate use of off-highway vehicles in the shallow, seasonal ponds in the area, which are important habitat for the rare long-toed salamander. There is also a decrease in the amount of down wood around recreation sites.

Stocking of game fish by Oregon Department of Fish and Wildlife in Three Creek and Little Three Creek lakes may have several impacts. The first is the continued attraction of high concentrations of anglers immediately following stocking, which has resulted in visitors parking vehicles off existing roads and potentially impacting amphibian habitat. The second potential impact is predation by stocked fish on local amphibians.

Recent management actions, such as stock tanks and corrals in the horse camps, have reduced impacts from horses in the riparian areas and in the meadows.

Recreation use outside of Three Creeks Management Strategy Area is not felt to impact late-successional habitat or species, except for small, localized sites along Squaw Creek (impacts to riparian vegetation and sediment into the creek).

The last potential conflict between recreation and Late-Successional Reserve objectives is the occurrence of intensive recreation, particularly within the Three Creek Management Strategy Area, within the Three Creek Lynx Analysis Unit. Management options for controlling visitor behavior and travel patterns, in order to reduce impacts on sensitive riparian and meadow habitats, may be in conflict with Project Design Criteria for the Lynx. Coordinate with the US Fish and Wildlife Service to determine acceptable actions.

Inventoried Roadless Areas and Wilderness

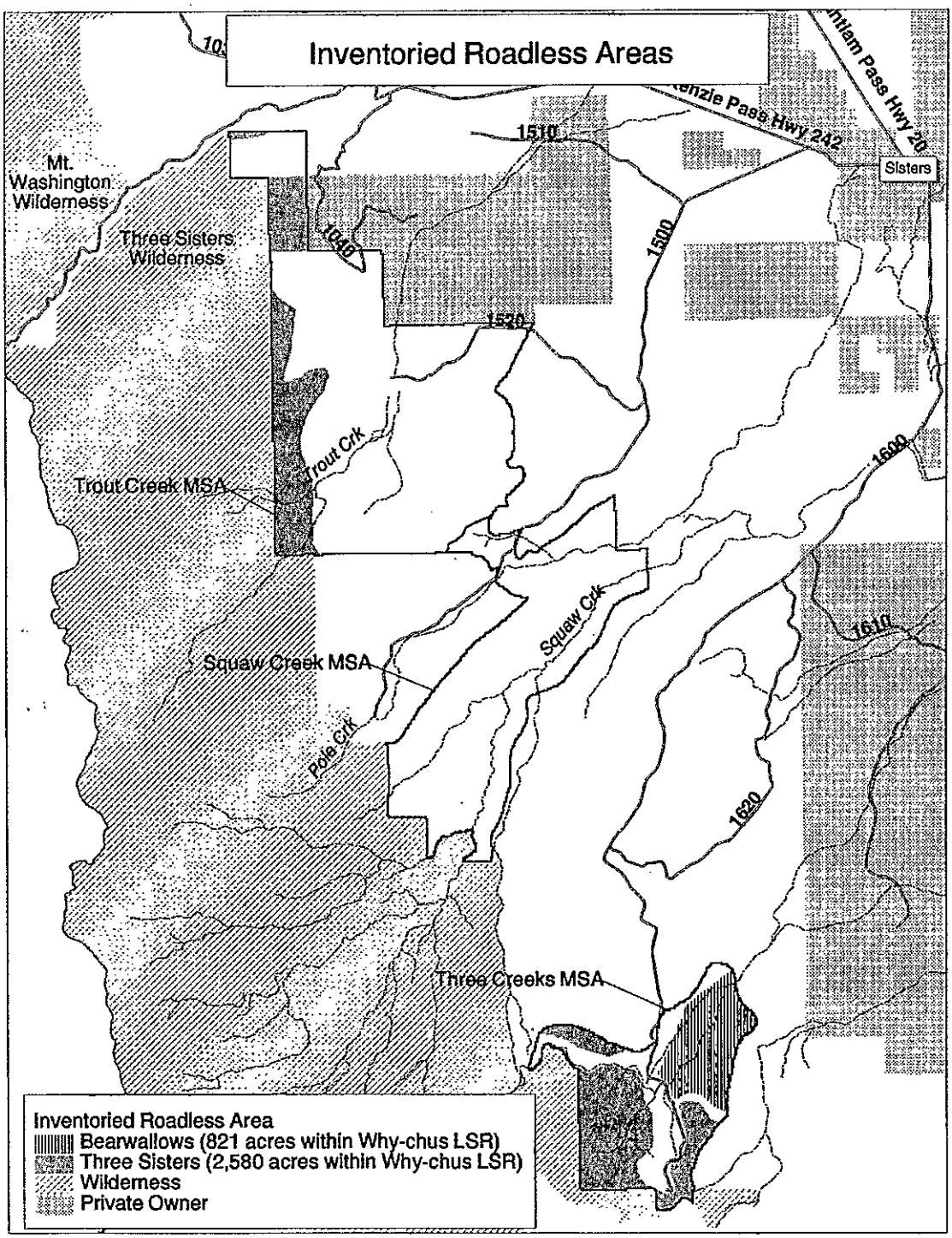
The Why-chus Late-Successional Reserve is bordered on the west and south by the Three Sisters Wilderness. There are approximately 7 parcels of inventoried roadless areas (portions of the Three Sisters and Bear Wallow Roadless Areas) within the Late-Successional Reserve, all which extend from the wilderness (Figure II-17).

Roads

There are 105.7 miles of roads in the Late-Successional Reserve, with a road density of 4.5 miles per square mile. Most of the transportation system was developed to access timber, to provide fire protection, and to access recreation destinations. Now, the roads themselves are a popular recreation resource. Maintenance is low on most secondary roads.

Potential Risks/Threats. Wisdom and colleagues (1999) documented 13 potential road-associated effects on wildlife habitat populations and habitats, including habitat loss and fragmentation, harassment of disturbance at specific use sites, negative edge effects, collisions, movement barrier, and displacement or avoidance. The road system may also contribute negative affects to water quality in the Late-Successional Reserve from sedimentation and alterations of stream channels.

Figure II-17. Inventoried Roadless Areas



Consumptive Uses

Timber

- 6,564 acres harvested (2,187 acres as regeneration, 4,377 as intermediate harvest)
- The 2,187 acres of plantations range in age up to 25 years old, though the majority are around 15 years old (1985). Most are scheduled to receive routine maintenance (animal damage control or thinning)

Historically the Late-Successional Reserve was part of the Central Oregon's "timber basket", particularly for ponderosa pine. The majority of timber harvest within the Late-Successional Reserve began after WWII (1947), and peaked in the 1970s and 1980s.

Potential Risks/Threats. The extensive road system created to access timber stands, and the harvest openings (plantations) fragment forest habitat and remove late-successional elements (e.g. large trees, down wood). See discussion of "Roads" above for potential affects of roads.

Grazing. There are no active allotments, though there was probably historic sheep grazing, as there was across much of the Sisters Ranger District.

Irrigation and Water Developments

- Snow Creek Ditch is an historic (inactive) water diversion off of Snow Creek. The abandoned ditch does not affect late-successional habitat.
- Impoundments on Little Three Creeks Lake and Three Creeks Lake (neither is under a special use permit). Historically water was diverted from Little Three Creeks to Three Creeks Lake. There is a private water right for water from Three Creeks, and water is diverted from Three Creeks just north of forest road 1628-600.
- Trout Creek Swamp was historically ditched and drained to create grazing land, and for irrigation of agricultural lands down stream. Lodgepole pine is encroaching into the swamp. The swamp is proposed for restoration in 2001 (see Chpater IV, Potential Management Options).

Potential Risks/Threats. Diversions and impoundments can create drier conditions along down-stream riparian areas and meadows, and reduce habitat effectiveness for meadow, riparian and aquatic associated species, including redband trout, amphibians, and great gray owl.

Mining

Geothermal

Though there was extensive exploration in 1980s, most leases have expired, though may be reopened with new applications. Development will depend on changes in future market demand.

Potential Risks/Threat. None currently

Gravel and Cinder

Squaw Creek Rock Quarry is the only quarry or pit located within Late-Successional Reserve boundary.

Potential Risks/Threat. Localized removal of late-successional elements if the quarry is expanded. The opening also contributes to habitat fragmentation.

Miscellaneous

Trout Butte Lookout – There is an inactive lookout located on the top of Trout Creek Butte. The access road is gated to prevent vandalism at the lookout (though the gate does not seem to be effective)

Potential Risks/Threats. None.

Range – There is a vacant allotment in the Squaw Creek Management Strategy Area, which was historically grazed by both sheep and cattle. The Forest proposes to close this allotment, but this proposal has not yet been analyzed

Private Lands. None.

F. MANAGEMENT STRATEGY AREAS

Three Management Strategy Areas (Figure II-18) were delineated based on common plant association groups (influenced by landforms and soils), known spotted owl and other late-successional focal species habitats, and common fire management strategies.

While the Management Strategy Areas have been identified as separate areas, they are linked to each other, and to adjacent habitats outside the Late-Successional Reserve, by ecological processes. Activities within these areas should consider the overall impacts to adjacent Management Strategy Areas and other lands outside the Late-Successional Reserve.

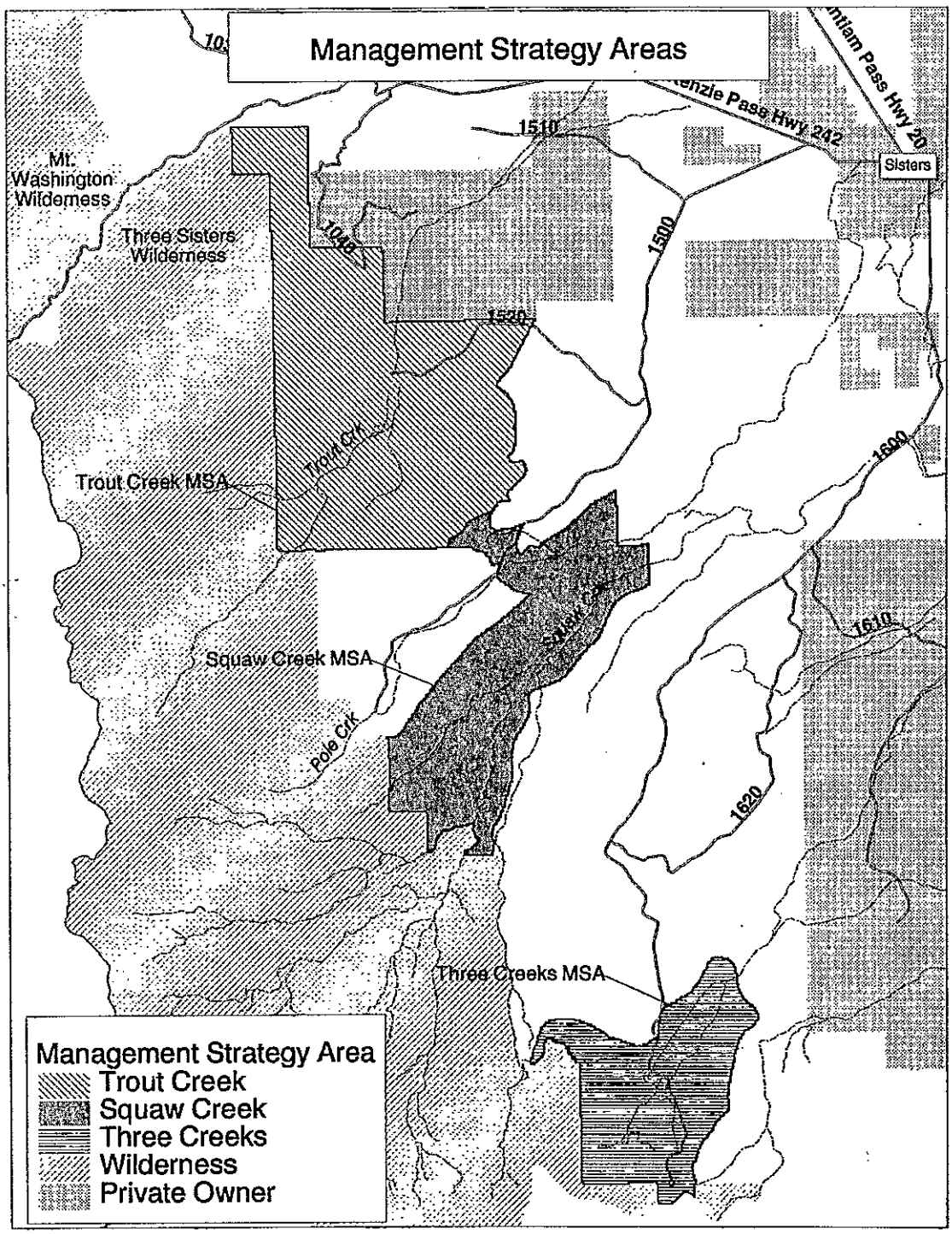
For objectives specific to each of the Management Strategy Areas, refer to Chapter III. For discussion of possible management actions within the Management Strategy Areas, refer to Chapter IV.

Table II-23. Summary of Forest Vegetation Characteristics by Management Strategy Area

Vegetation Characteristics	Percent of Trout Creek MSA	Percent of Squaw Creek MSA	Percent of Three Creeks MSA	PERCENT of LSR
Plant Association Group				
- Ponderosa Pine	0	2	0	<1
- Wet Mixed Conifer	43	40	6	35
- Dry Mixed Conifer	47	56	1	39
- Mountain hemlock	3	0	26	8
- Lodgepole	5	1	62	15
- Wetland meadows, riparian	0	1	1	2
Size Class				
- Seed/ sapling	17	10	2	4
- Pole	7	12	6	12
- Small	58	47	85	44
- Medium/large	18	29	4	8
Current Acres classified as "Possible Old Growth"[2]	25	35	58	35

[2] See definition and discussion of Possible Old Growth, pg. II-28

Figure II-18. Management Strategy Areas



TROUT CREEK MANAGEMENT STRATEGY AREA

Size: 7,576 acres

Location: northern 1/3 of Late-Successional Reserve, just south of Cache Late-Successional Reserve.

Physical Features: Includes portions of two large cinder cones, Trout Creek Butte and Black Crater. Primary water features include Trout Creek, a perennial stream, Trout Creek Swamp, and Black Crater Lake. The Management Strategy Area is bordered by Matrix lands to the south and east and the Three Sisters Wilderness to the west. It contains a portion of an Inventoried Roadless Area, Sisters 6192 - Three Sisters. Elevations range from 5,600 feet down to 4,600 feet.

Insect and Disease Condition – There was defoliation (north portion) in the late 1980's from a spruce budworm outbreak. Endemic levels of other insect and disease agents exist throughout the Management Strategy Area. Mortality is relatively low, except scattered pockets of low to moderate mortality in the northern part of the Management Strategy Area.

Fire Hazard and Risk

- *Trend:* 7 fires in the last 16 years (5 started by lightning, 2 human caused).
- Rating:
    - West half of Management Strategy Area – High Hazard, High Risk and High Intensity.
    - East half of Management Strategy Area – High Hazard, Moderate Risk, Moderate Intensity

Focal Late-Successional Species

Table II-24. Focal Species for Trout Creek Management Strategy Area

Terrestrial Species	Habitat and Occurrence
Northern spotted owl	This Management Strategy Area contains the most nesting, roosting, and foraging habitat for the spotted owl within the Why-chus Late-Successional Reserve, and one known nest site. The home ranges for the nesting pair, and a small portion for a pair to the north of the Late-Successional Reserve, are within this Management Strategy Area.
Northern goshawk	Potential habitat and moderate to high probability of occurrence throughout the area. One known nest site.
Great gray owl	Limited habitat adjacent to riparian meadows; probability of occurrence moderate. Incidental sitings.
Snag & Dead Wood Associated Species	Pileated woodpeckers, black-backed woodpeckers, Vaux's swift's and other cavity excavating/nesting species, have a high probability of occurrence throughout area.
Lynx, Wolverine	High probability of wolverine occurrence. Moderate probability of lynx occurrence; no known sitings.
Peck's penstemon	Populations are found in the lower portions of the Trout Creek

Terrestrial Species	Habitat and Occurrence
	drainage and have a moderate probability of occurring here in floodplains and subirrigated areas.
Riparian/Aquatic Species	**Habitat and Occurrence**
Lichens	Several rare (survey and manage) lichens have been reported to occur in the Trout Creek area or within the watershed, including *Lobaria pulmonaria, Lobaria halli, Pseudocyphellaria anomala, Pseudocyphellaria anthrapsis, Cladonia norvegica*, and *Calcium* species.
Cascade Frogs	Moderate probability of occurrence in Trout Creek. Found in Trout Creek Swamp.

Noxious Weed Conditions - High probability for occurrence for tansy ragwort, knapweeds, and thistle because of horse use, and vehicle use on roads and in timber sale areas.

Social Context

Primary Uses: Recreation – low to moderate

- Developed Facilities - Whispering Pines Horse Camp; Millican Crater and Scott Pass Trailheads.
- Dispersed Recreation Attractions - Black Crater Lake (light to moderate angling and dispersed camping use, mostly by local residents) and seasonal deer hunting camps (mostly near Trout Creek).
- Driving for pleasure occurs mostly along Road 1018 and 1520. The area has 61 miles of roads, an average of 5.18 miles of road per square mile.

SQUAW CREEK MANAGEMENT STRATEGY AREA

Size: 4,284 acres

Location: middle 1/3 of Late-Successional Reserve, south of Trout Creek Management Strategy Area, and north of Three Creeks Management Strategy Area.

Physical Features: Bordered by matrix lands except for wilderness to the southwest. Primary water features include a portion of Squaw Creek Wild and Scenic River (a Resource Assessment or Management Plan have not been completed at this date), Pole Creek and Twin Meadows. Elevations range from 4,000 to 5,400 feet.

Insect and Disease Condition - Stands infected by dwarf mistletoe dominate 38% of the MSA (1,645 acres). Stands weakened by mistletoe are vulnerable to other insects and diseases such as bark beetles or root rots. Mortality is relatively low.

Fire Hazard and Risk

- *Trend*: 1 human caused in past 16 years
- *Rating*: High Hazard, Moderate Risk, High Intensity. High density and contiguous shrub fields in this MSA.

Focal Late-Successional Species

Table II-25. Focal Species for Squaw Creek Management Strategy Area

Terrestrial Species	Habitat and Occurrence
White-headed woodpecker	High probability of occurrence. Extensive suitable habitat.
Goshawk	Minor amount of suitable habitat existing. Known occurrence – 1 known nest site
Northern spotted owl	No owls are known to nest in this area. A small portion of nesting, roosting, and foraging habitat is contained on the southwest portion of this Management Strategy Area. This habitat is the southern most extent of nesting, roosting, foraging habitat on the Sisters Ranger District and connects to a large block of unfragmented wilderness. The Cascade Mountain Range and lack of nesting, roosting, and foraging habitat at higher elevations creates a barrier for owls trying to disperse to the south and west. This area is not within a designated Critical Habitat Unit.
Great Gray Owl	One historic siting. Low to moderate probability of occurrence. Suitable habitat low, other than Twin Meadow.
Lynx	Low probability of occurrence. No know sitings.
Peck's penstemon	Moderate probability of occurrence. Populations are found in the lower portions of the Squaw Creek drainage and have a moderate probability of occurring here in floodplains and

Terrestrial Species	Habitat and Occurrence
	irrigated areas. The nearest population is 1 mile east of the Management Strategy Area boundary.
Riparian/Aquatic Species	**Habitat and Occurrence**
Cascade Frog	Known occurrence in streams within upper Squaw Creek watershed.

Noxious Weed Conditions - High probability for occurrence of tansy ragwort, cheat grass, and knapweeds associated with vehicle use of roads and in timber sale units.

Social Context

Primary Uses: Recreation, incidental firewood collection

- Dispersed Recreation Attractions – Squaw Creek Wild and Scenic River (1/2 mile corridor) and access to Squaw Creek Falls.
- Driving for pleasure occurs mostly along Road 1514 and 1526. The area has 39.3 miles of roads, an average of 5.87 miles of road per square mile.

THREE CREEKS MANAGEMENT STRATEGY AREA

Size: 3,045 acres

Location: southern 1/3 of analysis area. Three Creeks is a separate Late-Successional Reserve (#0-53), located south of Squaw Creek Management Strategy Area.

Physical Features: Bordered on the south and west by wilderness. Includes portions (totaling 69% of Management Strategy Area) of Inventoried Roadless Areas (Sisters 6192- Three Sisters, and Sisters 6193- Bearwallow). The primary land feature is Tam McArthur Rim, and primary water features include Three Creek Lake, Little Three Creek Lake, Trapper Meadow, Snow Creek and Three Creeks. Elevations range from 4,000 to 5,400 feet.

Insect and Disease Condition - Insect and disease occurrences are local and small scale; well within the normal historic range. However, due to higher stand densities on over half of the area, conditions are favorable for agents such as gall rust, mistletoe, and bark beetles. Mortality is relatively low

Fire Hazard and Risk

- *Trend*: 4 reported fires in the last 16 years (2 human caused and 2 lightning caused).
- *Rating*: Moderate Hazard, Moderate Risk, Moderate Intensity. Fuel loads are expected to increase as the lodgepole stands age and begin to fall. A stand replacement fire in the late-successional lodgepole is a normal part of succession in this plant association.

Focal Late-Successional Species

Table II-26. Focal Species for Three Creeks Management Strategy Area

Terrestrial Species	**Habitat and Occurrence**
Black-backed and three toed woodpeckers	There is potential habitat throughout the Management Strategy Area, especially in lodgepole pine plant association. Probability of occurrence is high.
Great gray owl	Limited habitat in the Trapper Meadow area. Probability of occurrence is moderate.
Wolverine and marten	Known occurrence of marten; moderate probability of use by wolverine. Riparian areas may function as important dispersal travelways for these species as well as primary denning, resting, and foraging habitat.
Lynx	High probability of occurrence.
Cup Fungus	*Helvella crassitunicata* (S&M 1,3) is known to occur in the area.
Newberry's gentian	Several large populations are known to occur in the area.
Riparian/Aquatic Species	**Habitat and Occurrence**
Cascade Frog	Known occurrence of Cascade frogs in lakes and streams within Three Creek watershed
Long-toed Salamander	Known occurrence of a rare form (or new species) in seasonal ponds in the Three Creek Lake area.

Noxious Weed Conditions – High probability for occurrence of knapweeds by horses, hay, and along Road 16. A severe knapweed infestation along Road 16 near Sisters has been advancing up the road towards the Three Creek area.

Social Context

Primary Uses: Recreation, incidental firewood collection. The Management Strategy Area receives the highest recreation use in the Why-chus Late-Successional Reserve. Summer activities include fishing, camping, horseback riding and hiking, while winter activities are cross-country skiing and snowmobiling. Use in both seasons is growing.

- Developed Facilities – Three Creek Lake, Trapper Meadow, and Driftwood Campgrounds; Park Meadow, Little Three Creek Lake and Tam McArthur Trailheads and trails
- Dispersed Recreation Attractions – Lake fishing, access to the wilderness, and associated with trail systems (the Upper and Lower Three Creek Sno-Parks are located several miles north of the Management Strategy Area, but funnel winter sports users into the area). Horse use is a concern because of impacts to riparian areas. Some Off- Road vehicle damage has occurred in the meadows.
- Driving for pleasure occurs mostly along Road 16. The area has 5.1 miles of roads, an average of 1.07 miles of road per square mile.

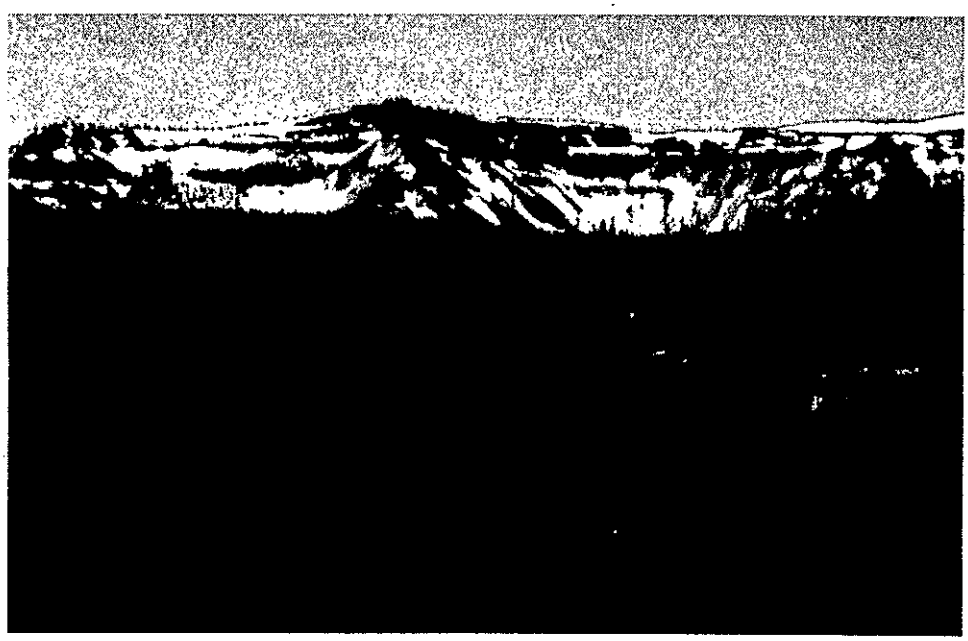


Photo II-8. Trapper Meadow in Three Creeks Management Strategy Area

CHAPTER III

LATE-SUCCESSIONAL RESERVE GOALS, AND DESIRED FUTURE CONDITION

A. INTRODUCTION

This Chapter addresses 1) direction in the Northwest Forest Plan and Northern Spotted Owl Recovery plan that were used as a basis for some of the Late-Successional Reserve goals and objectives, 2) description of the desired future condition of habitat in the Late-Successional Reserve by plant associations, 3) overall goals and objectives, and 4) specific goals and objectives for each Management Strategy Area. The goals and objectives provide the basis for developing and prioritizing Appropriate Treatments, which are discussed in Chapter IV.

The Need to Address Habitat Risk In The East Cascades Province

Both the Northwest Forest Plan and the Spotted Owl Recovery Plan recognize the increased risk of fire, insect and disease in the East Cascade Province, including in the Why-chus Late-Successional Reserve. The following summary of these two plans provides a basis for Why-chus goals and objectives, and for specific treatment criteria.

The Northwest Forest Plan recognizes that in the East Cascade province there is a very high risk to late-successional habitats due to past fire control and timber harvest in these dry, fire-adapted forests. To address this high risk, it may be necessary to implement management actions beyond the guidelines for Late-Successional Reserves *west* of the Cascades. The Plan states that "silviculture aimed at reducing the risk of stand-replacing fires may be appropriate", and that density reduction in mid-level canopy layers by thinning may reduce the probability of crown fires (B-7).

Management activities designed to reduce risk levels are encouraged in these Late-Successional Reserves, even if a portion of the activities must take place in currently late-successional habitat. While risk reduction efforts should generally be focused on young stands, activities in older stands may be appropriate if: 1) the proposed management will clearly result in greater assurance of long-term maintenance of habitat, 2) the activities are clearly needed to reduce risks, and 3) the activities will not prevent the Late-Successional Reserves from playing an effective role in the objectives for which they were established (C-13).

There are two principal objectives for silvicultural activities in Late-Successional Reserves: 1) development of late-successional and old growth forest habitats (*enhancement*), and 2) prevention of large-scale high intensity disturbance that would affect habitat to the extent that the Late-Successional Reserve would no longer be able to sustain viable populations of late-successional and old-growth dependent species (*risk reduction*).

The Northern Spotted Owl Recovery Plan sets goals and recommends management actions needed to bring the northern spotted owl to a condition in which it no longer needs the protection of the Endangered Species Act. This Plan also clearly recognizes that there are threats in the

Eastern Cascades province. These include declining habitat, and very high risk of losing existing habitat.

The Recovery Plan notes that the potential for large-scale loss of owl habitat from fire is higher here than for any other Oregon province, and is considered a severe threat. There is a low probability that Designated Conservation Areas (DCAs) in the province will avoid a stand replacing fire over a significant portion of the landscape during the next century. Loss of habitat has happened as drought created forest health conditions, which have decreased the acreage of suitable habitat in the province. These forest health concerns include the *potential for significant loss of habitat on the Deschutes National Forest.* DCAs in this area of catastrophic risk may require forest management activities beyond those recommended for most DCAs. These activities should focus on unsuitable habitat, but may occur in suitable habitat (Recovery Plan, pg. 149).

The Plan recommends applying a fuelbreak system plus substantial underburning, particularly in lower elevation habitat, to break up fuel continuity and reduce the risk of catastrophic fire. It is understood that these actions may come at some cost to existing owl habitat. To reduce the risk of loss from insect and diseases, the Plan recommends a focus on stand density control to reduce stocking and stress on existing stands.

The Plan further states:

> There are no forest protection options to maintain owl habitat at its current level in the East Cascades sub-region. As noted, the current extensive habitat is likely a result of an historical anomaly: successful fire protection. The structure resulting from this anomaly is inherently unstable, subject to increased fire, wind, disease, and insect damage. Any stand manipulation which will significantly increase resistance to these disturbance factors apparently will result in decreased owl habitat (Forest Protection Guidelines, pg ~~233~~ 471).
>
> Forest ecosystems are dynamic. They change with or without active management... A recommendation to implement a strategy that in fact reduces optimum owl habitat may seem a paradox. We believe that such implementation will in the long run better protect owl habitat than a shortsighted attempt to continue total protection.... Active management of habitat in the East Cascades sub-region, through protection strategies designed to prevent large-scale catastrophic events, is the most rational management direction (Conclusions, pg ~~234~~ 472).

In summary, the direction and guidance from these plans clearly sets the stage for the importance of reducing risk in the Eastern Cascade Province, including in the Why-chus Late-Successional Reserve. However, though risk is high in the Late-Successional Reserve, particularly in Trout Creek and Squaw Creek Management Strategy Areas, late-successional habitat quality and quantity is in better condition than in the two northern Late-Successional Reserves (Cache and Metolius).

B. DESIRED LANDSCAPE CONDITION BY PLANT ASSOCIATION

Ponderosa Pine

The ponderosa pine plant association is madeup of extensive large tree canopy arranged in a mix of small clumps and irregularly spaced individual trees. Reproduction is in even-aged clumps up to several acres in size, and scattered grass/shrub/forb openings, 1/10 to 1/4 acre in size with a few larger. This plant association group will generally develop into climax conditions, with infrequent denser stands found in riparian bottomlands and other moist ecotones. Stands are primarily one or two storied stands, less than 15% to 25% canopy closure. Understories are almost entirely ponderosa pine in scattered individuals or thinned even-aged clumps. Shrubs and grasses are young and vigorous, reflecting the influence of frequent, low intensity fire.

Stands managed with prescribed fire or for fuel breaks may have less than 100% maximum population potential of snags and down logs. In these stands, risk reduction would be a higher priority goal than maximizing amounts of dead wood. Low intensity fire is the primary disturbance agent; with fire return intervals ranging from 8 to 20 years.

Mixed Conifer (Dry and Wet)

Landscape is a mosaic of varying textures and seral stages, but predominately contains stands of small, medium and large trees. Patch sizes are 100 to 1000 acres. Ponderosa pine is the dominant overstory species with sparse understories of both shade tolerant and intolerant species. Low intensity fire return intervals are about 15-30 years and help maintain seral species and preventing the dominance of climax species in most stands. Moderate to high intensity fire is the primary stand modifying disturbance agent at varying intervals. Insects and disease also play a role on a smaller scale.

Mixed-Conifer Dry - Generally one or two storied stands, 20 to 40% canopy closure. Understory trees and shrubs are unevenly distributed and a mix of shade-tolerant and intolerant species. True fir does not comprise more than 20% of the stand. Snags are present sufficient to meet 100% MPP for focal species (usually 4 to 7 per acre). Down logs are scattered throughout the stand. Small openings exist, generally less than 10 acres in size, with 10 to 15 trees per acre and some large snags remaining. Stands managed with prescribed fire or for fuelbreaks may have less than desired numbers of snags and down logs

Mixed-Conifer Wet - In moister ecotones such as riparian bottoms, higher elevations, or north slopes, or other areas with longer than usual fire return intervals, stands are multi-storied, with 40% to 60%+ canopy closure, and including ponderosa pine, true fir, western larch and incense cedar. Understory trees, which may include shade tolerant species, are multi-aged, well distributed, but may occur as dense thickets when pioneering a disturbance opening. True fir does not comprise more than 30% of the stands. Snags and large down logs provide a significant amount of the structural complexity.

Scattered stands of climatic-climax conditions exist where disturbance intervals are longer. These stands are generally older and have a higher density of the largest trees. Northern spotted owl habitat is best provided by the climatic climax stands. Generally however, the percentage of stands in a late-successional climatic climax condition will be much lower and limited to moister ecotones with relatively high site potential.

Lodgepole pine and High Elevation Mt Hemlock

Landscape is a mosaic of varying textures and seral stages, but predominately containing stands of pole and small-sized trees with a few large remnants. Lodgepole stands are usually associated with frost pockets, poor soils, or other areas that are not tolerated by other species. Ponderosa pine, white fir, spruce, or white pine may be present. Mountain hemlock stands are located along the wilderness boundary and higher elevations. Lodgepole pine is the dominant early seral species, with sub-alpine fir, whitebark pine, and western white pine also present. Moderate to high intensity fire is the primary disturbance agent in both plant associations, at return intervals of around 150-300 years. Insects (especially bark beetles) and disease also play a role in stand replacement.

C. GOALS AND OBJECTIVES FOR WHY-CHUS LATE SUCCESSIONAL RESERVE

Goals (numbered below) describe the long-term desired future conditions, and are listed numerically. **Objectives,** which are recommended management paths that are likely to result in the goals being reached, are listed under each goal. Under these goals and objectives, "late-successional habitat" refers to those habitat conditions for the *focal species* (identified under the discussion on Management Strategy Areas, Chapter II, Section F).

Table III-1 and Figure III-1 (at the end of this chapter) provide approximate acres and spatial distribution of the "Long-term Treatment Strategies" that apply the general goals and objectives.

1. Late-successional vegetation, typical of the Eastern Oregon Cascade Province, is generally sustainable (exceptions related to the need to maintain spotted owl habitat; see goal #3 below). Succession of vegetation occurs under natural fire regimes. Within this context, disturbance processes (including fire, insect and disease) and forest vegetation structure and composition tend to occur within the historic range of variability.
    - Manage vegetative conditions to move toward late-successional conditions for focal species on suitable fire-climax, climatic-climax and high elevation forests (including high elevation lodgepole). (see figure III-1 for desired locations and distributions of late-successional habitat).
    - Manage species composition toward the Historic Range of Variability. Reduce white fir to approximately within 20% of stand composition in mixed-conifer dry stands, and 30% of stand composition in mixed-conifer wet stands.
    - Accelerate development of late-successional habitat in plantations.
    - Reintroduce the fire process into the ecosystem.
2. Risk of losing existing late-successional habitat is reduced.
    - Provide adequate protection and reduce risk of catastrophic impacts to important late-successional habitats (e.g. known nest sites, critical dispersal corridors, large trees, and unique habitats).
    - Reduce the risk of high intensity fire spreading from the wilderness into the Late-Successional Reserve.
    - Manage acceptable level of fire hazard. Where landscape-scale fuel modification is not possible, design, develop and maintain fuels reduction zones, defensible space zones, or fuel-breaks in the Late-Successional Reserve.
    - Manage acceptable levels of insect and disease so that Late-Successional Reserve Goals can be met.
    - Manage stand densities to reduce stress on existing and future late-successional habitat.

3. Habitat is available to sustain known and suspected late-successional associated species (including 1 nesting pair of spotted owls), and *species of concern* (those species that may not be dependent on late-successional conditions, but are listed as threatened, endangered or sensitive).
    - Allow some level of instability, as needed, to support species that require habitat conditions outside of the historic range of variability (e.g. the requirement of the spotted owl for high density stands for nesting, roosting, and foraging habitat)
    - Manage forest structure and density to develop and promote 21" and greater diameter trees (this stand structure is currently limited in the Late-Successional Reserve and across the landscape).
    - Identify and maintain unique habitats, such as hardwood stands or rock features, to enhance diversity.
    - Enhance habitat for focal species, where sustainable.
4. Riparian areas, wet meadows, and aquatic systems are healthy and hydrologic processes are within proper functioning condition.
    - Restore hydrologic conditions as typical within the historic range of variability.
    - Maintain hydrologic connections for dispersal of riparian-associated species.
    - Maintain healthy native wetland plant species.
    - Reduce impacts from human uses in riparian areas (also applies to Goal #5).
    - Adopt Riparian Reserve widths recommended in the ROD (C-30) and Why-Chus Watershed Assessment
    - Meet Aquatic Conservation Objectives, as stated in the ROD (B-11). Assure proposed management actions are consistent with these objectives.
5. Human uses of the Late-Successional Reserve and habitat needs of late-successional species are balanced, and occur with minimal conflict.
    - Reduce impacts on late-successional species and habitat (e.g. fragmentation) from human uses and developments (e.g. road system).

Goals and Objectives Specific to Trout Creek Management Strategy Area

- There is adequate nesting, roosting and foraging habitat to support late-successional species dependent on dense, multi-storied stand conditions.
    - Develop or maintain a contiguous, multi-storied, forested condition in wet mixed conifer and hemlock forests as habitat for the northern spotted owl, northern goshawk, and a variety of species associated with moist forests, snags and dead wood.
    - Where suitable, stands should be managed to obtain or move towards nesting, roosting, and foraging habitat. Manage stands in the southern part of the Management Strategy Area to meet future nesting, roosting and foraging habitat.
- Scattered blocks of nesting, roosting, and foraging habitat of 100 acres or more are connected by functional dispersal habitat.
    - Where sustainable, maintain mixed-conifer dry plant associations that will best develop into fire-climax, dispersal habitat. Protect and maintain large tree structure.
    - Accelerate development of late-successional conditions within young plantations and regenerated areas (high priorities for treatment are the stands with moderate to high (>30%) mortality, or that remain between the established plantations).
- The riparian and aquatic systems are healthy and functional.
    - Protect riparian and aquatic ecosystem, including wet and moist meadows, from human impacts (e.g. trampling/ loss of riparian vegetation, soil compaction and sedimentation), so that they can support the diversity of riparian-associated species that utilize this Management Strategy Area.
    - Reduce meadow encroachment and restore hydrological processes in Trout Creek Swamp.
    - Reduce occurrence and prevent spread of the noxious weed, reed canary grass, in Trout Creek Swamp.
- Risk of catastrophic impacts to late-successional habitat is reduced. Desired levels of nesting, roosting, and foraging habitat are protected.
    - Allow natural processes to continue in forested areas at less than catastrophic levels. Use risk reduction measures as needed, to promote the ability of the Management Strategy Area to function as habitat for the focal species (Chapter II, section F).
    - Develop a fuel break along the 1018 road, along the base of Black Crater, to reduce the risk of fire spreading from the wilderness into nesting, roosting, and foraging habitat to the east. Manage lands west of the nesting, roosting, and foraging habitat as fire-climax.

- Manage Mixed-Conifer Dry stands adjacent to private lands as fire climax with fuel loads and stand structures that will provide resiliency to low intensity fires, but will not support large intensity fires.
- Manage stands that are in excess of focal species needs, as fire climax (e.g. if there are excess acres of nesting, roosting, and foraging habitat or dispersal habitat for spotted owls, manage as fire climax and focus on the development of large trees).

Goals and Objectives Specific to Squaw Creek Management Strategy Area

- Late-Successional fire-climax habitat dominates the landscape, except in the southwest portion of this Management Strategy Area. Large snags provide optimal habitat for focal species. Dispersal habitat for spotted owls in the southern and western portion of this Management Strategy Area, and through Pole Creek drainage adjacent to the Late-Successional Reserve, provides access to separate areas of nesting, roosting and foraging habitat (Figure III-1).
  - Develop fire-climax late-successional nesting, roosting, and foraging habitat for whiteheaded woodpeckers along the northeastern edge of this Management Strategy Area.
  - Develop fire-climax late-successional nesting, roosting, and foraging habitat for goshawk along the southeastern edge of this Management Strategy Area.
  - Develop fire-climax late-successional dispersal habitat for spotted owls along the western edge of this Management Strategy Area. This habitat should connect adjacent nesting, roosting, and foraging habitat (in the southeast portion of the Management Strategy Area, and into the Trout Creek Management Strategy Area). Consider maintaining multi-storied pine stands of higher densities in riparian areas along Squaw Creek.
  - Maintain large trees (>21" diameter) and large snags, which are critical habitat elements for focal species. Maintain large down logs.
  - Protect plantations from being heavily infected by mistletoe (for example by pruning nearby infected trees, thinning lightly infected stands adjacent to plantations, killing heavily infected trees adjacent or within plantations, and removing infected small trees). Prevent *epidemic* levels of mistletoe Management Strategy Area; accept *endemic* levels (priorities for treatment are stands that are only lightly infected with mistletoe, young plantations/regenerated areas that can help reduce fragmentation and accelerate development of late-successional conditions, and stands that currently do not meet late-successional habitat conditions).
- Nesting, roosting and foraging habitat for spotted owls is provided, where sustainable, and future nesting, roosting and foraging habitat is developed, as needed.

- Maintain 10% to 20% of the Management Strategy Area in suitable late-successional climatic-climax nesting, roosting, and foraging habitat. Manage surrounding stands to provide future nesting, roosting, and foraging habitat, where sustainable.

- Riparian areas are healthy and in properly functioning condition, and provide optimal support for aquatic and riparian-associated species.
  - Protect riparian and aquatic ecosystem, including wet and moist meadows, from human impacts (e.g. trampling/ loss of riparian vegetation, soil compaction and sedimentation), so that they can support the diversity of riparian-associated species that utilize this Management Strategy Area.
  - Reduce meadow encroachment and restore hydrologic processes in Twin Meadows.
  - Reduce occurrence and prevent spread of the noxious weed, bull thistle, in Twin Meadows.
- Risk of catastrophic impacts to late-successional habitat is reduced. Desired levels of spotted owl nesting, roosting, and foraging habitat is protected.
  - Allow natural processes to continue in forested areas at less than catastrophic levels. Use risk reduction measures as needed, to promote the ability of the Management Strategy Area to function as habitat for the focal species.
  - Break up the fuels in large, contiguous shrub fields. Reduce ladder fuels by lowering shrub height through actions such as mowing and prescribed burning.
  - Protect nesting, roosting, and foraging habitat in the southern part of the Management Strategy Area by managing surrounding lands as fire-climax dispersal.
  - Consider a fuel break along road 1500 in the Matrix lands to the northwest of the Management Strategy Area.

Goals and Objectives Specific to Three Creeks Management Strategy Area

- Mature lodgepole pine stands cycle back to early seral stages, through natural disturbances typical of this plant association group.
  - Allow the natural cycling of the extensive mature lodgepole stands.
- Risk to public safety in this popular recreation destination is reduced through modification of fuel profiles along access routes and around high-use recreation sites.
  - Reduce fuels as needed to provide safe evacuation for visitors out of the Management Strategy Area, and for fire-fighter safety. Thinning may be

appropriate in some younger lodgepole stands to reduce fuels, particularly around recreation sites. Provide a fuel break along portions of Road 1600, 1628 and 1600-370.

- Generally, do not salvage, except to remove dead trees from an insect outbreak or fire which threaten road safety or have a high potential for burning or reburning.
- Personal use firewood collection may be appropriate to reduce fuel loads. Maintain large snags and down logs as needed for focal species.

- Prior to this cycling event, a contiguous, unfragmented landscape of late-successional lodgepole and high elevation forests serve as habitat for focal species.
- Riparian areas are healthy and in properly functioning condition, and provide optimal support for aquatic and riparian-associated species.
  - Protect, restore and improve habitat conditions in riparian reserves and wet meadows. Restore natural hydrological regimes, where possible.
  - Protect long-toed salamander habitat. Maintain amphibian dispersal corridors from known breeding sites to potential habitats. Monitor trends in salamander populations and use.
  - Protect probable and known habitat for other focal species.
  - Reduce conflicts between human uses of riparian areas and habitat needs for riparian-dependent species. Monitor impacts on habitat from human uses.
  - Prevent the introduction and spread of noxious weeds from horse and off-road vehicle use

Long-term Treatment Strategies

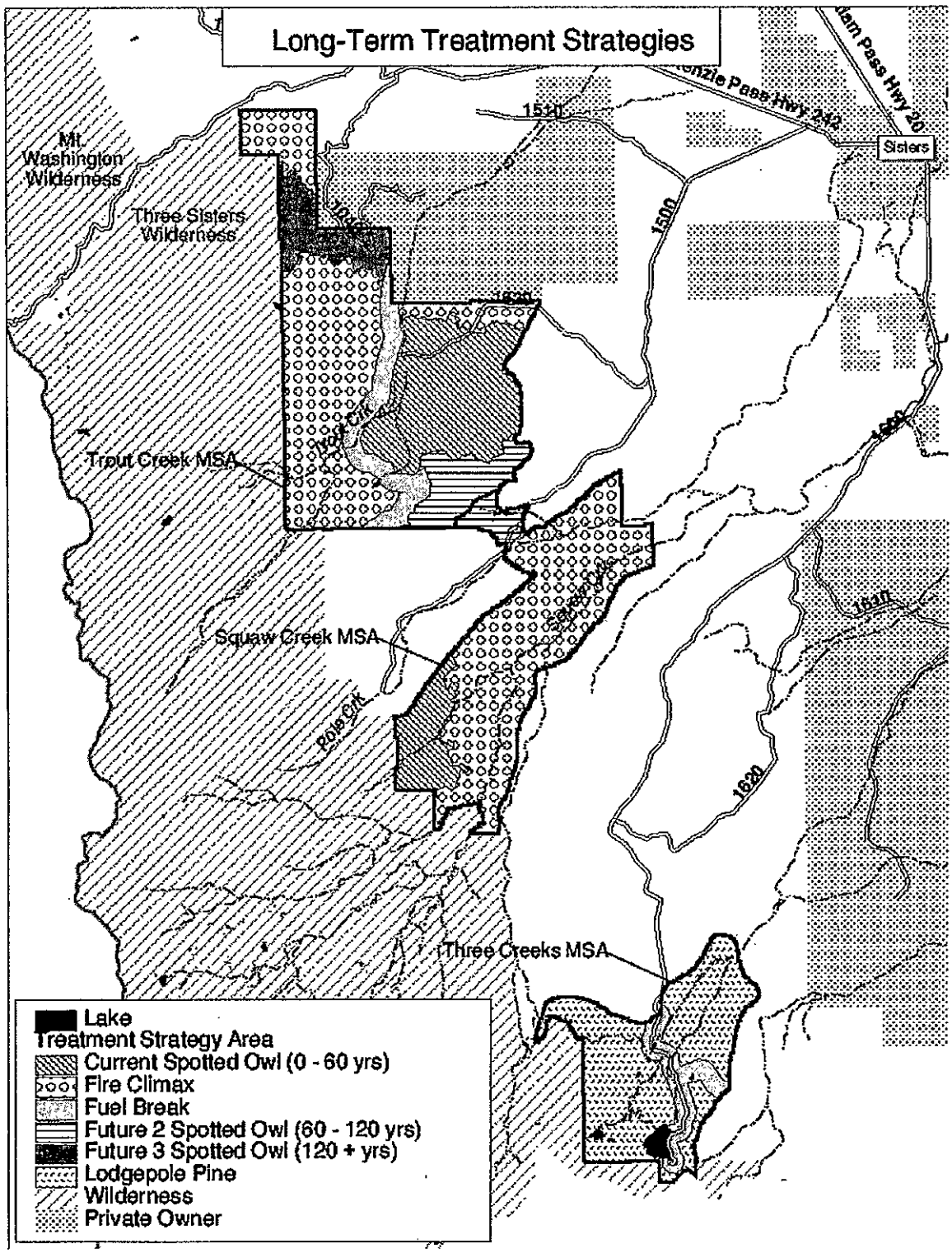
Table III-1. Description and Approximate Acres within each of the Long-termTreatment Strategy Areas (shown in Figure III-1).

Treatment Strategy	Description	Approximate Acres
Current Spotted Owl	Most suitable habitat for spotted owls over the next 60 years	2,7053 acres
Future 2 Spotted Owl	Area best suited for developing into the second cycle (from about 60 to 120 years from present) of sustainable spotted owl habitat.	858 acres[1]
Future 3 Spotted Owl	Area best suited for developing into the third cycle (greater then 120 years from present) of sustainable spotted owl habitat	661 acres[2]
Fire Climax	Habitat best suited for developing into and sustaining fire climax conditions	6,944 acres
Lodgepole Pine	The majority of the Three Creeks Management Strategy Area, dominated by lodgepole pine plant association group.	2,532 acres
Fuel Breaks	Areas generally running north/south through the Trout Creek and Three Creeks Management Strategy Areas, that would be strategically located to reduce the intensity of fires moving from the west to east (direction of prevailing winds in summer), protect emergency access route, and provide an area for firefighters to fight wildfires.	1,221 acres

[1] Some or all of the area from the "Current Spotted Owl" habitat would likely be available to supplement this future habitat area

[2] Some or all of the area from the "Current Spotted Owl" and "Future 2 Spotted Owl" habitat would likely be available to supplement this future habitat area

Figure III-1. Long-Term Landscape-scale Management Objectives and Treatment Strategies



CHAPTER IV
CRITERIA FOR DEVELOPING APPROPRIATE TREATMENTS

The process used to determine treatments which would be appropriate in Why-chus Late-Successional Reserve involved 1) describing the existing conditions (Chapter II), 2) defining the desired future conditions, and the Late-Successional Reserve goals and objectives (Chapter III), 3) identifying the gaps between existing and desired conditions (what are the barriers, limitations or opportunities to reach the desired future condition), and 4) proposing possible actions or treatments that would close this gap, and move the landscape toward the desired future condition.

This chapter discusses A) the treatments that would be appropriate throughout the Late-Successional Reserve, followed by B) a more detailed discussion of specific treatment and management options by Management Strategy Area. Monitoring recommendations are found under both sections, while priorities for management are found under Section B.

A. GENERAL RECOMMENDATIONS FOR HABITAT PROTECTION AND ENHANCEMENT

Landscape-scale Habitat Goals. Figure III-1 (Long-term Treatment Strategies) shows the goals for broad, landscape-scale habitats based on existing, potential and sustainable habitat conditions, and areas where strategic protection is needed from wildfires moving across the landscape. This landscape map was discussed in Chapter III under goals and objectives, but is briefly reviewed again here because it provides guidance for management actions discussed in this chapter.

Focal Species. A management consideration throughout the Late-Successional Reserve is "for what focal species is habitat being developed?" The assessment team recognizes that almost any structural stage or component could provide habitat for a variety of species (late-successional, rare or common), and that managers may struggle with decisions on determining when the landscape, stand or structural component is not functioning to meet desired goals. A key to resolving this dilemma is to focus on needs for the *focal species*. Focal species are listed under the discussion of Management Strategy Areas (Chapter II, Section F) and habitat needs and management considerations are discussed in detail in Chapter II Section C.

In general, following the management strategies shown in Figure III-1, decisions about how and when to treat vegetation in these areas should consider the following:

Current and Future Spotted Owl Habitat (these areas also provide suitable habitat for goshawks, marten, lynx and wolverine denning and travel corridors, and great gray owl when adjacent to openings)

- If the stand is functioning as nesting, roosting, and foraging habitat, and:
    - is not in excess of needs for the focal species, then do not treat the stand
    - is in excess of needs for focal species, *then* consider actions that may help reduce risk (reduce stand densities) and help develop and maintain important structural components (e.g. large trees).
- If the stand is functioning as dispersal habitat, and:

- it is strategically located and able to sustain nesting, roosting, and foraging habitat, *then* begin moving the stand in that direction.
- it is not able to sustain nesting, roosting, and foraging habitat, *then* consider actions that may help reduce risk (reduce stand densities) and help develop important structural components (e.g. large trees)
- is located in the area designated as Future Habitat 2, *then* begin to develop two-100 acre blocks of nesting, roosting, and foraging habitat for future nest groves
- is located in the area designated as Future Habitat 3, *then* focus development of fire climax habitat and large tree structure

- If the stand is not functioning as either nesting, roosting, and foraging habitat or dispersal habitat, and:
  - can sustain these conditions, *then* focus on developing large tree structure.
  - can not sustain these conditions, *then* consider actions that may help reduce risk (reduce stand densities) and help develop important fire climax structural components (e.g. large trees)

Fire Climax Habitat (provides suitable habitat for species such as white-headed woodpecker and peck's penstemon)

- If the stand is functioning as fire climax habitat, *then* protect and continue to develop future large tree structure. Do not permit development of continuous or dense mid-story canopy
- If the stand is functioning as fire climax habitat, is infected with mistletoe, and is in a strategic location for focal species habitat, *then* consider reducing the spread and level of infection (e.g. through pruning or killing infected overstory trees)
- If the stand is not functioning as fire climax habitat, and has the potential to develop into habitat, *then* begin developing large tree structure and reducing mid-story canopy and ladder fuels

Fuel Breaks – The primary functions of these areas are to break up the continuity of fuels, provide a location to "take a stand" during suppression operations and slow advancing fire fronts by setting "backfires", and prevent severe wildfire impacts on adjacent habitat or to public safety. The important management action in these areas is to maintain open conditions and low fuel load levels.

A secondary function would be as open fire-climax habitat.

Lodgepole Pine – This area provides habitat for black-backed woodpecker and also encompasses many of the riparian and wet meadow habitats important for amphibians. Vegetation management in Three Creeks Management Strategy Area would be minimal, mostly occurring in strategic locations to address public safety. It is expected that a large-scale disturbance will occur in this area.

(NOTE: there are lodgepole pine stands in the other Management Strategy Areas, but they generally fall within the Fire Climax Treatment Strategy areas).

General Management of Successional Stages. Within the above landscape areas, there will be a range of successional stages (refer to Chapter II, pg. 29 for a discussion about desired amounts of habitat in

each successional stage). The following discussion addresses recommendations for managing these successional stages.

Stage 1 - Preliminary Vegetation: This stage includes stands with insufficient components to meet either fire-climax or climatic-climax late-successional conditions, and includes meadows and concentrations of mortality.

Where it is desirable to develop late-successional conditions, thin high risk stands to emphasize growth and lower susceptibility to insects and diseases. Prescribed burning can help reduce hazardous levels of fuel. In areas adapted to frequent fires, lack of management is likely to result in cycling from other successional stages back into this stage as a result of insect, disease and wildfire.

Maintain openings and pockets of mortality for species associated with these components.

Stage 2 – Stable Fire Climax Suitable Habitat: Densities in these stands are generally below upper management zones. However, without natural or human induced density management, these stands often progress into unstable fire climax stage (Stage 3), and may progress into unstable climatic climax (Stage 4). Manage desired densities through thinning or burning to help maintain stands in this stage (Fire Climax habitat, figure III-1).

Stage 3 – Transitional Vegetation: This condition exists when stable fire climax vegetation increases in densities and becomes unstable fire climax. Stands are generally above the upper management zone, but have insufficient densities, species composition and structural characteristics required for optimal climatic climax late-successional habitat. If fire climax is the desired future condition of these stands, then focus on reducing stand densities and protecting and enhancing large tree structure. If climatic climax late-successional conditions are desired, then focus on both developing large tree structure and developing suitable understory conditions.

Stage 4 – Climatic Climax Suitable Habitat: These stands have structural attributes necessary for climatic climax late-successional habitat (Current and Future Spotted Owl habitat, figure III-1). In most situations, these stands are not likely to retain climatic climax habitat conditions over the long-term (both retain essential structural characteristics *and* be below the upper management zone). Though active management (e.g. thinning) may enhance stability, it is likely to degrade the suitability of these stands, in the short-term, for late-successional species associated with dense, interior forest conditions. However, if these stands are left unmanaged, they are likely to revert to some variation of the preliminary vegetation stage (Stage 1) or, less likely, the transitional vegetation stage (Stage 3). Appropriate management actions will depend on the amount of existing, desired and potential climatic climax late-successional habitat needed for focal species. If there is more habitat than needed in the short-term, risk reduction actions may be desirable, particularly if these actions promote more stable future habitat. If the amount of habitat is deficient, then it may be desirable to protect what currently exists, and focus on developing future climatic climax conditions in adjacent areas, where sustainable.

Large Trees, Snags, and Down Wood

Protection of trees, snags, and down wood greater than 21" diameter is of primary importance in Why-chus Late-Successional Reserve. These structural components are the constituent elements of suitable late-successional habitat, are generally limited in the existing landscape, and require the longest time period to replace once they have been removed. Avoid removal of large trees.

The recommended exceptions, under which removal of 21" or greater diameter trees would be removed include:

Photo IV-1. Large snags can provide important habitat

- Removing large, fast growing true fir (e.g. white fir) in order to meet a maximum basal area objective that is otherwise fulfilled by large pine or other desirable species. The fir removal should be specific to a stand or grove where the choice is between removal or continued stress on more desirable large trees. Consider the canopy contribution of the white fir to be removed.
- Removing large true fir to favor growth of smaller pine in the understory.
- Removing large true fir to create openings for pine regeneration.
- Removing large true fir to give other species a chance to seed in and recolonize the site.
- Large trees of any species that are determined to be hazards to restoration or risk reduction activities, developed recreation sites (through the use of the R6 Hazard Tree Rating Guide), or public access roads.

It is desirable for snags and down wood to be distributed across the Late-Successional Reserve in amounts which provide 100% maximum population potential (the point where populations are limited by something other than habitat availability), except within fuel breaks.

Recommended Snag Retention:

- Retain hollow logs and trees
- Ponderosa pine, western larch, aspen, and Douglas fir snags are preferred by cavity excavators and should be retained over other species.
- Retain large (>20"dbh) snags
- Retain tall snags where woodpeckers are the focal species (taller snags help woodpeckers stratify their use)
- Retain a mix of decay classes. Class 1 is used primarily for foraging, Class 2 for both foraging and nesting, and Class 3 for nesting by secondary excavators.
- Retain clusters of snags over individual snags where applicable. Manage snags on every 5 to 25 acres due to territoriality.
- Where needed to provide additional cover, leave snags adjacent to green trees.

Recommended Coarse Woody Material Retention:

- Leave a variety of sizes and concentrations across the landscape
- Logs left along a contour are preferred over those lying across contours.
- Larger sized logs are preferred and used by more species.
- Consider moving coarse woody debris into plantations that are deficient.

Prior to removal of large snags or coarse woody debris consider the following options:

- Topping large, hard snags to reduce downwind spotting distance (but still maintaining structure)
- Risk rating snags for ignition potential, and removing only the highest potential snags
- Maintaining declining trees (those likely to die in 5 to 20 years) as substitutes for more volatile snags.
- Remove in recreation sites and along roads where needed to meet safety standards.

Management of Mortality

Mortality is a valuable component of Late-Successional Reserves, and the NWFP generally limits salvage to patches larger than 10 acres. Consider not salvaging dead or dying trees if patches are within the low range of historic size (see Table IV-2 for historic percent of mortality by plant association).

Photo IV-2. High mortality stand in Cache Late-Successional Reserve

Mortality, for this discussion, describes forested stands where 30% to 100% of the basal area is dead (moderate to very high mortality). Stands that are mostly dead, but with some green can provide beneficial habitat. It is recommended that a range of different levels of mortality (some moderate, some high, some very high) be retained. Other desirable characteristics for these habitats include the presence of large trees (live and/or dead), down logs, open canopies (less than 40% closure), and undisturbed forest floors and soils. Patches do not need to be connected, but should be well distributed across the Late-Successional Reserve. Values at risk (late-successional habitat and sensitive resources) should be considered when locating these habitats (i.e. do not try to manage a 100 acre patch of dead forest adjacent to private lands or critical spotted owl nesting, roosting, and foraging habitat).

During the evaluation of potential salvage operations, assess whether there is sufficient mortality (a range of stands from 30% to 100% mortality) on the landscape. In general, apply the following guidelines to achieve a desired range of mortality:

Table IV-1. Historic Amounts of Mortality

PLANT ASSOCIATION GROUP	MORTALITY BY PLANT ASSOCIATION	RATIONALE
Ponderosa pine dry	<1% (approximately 2 acres or less)	Historically low levels, but desirable to retain some for focal species (white headed woodpecker, flam owls)
Mixed-Conifer Dry (includes ponderosa pine wet)	5-15% (approximately 10 to 300 acres)	Historically somewhat higher levels than PP, but not significant portion of the PAG. Desirable to retain slightly higher levels. Slightly higher risk is acceptable.
Mixed-conifer Wet	7-10% (approximately 10 to 300 acres)	Historically somewhat higher levels than MCD, but not significant portion of the PAG. Desirable to retain adequate mortality, but not able to accept much risk because this is the PAG that has current and future spotted owl habitat, which is and will continue to be very limited.
Lodgepole pine	No range specified – allow natural cycling of lodgepole pine	Natural range of mortality in LP would range from 0 to 100% depending on the stage of the stand cycling. There is little benefit (or success) in trying to alter these natural cycles

Habitat Connectivity

Various management activities such as salvage, thinning and prescribed fire are considered appropriate tools to accomplish protection or enhancement goals. However, maintaining connectivity between late-successional habitat throughout the Late-Successional Reserve is also essential and must be a primary consideration in the application of these tools. Vegetation management activities may isolate populations of some species or impact unique habitats. Thus, prior to implementation, the potential implications of management activities should be weighed against the potential implications of no activity. Spotted owl habitat is of particular concern in the Trout Creek and Squaw Creek Management Strategy Areas. The following guidelines are intended to help maintain spotted owl dispersal habitat, and are expected to enhance habitat for a variety of other late-successional associated species.

Spotted Owl Dispersal Habitat: Maintain stands so that on average the following conditions still exist after treatment (where available prior to treatment):

- Mixed-conifer (wet and dry) plant association groups managed as climatic climax - 40% canopy cover in trees that average at least 11" diameter.
- Ponderosa Pine and Mixed-Conifer Dry plant associations managed for fire climax - 30% canopy cover in trees that average at least 11" diameter.
- Lodgepole and Mountain Hemlock - 30% canopy cover in trees at least 7" diameter.

Dispersal Habitat for Other Species:

- For late-successional species in general, leave 10% to 30% of treatment units (which affect late-successional elements) in an untreated condition. Implementation of this mitigation for management activities such as commercial thinning, salvage, and burning will preserve biological legacies, retain biodiversity, and enhance dispersal for a variety of plant and animal species. The amount left untreated will depend on connectivity to adjacent stands, size of adjacent openings, and focal species objectives.

- To enhance habitat connectivity, meet snag and down wood recommendations (listed above under "Large Trees, Snags and Down Wood"), and do not salvage or allow fuelwood collection in retained, un-treated areas. Management actions in riparian areas must meet Aquatic Conservation Strategy objectives (USDA, USDI ROD 1994, B-11) and should focus on habitat enhancement.

- Prioritize precommercial thinning in young plantations that present a "barrier" to late-successional habitat connectivity. As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

- Look for opportunities to maintain or improve habitat connectivity in lands under the Matrix allocation (NWFP) between Management Strategy Areas.

Dispersal in Riparian Areas and Wet Meadows:

- Maintain healthy riparian vegetation and prevent creation of barriers to connectivity in riparian corridors. This is especially important along the Trout Creek stream corridor, which has been extensively affected by harvest on adjacent private lands.
- To maintain important riparian connectivity, focus thinning in plantations bordering streams to accelerate canopy development (e.g. Squaw Creek, both within and adjacent to the Late-Successional Reserved, and Upper Pole Creek area (adjacent matrix land) along riparian areas).
- Maintain and improve hydrological connectivity of meadows, streams, and lakes in Three Creeks area, where hydrology has been altered by dams and irrigation.

Recommendations for Specific Late-Successional Animal Species

Spotted Owl – (see Section B of this Chapter for specific treatment options)

Within Critical Habitat Units (CHUs), Late-Successional Reserves, and core areas, project activities should promote the primary constituent elements for critical habitat. These features include but are not limited to the following:

1. Dispersal – space for individual and population growth, and for normal behavior;
2. Foraging – food, water, or other nutritional or physiological requirements;
3. Roosting – habitat or shelter;
4. Nesting – sites for breeding, reproduction, rearing of offspring;
5. Connectivity/fragmentation – habitats that are protected from disturbance or are representative of the historical geographical and ecological distributions of a species.

Within CHU, forested stands not capable of becoming nesting, roosting, and foraging habitat should be managed to provide dispersal habitat.

Canada Lynx

Maintain adequate levels of down woody material within or adjacent to suitable denning habitat. Delay plantation thinning in lynx analysis unit, until average tree height exceeds 15'. Where sustainable, develop understories to provide foraging habitat. Maintain travel cover and connectivity along prominent ridges, riparian areas, and through saddles. Avoid creating openings greater than 300 feet wide where connectivity is important.

Strive to reduce road densities to 2 miles per square mile for the LAU. Where roads are within ¼ mile of suitable denning habitat, prohibit human disturbance and motorized use except on arterial and collector roads between April 15 through July 15 (denning period). Refer to the FY00 Biological Assessment to determine the mix of habitats needed by plant association for the Three Creeks LAU.

Wolverine

Management guidelines for lynx should provide suitable habitat conditions for Wolverine. In general, it is desirable to maintain unfragmented habitats with few or no roads. In Trout Creek Management Strategy Area, consider closing or decommissioning forest roads 1024-720 and 1024-740, and other spurs off 1024 adjacent to the wilderness, to decrease potential disturbance and enhance dispersal. Wide distribution of large down wood provides rendezvous sites for kits and females. Open stands attract a prey base of large ungulates. Healthy riparian areas and berry patches are also beneficial habitat components.

Goshawk

Maintain and improve canopy cover and the stability of potential nest stands through actions such as thinning from below. Thin younger stands to develop large tree structure in future nest stands. Promote aspen/cottonwood development. Improve habitat conditions in the higher mortality stands near private land north of the Trout Creek Management Strategy Area.

Great Gray Owls

Priorities for habitat management are Trout Creek swamp, Twin Meadows and the area near Scott Pass Trailhead. Focus nesting habitat enhancement in stands adjacent (within ¼ mile) to these meadows by protecting or developing:

- broken top trees or snags measuring 23-42"dbh (ponderosa pine, lodgepole pine, Douglas fir, grand fir or deciduous trees);
- mature or old growth stands with greater than 60% canopy cover, but with open understory; and
- several leaning trees for fledglings.

Promote the growth of large trees capable of supporting large nest platforms. Leave snags and snag replacements that favor broken top nest structures. Consider installing platforms around suitable habitat where large structure is missing or limited but other aspects of suitable habitat exists. Reduce conifer encroachment into meadows to maintain open forage areas.

Black-backed Woodpecker: Manage this woodpecker at the 100% Maximum Population Potential (MPP) level, where suitable (directed under the Northwest Forest Plan). Maintain adequate amounts of mortality for foraging. Diseased/mistletoe lodgepole pine trees provide nesting habitat. This woodpecker requires high numbers of snags and down wood for foraging, and trees with heartrot for cavity excavation (Goggans et al. 1989). It is desirable to have a mosaic of these habitat components adjacent to, or intermixed with healthy stands to assure future habitat in the same locations.

Provide 0.12 snags/acre >17" diameter. Suitable nesting habitat consists of stands of lodgepole pine or lodgepole pine dominated mixed conifer with canopy closures between 10-25% and an average stand size of 8"dbh. Suitable foraging habitat occurs in the same plant associations with a slightly higher canopy closure (40%) and a smaller average stand size (6"dbh).

White-Headed Woodpecker: In areas where white-headed woodpecker is the focal species, do not remove snags over 20" diameter, except to meet safety hazards. Manage at 100% MMP, with 0.06 snags per acre greater than 15" diameter. Suitable white-headed woodpecker habitat includes:

- 20-40% canopy closure
- 10 tpa >21" dbh or 2 tpa >31" dbh
- high stumps >4' provide habitat
- thinning to leave no more than 165 tpa in younger stands
- open understories with little brush
- one to two canopy layers preferably with no mid layer.

Marten

Marten prefer forest with ≥40-60% canopy closure (Thompson and Harestad 1994); demonstrate a near-universal avoidance of large openings (Buskirk and Powell 1994); use large (>19.5'dbh) snags and live trees with woodpecker holes, broken tops or other cavities, mistletoe and gall rust brooms, large down logs and stumps, squirrel middens, and accumulations of blowdown or slash piles (Raphael and Jones 1991, in press, Buskirk and Powell 1994) for rest and maternal/natal den sites; and need adequate down wood to provide subnivian access points for energy efficient foraging in winter (Buskirk and Powell 1994).

Snags and Down Wood

Recommendations for the majority of the Late-Successional Reserve are described under "Large Trees, Snags and Down Wood" on page II-60. Recommendations for fuel breaks and recreation sites follow.

Fuel Breaks - Snag and down woody material levels in fuel breaks will not meet 100% maximum population potential (MPP), though they will still have some of these components. Provide snags at 40% MPP, widely spaced, and down wood at 50 to 90 linear feet per acre. These habitat components could be feathered within the fuel break also.

Recreation Sites - 100% MPP may not be achievable in established recreational sites due to safety concerns and firewood gathering. Provide on-site information to educate visitors about the need to maintain snags and down wood, where important for associated species. Consider alternative methods for providing habitat (e.g. topping snags, or nest boxes).

Long-Toed Salamander

Leave down woody material in riparian reserves and distributed across the landscape for connectivity and dispersal. Construct barriers to prevent impacts from recreationists (either collection, or trampling from pedestrians, horses or Off Highway Vehicles) around known occupied sites to reduce disturbance and damage to habitat and species. Restrict recreational use in and adjacent to the known breeding pond in the spring and early summer (immediately after snowmelt) to facilitate movement of adults from terrestrial sites to aquatic sites.

Cascade Frogs

Management in riparian areas should focus on maintaining or developing the following habitat elements for Cascades frogs:

- Maintain and develop riparian connectivity between ponds, streams and riparian areas.
- Protect emergent vegetation (or large rocky substrate), muddy substrate, shallow water, and gentle shoreline slope in potential breeding habitat (where water persists for at least 2 months)
- Reduce encroachment of conifers into wet meadows
- Eliminate dewatering of ponds (e.g from road maintenance, fire work, recreation, etc), especially those utilized for breeding
- Determine effects of altered hydrology on riparian network and mitigate losses of riparian habitat if applicable
- Limit fish stocking where native amphibians are present (except allow stocking at Big Three Creeks Lake)
- Develop educational effort to reduce recreational impacts (removing animals, trampling habitat, etc.). Move horse/hiking trail away from streams in the Three Creeks Management Strategy Area to improve habitat conditions. Rehabilitate streams/riparian areas from recreational/horse use.
- Limit use around and adjacent to riparian areas in the Three Creeks Management Strategy Area a) right after snowmelt when adults are migrating from terrestrial areas to aquatic areas, and b) as water levels shrink and animals become concentrated.
- Limit firewood gathering in riparian areas.

Recommendations for Specific Late-Successional Plant Species

For all plant habitats, survey potential habitat areas before activities occur, follow existing conservation strategies, maintain habitat connectivity, and focus treatments in younger stands to accelerate development of late-successional conditions.

Peck's Penstemon, and other species with potential to occur in ponderosa pine habitats

- Enhance population areas and adjacent potential habitat by reintroduction of fire. Prevent spread of noxious weeds into burned areas.
- Avoid using machinery (mechanical thinning, timber harvest) in known populations until such time that a Management Treatment Monitoring Study can be completed that indicates the treatment is beneficial to plants.
- Management treatment monitoring study priority is the effects of mechanical thinning operations on the plant.
- Conduct surveys to locate additional populations.

Rare Lichens Group

- Maintain potential habitats by maintaining ecological conditions, including undisturbed forest structure, substrate, and interior forest microclimates in intact riparian forested areas.
- Revisit reported sites and complete site forms with all required ecological information.

Gentian, and other wet meadow species

- Evaluate restoring hydrology and natural disturbance processes such as fire.
- Protect biological diversity of meadows if restoration activities are recommended. Minimize ground disturbance and prevent and control non-native species or noxious weeds.
- Protect from impacts related to off-road vehicles or excessive trampling.
- Consider indirect hydrological and microclimatic effects of treating adjacent forest stands on meadows in planning treatments.
- Increase education efforts in the Three Creeks recreation area regarding protection of plant species and meadow habitats. Implement closures to flower picking or site controls if problems continue.
- Establish photopoints in key meadow locations.

Rare Fungi (survey and manage species)

Follow direction in the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures (USDA, USDI 2001).

- Determine appropriate management area through consultation with regional mycologist.
- Maintain current habitat and microclimatic conditions.
- Minimize soil disturbance, especially loss, disruption or compaction of soil from management, road construction or recreational activities.
- Prevent damage or removal of host trees, maintain dominance of host trees. Manage tree disease to minimize loss of host trees.

- Revisit known sites and collect ecological data to more completely characterize habitat.
- Conduct surveys to locate additional populations.
- Visit sites periodically to assess compliance with management guidelines and evaluate impacts.

Soil And Water (see also Why-chus Watershed Assessment, 1998, pages 215-219)

- Avoiding soil impacts is preferred over restoration of impacted areas. To protect the soil resource, when competing objectives allow, implement a harvest treatment that maximizes the time period between harvest entries. This will reduce soil impacts by reducing entries into a stand. Longer periods between harvest entries can also reduce the need to maintain a transportation system and increase the opportunity to do soil restoration activities such as subsoiling.
- Reduce post harvest entries by treating stands as much as possible with the commercial timber harvest rather than post harvest. For example, treatment of material down to a smaller diameter may reduce the post harvest whip falling and thus, may avoid post harvest mechanical fuel treatments such as machine piling. It may also be possible to meet fuel treatment objectives with the timber harvest and, in some cases, avoid the need to treat fuels post harvest.
- If possible, use prescribed fire to treat activity fuels rather than mechanical fuel treatments that increase soil compaction and displacement. Prescribed fire can also avoid the larger slash piles associated with mechanical piling, which can result in soil damage when burned.
- Whenever possible, integrate less impactive harvest systems such as cable or helicopter into a portion of some sales.
- Reduce riparian damage in fragile meadows. Use education outreach to work with the public on staying out of riparian areas.
- Soils in the Why-chus LSR have been subsoiled with good success in the past. Subsoiling sets up the conditions for the soil to rehabilitate over time, but does not return an area to a pre-treatment state. Soil impacts should be minimized as much as possible throughout planning and implementation of projects.
- Reduce road density (including road obliteration, inactivation and decommission), maintain roads to prevent sedimentation into streams, and control erosion.
- Restore hydrological function to Trout Creek Swamp.
- Repair impacts to meadows and streams in Three Creeks from recreational use, and restore hydrological function to meadows that have been altered due to ditches being installed.

Special Forest Products

The following recommendations address actions that are specific to this Late-Successional Reserve. Other guidelines for special forest products should follow District policy.

- Matsutake Mushrooms: No harvest permitted.

- Rare Fungi, Lichen and Moss Species: No harvest is recommended.
- Fuel-wood Gathering: Fuelwood gathering in specifically designated areas, as approved under the NW Forest Plan ROD (USDA, USDI 1994, C-16) is recommended as a tool for reducing fuel loads and the risk of high intensity fires. Specific fuel objectives should be identified prior to fuelwood gathering, and monitoring of the designated area should determine when the objectives have been met. Incidental fuelwood gathering should not be encouraged within the Late-Successional Reserve. Generally, firewood gathering should be targeted towards white fir, and pine smaller than 15" in diameter.

Access

Road densities are relatively high in portions of the Late-Successional Reserve, and some roads are affecting the quality of late-successional habitat. Apply the Forest and District Transportation Management Plan, and Forest Service Road Analysis Process (1999) to determine which secondary and unimproved roads are necessary for management and recreation, and which roads are in excess and available for inactivation or decommissioning.

In regards to maintenance of access, the ROD (C-16) states, ``Road maintenance ...[in Late-Successional Reserves]...may include felling hazard trees along right-of-ways. Leaving material on site should be considered if available coarse woody debris is inadequate. Topping trees should be considered as an alternative to felling. Late-Successional Reserve habitat, reduction of fuels, and scenery objectives must all be considered when managing vegetation adjacent to primary roads.

Stocking with Non-native fish

If it is determined that fish have a negative effect on native aquatic species, consider suspending or reducing fish stocking in lakes in the Three Creeks MSA.

Scenic and Recreation Values

These values are very high in this late-successional reserve, and must be considered when managing late-successional habitat needs. Weigh the potential impacts from treatments on scenic and recreational values, and involve the public and local residents if potential impacts are predicted.

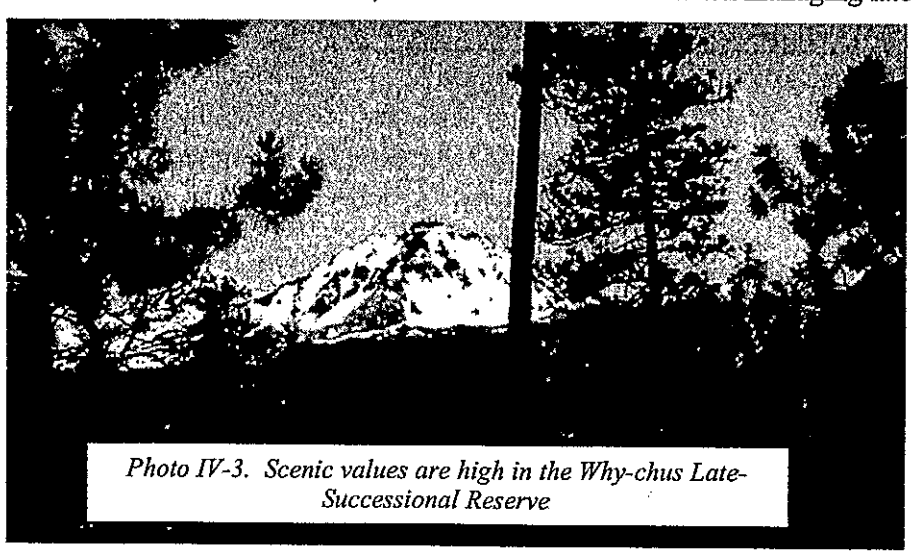


Photo IV-3. Scenic values are high in the Why-chus Late-Successional Reserve

B. PRIMARY RISKS AND OPTIONS FOR MANAGEMENT

Following is a list of primary risks, threats or limiting factors preventing attainment of Late-Successional Reserve goals and objectives; rationale or basis for treatment/management (what objectives would be met); treatment options; and where, how much and when treatment should occur. This discussion of treatment options serves as a list of possible projects. Treatment options are assigned either a high, or low/moderate priority. Triggers for action serve as a baseline for monitoring and identify elements to monitor.

Estimates on the amount of the Late-Successional Reserve that could be affected by possible management or treatments are based in part on the Landscape Treatment Strategy map (figure III-1). This map indicates the general desired future for late-successional habitat conditions.

1) Risk of loss from catastrophic fire — All MSAs

Priority = High

Includes high risk of fire in lodgepole pine stands in Three Creeks Management Strategy Area, in the contiguous shrub fields in Squaw Creek Management Strategy Area, and in the nesting, roosting and foraging habitat in Trout Creek Management Strategy Area. Also addresses the risk of fires ignited in the wilderness and spreading into the Late-Successional Reserve.

Objectives 1: Protect late-successional species and habitat, and public safety (particularly in Three Creeks, with limited access into and out of the area) from wildfire impacts. Reintroduce the fire process into the Late-Successional Reserve ecosystem to help develop and maintain fire-climax late-successional habitat.

Management Options 1

Management Options	Where	How much	When / Triggers
Thin trees up to 21" diameter	In mixed-conifer and ponderosa pine stands in Trout Creek and Squaw Creek Management Strategy Areas, where: 1) it is desirable to manage for late-successional species associated with fire-climax conditions, and 2) between areas of higher risk of wildfire ignition and important late-successional habitat.	Would occur primarily in the Fire Climax Treatment Strategy Areas (Figure III-1), and within Fuel Breaks	When stand basal area is at or exceeds upper management zone, or the stands are not functioning as late-successional habitat for focal species, but can be developed into functional habitat.

Change all "thin to 8" to "10" or all thin the same?

Management Options	Where	How much	When / Triggers
Thin trees up to 8" 10" diameter	In current and future spotted owl nesting, roosting, and foraging habitat (see Figure III-1) in Trout Creek and Squaw Creek Management Strategy Areas,	In selected stands which are considered at high risk to loss from wildfire (or will soon become high risk)	When needed to reduce high risk and meet strategic fuel reduction objectives
Prescribed burn	In Mixed-conifer stands where it is desirable to maintain fire-climax conditions	Would occur primarily in the Fire Climax Treatment Strategy Areas, and within Fuel Breaks (Figure III-1)	When conditions are within approved burn prescriptions: 1) in areas identified for prescribed natural fire, 2) after mechanical treatments, as needed, or 3) before horizontal fuel densities become higher than desired.
Create fuel breaks	1) In strategic locations to prevent spread of wildfire into important late-successional habitat, or private lands (e.g. roads 1018, 1600, 1628, 4600-370, and outside the Late-Successional Reserve along road 1500). 2) To maintain safe evacuation routes (e.g. road 1600). Locate along existing road corridors or ridgelines. 3) Adjacent to areas where stand manipulation is not desirable (riparian reserves, sensitive soils) - Link existing openings where feasible.	The width of "shaded" fuel breaks would be variable, depending on terrain, ranging up to ¼ mile wide. Fuel breaks would occur on approximately 1,000 to 1,500 acres in Trout Creek and Three Creeks Management Strategy Areas	Conditions of risk are high in certain areas now. Phase in implementation over next 10 years. Keep fuel breaks maintained as needed
Mow	Dense shrub fields in Squaw Creek Management Strategy Area, and other areas where it is desirable to develop and maintain fire climax conditions, or reduce fire	Approximately 500 to 1,000 acres per year, as needed, to break up fuel continuity. Total area that could be affected would be the acres of fire-climax habitat on	When shrub cover contributes significantly to ladder fuels and risk of crown fire. Monitor continuity, height and

Management Options	Where	How much	When / Triggers
	hazard (Figure III-1)	terrain suitable for mowing (up to 25% slope).	mortality of shrubs.
Education and awareness of fire risk	In developed recreation sites	Post information as needed on existing bulletin/ information boards	Initiate now. Monitor trends in human-caused fire starts.

Rationale and Description 1

Thinning reduces the risk to late-successional habitats by: 1) providing stand densities, species composition, and stand arrangements that are sustainable and resilient, 2) by changing both live and dead fuel profiles to reduce the risk of fires that burn at high enough intensities to threaten late-successional resources, and 3) reducing ladder fuels to reduce risk of crown fires.

Prescribed low intensity fire thins understories to reduce risks as described above, creates openings in shrub understories to break up continuity of fuels, reduces duff cover, removes competing species to allow development and expansion of fire dependent focal flora species, and enhances native grasses. In areas with high stand densities or brush component, it may be necessary to thin, or mow prior to burning. Continue to maintain fire-climax conditions, as needed, in areas treated to assure long-term effectiveness.

Fuel breaks reduce fire intensity and increase likelihood of successful suppression in areas with limited fuel treatment options. The fuel breaks are intended to provide a location to stop or slow a large front of high intensity fire. Apply combinations of understory thinning, reduction of ladder fuels, and break up of fuel continuity to reduce amounts of fine and heavy ground fuels. Maintain late-successional stand conditions at the lower boundary of the density management zone, with most of the basal area in the largest available trees. Fuel breaks would contain snags at about 40% of potential and down wood amounts would range from 50-90' per acre. Snags should be spaced widely enough that they do not contribute to the spread through spotting. Fuel breaks could be designed to feather late-successional habitat components, with lighter densities of components toward the interior of the breaks (more open conditions with fewer snags and down wood), and denser toward the outside edges. Continue to maintain fire-climax conditions, as needed, in areas treated to assure long-term effectiveness.

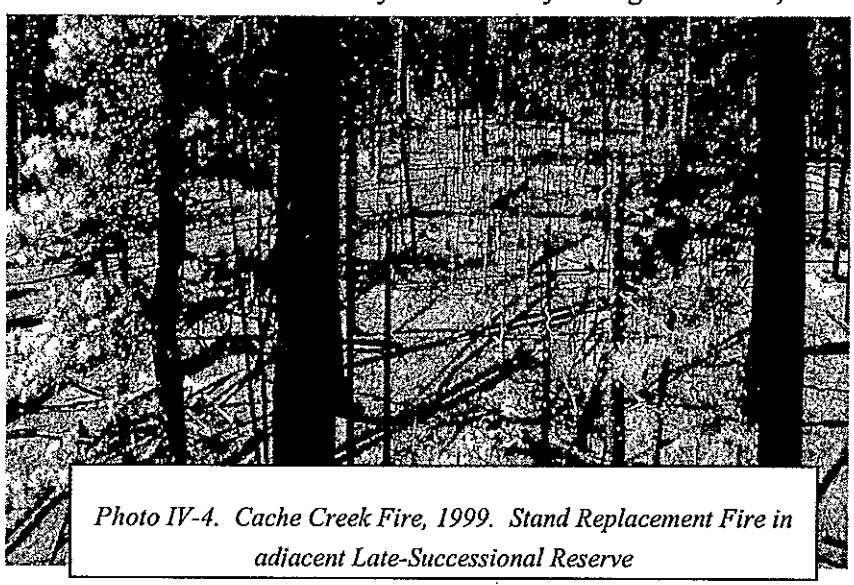


Photo IV-4. Cache Creek Fire, 1999. Stand Replacement Fire in adiacent Late-Successional Reserve

Mowing shrubs will reduce ladder fuels that can carry fire from the ground level into tree crowns. Manzanita are not expected to require as frequent maintenance as ceanothus shrubs. Where they do not contribute significantly to the fuel profile, protect and retain shrubs, grasses, and forbs.

Education and awareness – Information provided to the public, with a clear rationale of the public benefits, can increase compliance with posted regulations and modify behavior to help prevent potential human-caused fire starts.

2) Limited large tree structure **Trout Creek and Squaw Creek MSAs**

Priority = High

Trees greater than 21" in diameter are one of the primary late-successional habitat components that are limited on the landscape, are one of the elements that take the longest to develop/replace, and are important habitat elements for a variety of late-successional associated species, both within the climatic and fire climax forests.

Objectives 2: Retain and develop large tree structure, in amounts and species composition that are suitable for the plant association.

gather high density stands

Management Options 2

Management Options	Where	How much	When / Triggers
Thin trees under 21" diameter	1) High density stands and plantations in ponderosa pine, mixed-conifer dry fire-climax and climatic-climax that are not functioning as nesting, roosting and foraging habitat. (Check consistency with lynx foraging needs). 2) If the stand is functioning as possible old growth, then only thin if the objective is to develop fire-climax. 3) Around individual large trees of desired species	Thin plantations to favor and develop the larger dominant and co-dominant trees. Favor seral species such as ponderosa pine and Douglas fir. Climax species such as white fir can be left for diversity, but should not comprise more than 10% to 20% of the resulting stand, and should be left in clumps rather than as individual trees. Spacing should be as random as possible. - How much in other high density stands ok	Thin plantations after individual trees begin to express dominance, but before growth begins to slow down. Balance timing between the desire to provide some cover via dense stands, and the need to thin before trees become so large that cover is reduced by self-pruning, growth rates slow down or stagnate, and/or the cut trees will produce an unmanageable fuel load. Trigger for other high density stands
Prescribed burn	In Mixed-conifer stands where it is desirable to maintain fire-climax conditions	Would occur primarily in the Fire Climax Treatment Strategy Areas (Figure III-1), and within Fuel Breaks	When conditions are within approved burn prescriptions: 1) in areas identified for prescribed natural fire, 2) after mechanical treatments, as needed, or 3) before horizontal fuel densities become higher than desired.

Rationale 2:

Stand density reduction reduces risks of stress-induced mortality to existing and future large trees, and risk of moderate to high intensity fires.

Thinning reduces the risk to late-successional habitats by providing stand densities, species composition, and stand arrangements that are more sustainable and resilient

Thinning plantations enhances Late-Successional conditions by accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands.

Prescribed low intensity fire helps promote large trees by thinning understories to reduce risks, creates openings in shrub understories, and removes competing species.

Resulting stand (see cache p.123 ~~p.125~~ ~~generally one-2 storied~~

Resulting stand (see Cache p. 123-125 - fire climax, Climatic Climax - p. 131

↓ Remove most or all dead + dying trees < 21" dbh, but maintain large snags + green trees of low vigor

→ Thin other high density stands when stand basal area is at or exceeds the UMZ of 6BA. (p. 124 cache)

3) Inadequate nesting, roosting and foraging habitat (both short-term and long-term), for spotted owls and other interior forest species. **Trout Creek and Squaw Creek MSAs**

Priority = High

Current habitat that qualifies for spotted owl nesting, roosting, and foraging habitat is not entirely located within the 1.25 home ranges in Trout Creek Management Strategy Area, but spread out across both Trout Creek and Squaw Creek Management Strategy Areas (Squaw Creek has nesting, roosting, and foraging habitat in the southern portion of the Management Strategy Area, but no owls have been reported there). Only 762 acres of nesting, roosting, and foraging habitat occur *within* the home ranges; 1500 acres is needed for both pair.

In addition, the current habitat is at risk of loss due to the inherent instability of higher density stands. It is important to protect the habitat that exists, to focus development of additional nesting, roosting and foraging habitat within and adjacent to the home ranges as future replacement, and to develop new nesting, roosting, and foraging habitat where it is sustainable (e.g. southern Squaw Creek).

Objectives 3: Protect existing and develop future nesting, roosting and foraging habitat for spotted owls and other late-successional species dependent on dense, interior forest habitat.

Management Options 3

Management Options	Where	How much	When / Triggers
Thin trees under 21" diameter	1) In strategic locations for development of future nesting, roosting and foraging habitat (see figure III-1, current and future spotted owl habitat) 2) Within home ranges, but outside of functional nesting, roosting and foraging habitat	1) Adequate thinning from below to promote large tree structure + reduce stand densities ?? 2) May occur on up to approximately 738 acres within home ranges, when need is triggered, to bring acres of nesting, roosting, and foraging habitat up to desired 1500 acres.	- When large trees show sign of decline due to competition stress, or there is a decline in canopy cover below the threshold for spotted owl nesting, roosting, and foraging habitat. - When stands are not functioning as nesting, roosting, and foraging habitat, but can sustain those conditions, begin development of desired structural components.
Remove the majority of white fir or late seral species, when these species are dominant in	1) In strategic locations for development of habitat for focal species, 2) In stands that are not currently habitat for focal species and are not expected to develop into habitat in their	Would occur in Current and Future Spotted Owl Habitat Treatment Strategy areas (Fig. III-1), within stands that do not meet habitat objectives	When a stand is no longer deemed habitat for identified focal species, or when mortality and decline are moderate to high (i.e., affect greater then 30% of the stand)

Management Options	Where	How much	When / Triggers
stands where ponderosa pine was historically the dominant species:	current condition ~~(stand stagnation)~~ 3) Primarily in mixed conifer stands with a significant component of climax species		

Rationale 3:

Thinning reduces the risk of losing the large tree structure required for suitable nesting, roosting, and foraging habitat, by reducing competition for nutrients, water and sunlight. Once the large tree structure is established, consider discontinuing thinning so that a multi-storied stand can develop.

4) Inadequate or fragmented spotted owl dispersal habitat **Trout Creek and Squaw Creek MSAs**

Priority = Low to moderate

Includes poorly developing or unsustainable dispersal habitat due to high stand densities, and fragmentation of dispersal habitat from numerous plantations

Objectives 4: Develop sufficient habitat to support dispersal of spotted owls between isolated nesting, roosting and foraging habitat patches within the Late-Successional Reserve and to other reserves outside of this Late-Successional Reserve.

Management Options 4

Management Options	Where	How much	When / Triggers
Thin high density stands and plantations	High density stands and plantations in mixed-conifer dry fire-climax, and climatic-climax that are not functioning as dispersal habitat	Thin to favor and develop the larger dominant and co-dominant trees. Favor seral species such as ponderosa pine and Douglas-fir. Maintain adequate canopy cover (about 30%-35% in fire climax, or below 35%-40% in climatic climax), where sufficient cover exists.	Thin after individual trees begin to express dominance, but before growth begins to slow down. Balance timing between the desire to provide some cover via dense stands, and the need to thin before trees become so large that cover is reduced by self-pruning, growth rates slow down or stagnate, and/or the cut trees will produce an unmanageable fuel load.
Prescribed burn	In mixed-conifer stands where it is desirable to maintain fire-climax dispersal (see figure III-1)	Would occur primarily in the Fire Climax Treatment Strategy Areas (Figure III-1), and within Fuel Breaks	When conditions are within approved burn prescriptions: 1) in areas identified for prescribed natural fire, 2) after mechanical treatments, as needed, or 3) before horizontal fuel densities become higher than desired.
Close Roads	In home ranges or in connectivity corridors between nesting, roosting, and foraging habitat	Move toward the recommended road densities of no more than 2.5 miles per square mile	Initiate as soon as is feasible

Rationale 4

Thinning reduces the risk to late-successional habitats by: 1) providing stand densities, species composition, and stand arrangements that are sustainable and resilient, and 2) by changing both live and dead fuel profiles to reduce the risk of fires that burn at high enough intensities to threaten late-successional resources.

Thinning plantations enhances Late-Successional conditions by accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands. Plantations afford the best opportunities to make long-term adjustments in the types of habitat to be provided in Late-Successional Reserves. Generally, plantations on sites with low productivity and drier ecotones should be managed as fire-climax. Conversely, plantations in areas with higher productivity (e.g. north aspect) can be aimed towards climatic climax.

Prescribed low intensity fire thins understories to reduce risks as described above, creates openings in shrub understories, reduces duff cover, and removes competing species to allow development and expansion of fire dependent focal flora species.

Closing Roads would reduce fragmentation of the habitat over time.

Intro - Not trying to control disease but to provide for sp. habitat

Adjustment

5) Risk of loss from *epidemic* levels of mistletoe, and other insects or disease

Trout Creek and Squaw Creek MSAs

Priority = Low to moderate

Includes primarily the current risk of loss from extensive occurrence and spread of mistletoe, the resultant stress on stands and subsequent susceptibility to impacts from other factors (e.g. other insects, diseases or drought), and the effect of the development of late-successional conditions being suppressed in infected stands (see discussion of estimated spread and effects of mistletoe, Chapter II, pg. 15?). Also addresses the high risk of future loss from insect and disease due to high stand densities, and high levels of true fir.

Objectives 5: Protect late-successional habitat from catastrophic loss, reduce ladder fuels (mistletoe brooms in the lower branches, and stunted, brushy-like tree growth), promote the development of late-successional conditions in suitable stands, and prevent re-infection of stands already treated (plantations). Accept endemic levels of insect and disease.

Management Options 5 - For Spruce Budworm and Other Insects and Disease, (options for Mistletoe, see next table)

Management Options	Where	How Much	When/ Triggers
Thin trees up to 21" diameter	In high density stands in Trout Creek and Squaw Creek Management Strategy Areas	Would occur primarily outside of functional nesting, roosting, and foraging habitat for spotted owl and other interior forest species.	When stand basal area is at or exceeds upper management zone, or the stands are not functioning as late-successional habitat for focal species, but can be developed into functional habitat.
Remove the majority of white fir or late seral species, when these species are dominant in stands where ponderosa pine was historically the dominant species:	1) In strategic locations for development of habitat for focal species, 2) In stands that are not currently habitat for focal species and are not expected to develop into habitat in their current condition (stand stagnation) 3) Primarily in mixed conifer stands with a significant component of climax species	Would occur in Current and Future Spotted Owl Habitat Treatment Strategy areas (Fig. III-1), within stands that do not meet habitat objectives	When a stand is no longer deemed habitat for identified focal species, or when mortality and decline are moderate to high (i.e., affect greater then 30% of the stand)

Management Options 5 - For Dwarf Mistletoe

Management Options	Where	How much	When / Triggers
Kill overstory trees that are heavily infected with mistletoe (e.g. by removing tops or girdling, or attracting pine beetles through application of pheremones). Thin understories where dwarf mistletoe infection is absent or light, and remove understories when dwarf mistletoe infection is moderate to high	Plantations, and in young stands that do not currently provide late-successional habitat for focal species, but are capable of providing future habitat.	Treat individual trees within plantations and within 1 to 2 chains from the edge of plantations.	When mistletoe could spread to developing young trees and stands, and therefore prevent development of late-successional stand conditions in areas important for focal species.
Prune out mistletoe	1) In important habitat for focal species, in desired tress where crowns are not yet affected (e.g. mistletoe is only evident in the lower half of the tree). 2) In young plantations, to prevent the spread of mistletoe through the stand	In individual trees important for focal species habitat	Prior to tree being rated as 4+ on Dwarf Mistletoe Rating (DMR)
Thin trees under 21" dbh	In high density stands that are only lightly to moderately infected (average DMR <2), to reduce risk of loss from high stand densities and increase vigor of remaining stand - remove trees with the greatest level of infection	The maximum acres potential affected by light to moderate infection, outside of function spotted owl habitat (about 2,500 acres)	When stand density is greater than upper management zone, and is not functioning as late-successional habitat for focal species, but it is desirable to develop late-successional habitat
Continue inventory of stands for mistletoe infection	Throughout Trout Creek and Squaw Creek MSAs		Establish baseline by 2005. Monitor trend in area of infection once every 10 years.

Management Options	Where	How much	When / Triggers
Regenerate stands	Stands with high dwarf mistletoe infection (average DMR 2+), and that are not functioning as habitat for the focal species, but are in areas where it is desirable to develop focal species habitat	Treat blocks of infected stands, approximately 50 to 100 acres per decade, of the infected areas	When mistletoe is preventing development of late-successional stand conditions in areas important for focal species.

Rationale 5: *Thinning* can reduce the risk to late-successional habitats, and reduces the spread and intensity of mistletoe infection by: 1) providing stand densities, species composition, and stand arrangements that are sustainable and resilient, and 2) by changing both live and dead fuel profiles to reduce the risk of fires that burn at high enough intensities to threaten late-successional resources.

Pruning can be an effective method of controlling dwarf mistletoe in individual trees. Pruning off infected branches and witches brooms provides a way to reduce, and in many instances eliminate the debilitating effects of the parasite while saving valuable trees. Past experience with pruning dwarf mistletoe infected ponderosa pine in the southwest United States showed the trees typically improved in crown color and foliage quantity as quickly as two years after removal of large brooms (Lightle and Weiss, 1974)

Killing Infected overstory trees will remove the live host required for mistletoe to survive, while still maintaining desired large structure. Snags can be created through a variety of methods including girdling the tree, blasting the treetops, or attracting bark beetle to the tree through use of pheremones (the bark beetle would eventually kill the tree).

Photo IV-5. Large ponderosa pine infected with dwarf mistletoe

6) Species Composition **Trout Creek and Squaw Creek MSAs**

Priority = High

High densities of white-fir understories greatly increase the risk of catastrophic loss of important late-successional habitat. The recommended (Deschutes NF Forest-wide LSRA) composition of white fir in the landscape ranges from 20% in mixed-conifer dry stands to 30% in mixed-conifer wet and high elevation stands. The current composition of white fire in many stands is from 30% to over 50%.

Objectives 6: Reduce risk to late-successional habitat from competition stress and from high ladder fuels, return species composition closer to sustainable conditions, and promote large tree structure.

Management Options 6

Management Options	Where	How much	When / Triggers
Thin trees under 21" diameter	1) In stands with true fir component is greater than recommended range 2) In areas *not* functioning as spotted owl dispersal or nesting, roosting, and foraging habitat, and has a good component of ponderosa pine to favor.	Amount of area affected would be determined by conditions discussed under "Triggers" (estimated at about 6,900 acres)	When the white fir component is greater than 20% in ponderosa pine or mixed-conifer dry, and greater than 30% in mixed-conifer wet or high elevation hemlock forests
Reintroduce fire through prescribed burning	In mixed-conifer dry fire-climax stands	Estimated at about 6,900 acres	When the white fir component is greater than 20% in ponderosa pine or mixed-conifer dry
Remove the majority of white fir or late seral species, when these species are dominant in stands where ponderosa pine was historically the dominant species:	1) In strategic locations for development of habitat for focal species, 2) In stands that are not currently habitat for focal species and are not expected to develop into habitat in their current condition (stand stagnation) 3) Primarily in mixed conifer stands with a significant component of climax species	Would occur in Current and Future Spotted Owl Habitat Treatment Strategy areas (Fig. III-1), within stands that do not meet habitat objectives	When a stand is no longer deemed habitat for identified focal species, or when mortality and decline are moderate to high (i.e., affect greater then 30% of the stand)

Rationale 6:

Removing white fir where it dominates ponderosa pine or mixed-conifer dry stands, and in which it is not historically a significant component can reduce the risk of loss of late-successional habitat by 1) reducing stand densities, and restore species compositions and stand arrangements that are more sustainable and resilient, and 2) changing both live and dead fuel profiles to reduce the risk of fires that burn at high enough intensities to threaten late-successional resources. Removing white fir can be achieved through a variety of silvicultural means (e.g. thinning, small group openings, understory removals), depending on the dominance of white fir in the stand, need for protection of adjacent late-successional habitat, and condition of other long-lived species (e.g. ponderosa pine, Douglas-fir, larch)in the stands.

Reintroduce fire by using low to moderate intensity fire for stand density reduction, fuel profile modification, and to provide conditions conducive to regeneration of grasses, shrubs and forbs. Protect snags and large down wood in stands that are deficit.

7) Limited snags and down wood **Squaw Creek MSA**

Priority = low to moderate

In certain areas of the Late-Successional Reserve, snags and down wood (particularly those in the large size class) are at levels lower than desired (though, across the landscape, there are sufficient amounts of snags). (see App C for recommended amounts of snags & down wood

Objectives 7: Provide adequate amounts of snags and down wood, particularly snags 21" or greater in diameter, in areas that are deficient.

Management Options 7

Management Options	Where	How much	When / Triggers
Protect large snags and down wood from loss	In areas of the Late-Successional Reserve that are currently deficient	Meet 100% maximum population potential (MPP), where possible, except within fuel breaks	Monitor on a landscape level. Select representative stands within each PAG and size class to conduct sampling
Create snags	In stands with large trees infected with mistletoe, outside of fuel breaks	To move toward 100% maximum population potential (MPP), where possible, except within fuel breaks	Monitor on a landscape level. Select representative stands within each PAG and size class to conduct sampling
Move down wood, from locations where there are excess amounts, into plantations	Where it is feasible and economical, to enhance composition of plantations in landscapes where these components are deficient. - Not within fuel breaks	As much as is feasible and economical, outside of fuel breaks	Most plantations are deficient of down wood, and future late-successional habitat conditions could benefit from increased amounts.

Rationale 7:

Protecting snags and down wood can provide an important habitat component that is rare in drier, fire-climax stands. However, too much down wood can place portions of the Late-Successional Reserve at higher risk of stand replacing fires. The point at which a stand moves into a high risk condition varies by plant association, with drier sites moving into high risk situations with lower fuel loads than moister sites.

Creating snags in areas snag deficient, but with adequate amounts of green trees, can provide an important habitat component for certain late-successional species

Moving Down Wood to areas deficient (plantations) can add important habitat components for certain late-successional species, such as black-backed woodpeckers, fungi and bryophytes. Size, distribution and orientation are often more important for wildlife than tonnage of volume. For example, Canada Lynx need pockets of down wood for use as denning habitat.

8) Riparian impacts from human uses **All MSAs**

Priority = High

Includes trampling of riparian habitat and impacts to water quality and riparian habitat from people, horses or vehicles in riparian areas or wet meadows (e.g. trampling of vegetation, compaction/sedimentation, disruption of riparian connectivity corridors).

Objectives 8: Protect late-successional or rare species and habitat (including riparian areas and wet meadows), protect water quality, and maintain dispersal routes along riparian areas.

Management Options 8:

Management Options	Where	How much	When / Triggers
- Education and awareness. - Increase Forest Service presence; Post signs in developed and popular dispersed sites. - Develop partnerships; work with volunteers to help protect sensitive sites	Throughout LSR in popular recreation areas or known sensitive sites		When impacts observed over more than 2 years. Monitor 1-2 times during summer/ high use season
- Barriers to vehicles and horses (rustic fences) - Establish hardened sites for pedestrians and horses to access water in sensitive areas. - Provide pedestrian boardwalks or bridges through wet meadows or over small streams	- Barriers at sensitive sites (seasonal salamander pond). - Access to water at higher use camp sites - Boardwalks /bridges in heavy use sites (e.g. campgrounds)	Where needed to protect important riparian habitat	- Trend of declining population of salamander use (use baseline data from OSU research) - Trend of declining quality and amount of riparian vegetation (use baseline data that will be established)
Identify and prioritize protection of amphibian connectivity corridors	Between known or potential habitat/ sites	Monitor changes at site annually	Establish baseline data by 2005
Evaluate the option of establishing an entrance station into the Three Creeks recreation area, and charging a use fee	Consider entrance station location along road 1600, prior to entering intensive recreation area	Use fee should be adequate to help fund administration of site, developments, and development and distribution of educational material	Evaluate option by 2010
Inventory dispersed recreation sites around riparian areas	At riparian areas throughout LSR	Monitor changes at site every 3 years	Establish baseline data by 2005

Rationale 8:

Education and awareness - Many resource impacts caused by humans are unintentional (cite??), and compliance with posted requests to modify behavior is commonly high, if a rationale for the requests is provided and the benefits to the visitor are described.

Boardwalks/bridges - Concentrating use onto raised treads, boardwalks or bridges can be very successful, if the route is logical and provides access to where visitors want to go (cite?). In fact, outdoor recreationists have indicated that pedestrian travel on these types of pathways is often preferred and considered an enhancement of the recreation experience.

Developments in a Late-Successional Reserve are appropriate if they have a beneficial or neutral effect on the objectives of the Late-Successional Reserve.

Entrance Station/Use Fee could provide a critical point of contact with visitors to distribute educational message about the unique and sensitive habitat in the Three Creeks Area. An entrance fee would help fund administration of recreation use and facilities in the area, and may help control the amount of use (use fees, even if nominal, may reduce the amount of visitation).

9) Density and composition of riparian vegetation Trout Creek and Squaw Creek MSAs

Priority = High

Includes insufficient large trees for habitat and future large woody debris recruitment in riparian areas, very high stand densities of small trees, loss of species diversity (primarily aspen, and cottonwood).

Objectives 9: Protect riparian habitat, promote large tree structure, and maintain dispersal routes along riparian areas.

Management Options 9:

Management Options	Where	How much	When / Triggers
Reduce stand densities through thinning trees less than 21" diameter	1) In riparian areas where stand density is greater than the upper management zone 2) Around future large trees of desired species	In no more than 50% of the riparian plant association (about 135 acres) * Add criteria to Rationale?	When stand densities are greater than the upper management zone
Small Group Openings	Around aspen and other hardwoods	In no more than 50% of the riparian plant association (about 135 acres)	When hardwoods show decadence due to over crowding by conifers, or where there is no, or very little, regeneration of hardwoods
Leave coarse woody debris on the ground	Throughout LSR	To meet 100% MMP, if possible, outside of fuel breaks	When amount are <75% MMP. 90-75%? Remove?

Rationale 9:

Stand density reduction reduces risks of stress-induced mortality and moderate to high intensity fires, and develops and maintains late-successional habitats.

Small Group Openings (less than 5 acres) aid conversion of small portions of stands to desired early seral species (e.g. aspen or cottonwood). They can also be used to reestablish seral species where no seed source exists. Protect the large trees within openings.

hardwood

Coarse woody debris is deficient in many stands, particularly in the larger size classes. Leaving coarse woody debris provides additional habitat for marten, lynx, small mammals (hiding cover), and moist sites for amphibians.

10) Meadow Encroachment **All MSAs**

Priority = High

Conifer trees (primarily lodgepole pine) are encroaching on several of the meadows (e.g. Twin Meadow and Trout Creek Swamp), which is resulting in the gradual reduction in acres of this type of habitat. Meadows provide important habitat for several late-successional species, including Cascades frogs, and great gray owls. In the dry East Cascade Province, meadows and wetlands are a limited resource.

Objectives 10: Prevent loss of amount and quality of meadow habitat

Management Options 10

Management Options	Where	How much	When / Triggers
Remove conifers from meadow edges, or kill and leave standing.	Trout Creek Swamp, Twin Meadow	Back to the historic meadow edges (determine from historic aerial photos)	Can initiate now
Prescribed burn	Dry meadows	As needed to assist reducing conifer encroachment	Every 10-20 years, depending on historic fire occurrence
Restore hydrology through filling created ditches and re-establishing of original stream channels	Trout Creek Swamp, and other meadows with altered hydrology		Trout Creek restoration planned for 2002

Rationale 10:

Restore hydrology and prescribed burn - Hydrologic alterations and fire exclusion have altered conditions to encourage growth of young conifers in areas where they would have been suppressed by high water tables. A restored, higher water table will likely drown out undesired conifers.

Photo IV-6. Conifer encroachment in Twin Meadow

11) Impacts from high road densities and use of vehicles off-roads **Trout Creek and Squaw Creek MSAs**

Priority = High

Trout Creek and Squaw Creek both have high road densities, which can affect fragmentation of late-successional habitat, and contribute sediment to aquatic systems.

Objectives 11: Reduce fragmentation of late-successional habitat and reduce impacts to riparian/aquatic systems from roads and road use.

Management Options 11

Management Options	Where	How much	When / Triggers
Inventory sites with impacts from OHV use	Throughout Late-Successional Reserve		Develop baseline by 2005. Monitor every 5 years
Decommission or inactivate roads	Roads that are not necessary for public or administrative access, or are contributing unacceptable resource impacts	Move toward the recommended road densities of no more than 2.5 miles per square mile (2.0 miles per square mile within Lynx Analysis Units)	Initiate now (the areas currently exceed recommended road densities)
Education and awareness about potential impacts of off-road vehicles use to sensitive habitats and species	Post information at areas where unauthorized off-road vehicle use is resulting in resource impacts	In locations where resource impacts are occurring	Initiate by 2005. Monitor trends in compliance with OHV regulations.

Rationale 11:

Reduction of open road miles can reduce impacts to late-successional habitat and species. Roads can reduce the amount and effectiveness of suitable late-successional habitat. Fragmentation of interior habitat can result in animal avoidance of otherwise suitable habitat. Reudiger (1996) documented displacement of rare carnivores in heavily roaded areas. Habitat fragmentation can result in increased predation on interior habitat species and can disrupt natural movement patterns. Recent studies document that roads can present a significant barrier to movement for many animals (Foster and Humphrey 1995, Meffe and Carrol 1994). For immobile species, roads represent a swath of uninhabitable land; the wider the road the more effective the barrier. Some small mammals rarely cross roads greater than 66' wide, while some spiders and beetles may rarely cross even unpaved forest roads (Meffe and Carol 1994). High road densities (and habitat fragmentation in general) tend to have pronounced effects on amphibians and reptiles (Harris 1984).

Education and awareness can reduce impacts from those visitors who were ignorant about the affects of their behavior, and intend to "do the right thing". It is not likely to affect the behavior of those who intend to cause impacts or who do not feel the Forest Service is a legitimate authority to restrict their mode of travel.

12) Noxious weeds **All MSAs**

Priority = High

Includes the potential or known occurrence of noxious weeds invading meadows and wetlands, the risk of invasion in popular horse use camps from feed and manure, and along high use roads (e.g. road 1600). Noxious weeds and aggressive, non-native plant species can reduce biological diversity and habitat quality, altering community processes and function.

Objectives 12: Prevent the risk of displacement and competition with native vegetation from the introduction and spread of noxious and non-native vegetation.

Management Options 12

Management Options	Where	How much	When / Triggers
Remove noxious weeds from wetlands and meadows	Trout Creek Swamp – control and prevent the spread of canary reed grass. Twin Meadows – remove bull thistle	Trout Creek Swamp – focus removal in areas, which may be disturbed by restoration projects. - In other areas, remove all noxious weeds	- Initiate in 2002 for Trout Creek Swamp - In other areas, when native species are declining due to competition with weeds (1 reproducing plant is a threshold)
Control and prevent the spread of spotted knap weed along roads	Road 1600 between Sisters and the Late-Successional Reserve	Remove as many plants as possible. Do follow-up treatments annually until no new plants appear	1 reproducing plant is a threshold
Education for horse users about weed-free feed sources and importance of proper disposal of manure in campsites	Three Creeks and Whispering Pines campgrounds (and horse camps outside the Late-Successional Reserve but from where use originates – Graham Corral and Cow Camp)		Initiate by 2005
Continue weed inventories	Throughout the Late-Successional Reserve	Associated with projects	Initiate now

Rationale 12:

Removing noxious weeds through manual or chemical means can prevent further spread and, if thorough and persistent, can eliminate established populations.

CHAPTER V
FIRE MANAGEMENT PLAN

Fire management planning is a critical component of Late-Successional Reserve Assessments. This planning effort is especially significant in Late-Successional Reserves located east of the Cascade Mountains (ROD, C-11) where fire plays an important role in the development and maintenance of the landscape. The ROD and USFWS Final Draft Recovery Plan (December, 1990) identified considerable risk to late-successional habitat from large-scale disturbances, such as fire, insect and disease in the Late-Successional Reserves of Washington and Oregon Eastern Cascades (ROD, B-7, B-8 and C-12). Large-scale disturbance events have the potential to eliminate old growth, existing late-successional habitat, and future late-successional habitat on hundreds or thousands of acres. The alteration or elimination of fire as a disturbance process in fire-dependent ecosystems, including the Why-chus Late-Successional Reserve, is known to threaten the existence of species adapted to such conditions and to put the entire ecosystem at risk of large-scale disturbances.

Fire management planning, including fire suppression, wildfire hazard reduction and prescribed fire use, will be conducted in a manner compatible with the overall goals and objectives of the Why-chus Late-Successional Reserve. Goals and objectives relating to fire management, discussed in Chapter II, address:

- Protecting known and potential late-successional habitat
- Reducing the risk of loss of late-successional habitat from high intensity wildfires.
- Improving the sustainability of the Late-Successional Reserve to provide late-successional habitat in the long term.
- Beginning the process of reintroducing fire into fire-adapted ecosystems to improve, sustain and develop late-successional habitat in the long term.

The objectives for this plan are discussed on page V-12, under **Fire Management Strategies**. This Fire Management Plan does not include site-specific prescriptions. Additional analysis will be required for all site-specific projects and before fire use for resource benefit can be implemented in the Late-Successional Reserve.

This chapter discusses historic and current conditions, hazard/risk ratings for the Late-Successional Reserve, and fire suppression for each Management Strategy Area. Specific actions to reduce hazards are listed in the **"Primary Risk and Options for Management"**, Chapter III.

A. HISTORIC CONDITIONS

Fire is a process that has played a significant role in shaping the landscape of the Why-chus Late-Successional Reserve. Early visitors to Central Oregon described the conditions they found here. Frederick Colville's 1898 report, "Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon", reveals that forest composition was quite different a century ago. He described the general forest types as "the yellow pine forests, and the heavy west slope forests." Describing the yellow pine forests, he wrote, "The principal species is the yellow pine, pinus ponderosa. The individual trees usually stand well apart, and there is plenty of sunshine between them". He also recognized the role of fire. "The

scant grass and underbrush do not make a destructive burn, while the bark of the yellow pines is so thick and so nearly devoid of resin that only under exceptional circumstances is a mature tree killed. The saplings, however, up to an age of fifteen or twenty years are readily killed by fire."

Colville described the differences in the mixed conifer zone, including the different role of fire. "At their upper elevations the yellow pine forests are denser, and often contain a considerable amount of Douglas spruce (Pseudotsuga macronata) and California white fir.. . . In this zone, in the higher elevations of the yellow pine zone, where there is a large mixture of white fir and Douglas spruce, the underbrush is thicker. A forest fire is often extremely destructive to the timber, and is followed by a very dense growth of shrubs".

From historic records (1870s surveyor's notes) it was estimated that, in the 1860s, a fire burned 600 to 1,000 acres in mixed conifer stands west of Trout Creek Swamp and south of Black Crater. This is the only record of a large fire within the Late-Successional Reserve. Large fires have burned adjacent to the Late-Successional Reserve, including 64 acres in 1913 on an area that is now private land.

Historic Conditions And Fire Regimes By Plant Association Group

Fire regimes are based upon historic conditions. A fire regime is a generalized description of the role fire historically played in an ecosystem, and is an effective way to classify the effects of fire on vegetation (Agee, 1993). The fire regime identifies potential fire effects and historic size, frequency, and intensity of fires within the vegetation types of the Why-chus Late-Successional Reserve.

Ponderosa Pine:

Little fire regime research has been completed in the ponderosa pine of the Why-chus Late-Successional Reserve, but information from proximate sites with similar vegetation and weather conditions has been compiled. The historic fire return interval for ponderosa pine forests on the Warm Springs Indian Reservation is 11 to 16 years (Weaver, 1959). Soeriaatmadja (1966) found mean fire return intervals of 3 to 36 years in the same area the following decade. In 1985, Bork found an average fire return interval of 16 years on sites near Cabin Lake and Pringle Falls on the Deschutes National Forest. Bill Hopkins, Area 4 Ecologist, estimates fire return intervals of 8 to 12 years for low intensity fires and 150 years for stand replacement fires. Hopkins estimates stand replacement fires to be 150 acres in size while the Deschutes NF Watershed Evaluation and Analysis for Viable Ecosystems (WEAVE) estimates them to be 100 to 1,000 acres in size. "The area covered by individual fires in ponderosa pine forests was probably large, because continuous fine fuel was available on the forest floor: long-needled pine litter and extensive cured grass in the understory" (Agee, 1992).

Historically, fires were of low intensity, rarely scorching the crowns of the mature trees. This can be inferred from the pattern of scarring found on residual trees and from early accounts of wildfires in the ponderosa pine. "Ordinarily, a fire in yellow-pine woods is comparatively easy to check. Its advance under usual conditions may be stopped by a patrolman on a fire line a foot or so wide, either with or without backfiring. The open character of the woods makes the construction of fire lines relatively easy, and in many cases horses may be used to plow them" (Munger, 1917).

"Frequent underburns killed most of the small understory trees which colonized the sites during brief fire-free intervals, maintaining an open, park-like appearance" (Agee, 1992). These open and park-like stands had substantial grass and forb cover (Wickman, 1992). Frequent, light burning allowed bunchgrasses and most forbs to recover rapidly, so the herbaceous vegetation dominated the understory. The natural landscape pattern was a seemingly unbroken parkland of widely spaced tree clumps and continuous herbaceous understory. "The stable patch dynamics were largely a result of frequent, low intensity fire. Disruption of this pattern occurred as small scales when trees in patches became senescent or when mistletoe infested trees torched. Of all the Eastside forest vegetation types, the Pinus Ponderosa type was the most stable in landscape pattern" (Agee, 1992).

"The dynamic process leading to stand replacing fire events in ponderosa pine is complex. It is often facilitated by some other event such as insect mortality, diseases, wind events, drought, or by natural fire exclusion allowing time for ladder fuels to accumulate to the extent necessary to either sustain a crown fire over a large area or to generate sufficient intensity and duration to reach inside bark temperatures capable of killing a normally fire resistant mature tree" (WEAVE, 1994).

Fuels were rarely at high levels because the frequent fires consumed forest floor fuels and pruned residual trees. Fine fuels were produced by needlefall or understory vegetation. "In presettlement stands, downed logs were probably clumped at the same scale as the live tree components from which they were created, as such clumps contributed to local increases in fire behavior. It is doubtful that logs remained long on the forest floor to provide wildlife habitat, rooting media for seedlings, or sites for nitrogen fixation by microorganisms, as they were probably consumed by the next several frequent fires on the site" (Agee, 1993).

Mixed Conifer (Wet and Dry)

"The most complex set of forest types in the Pacific Northwest includes those called mixed-conifer .... They differ in their specific mix of species, their fire regime, and the successional patterns likely after disturbance.... Ponderosa pine as a seral species and Douglas-fir as a seral or climax species can be found in each type, although not at every site" (Agee, 1993).

Historically, the mixed conifer forests show the most frequent fire activity of all Eastside forests, although cooler, wetter sites have longer fire return intervals (Agee, 1992). More frequent fires in dry mixed conifer plant associations are presumably due to the higher productivity of these sites, compared to ponderosa pine plant associations. The elevation and weather conditions would be similar in dry mixed conifer and ponderosa pine plant associations but mixed conifer sites would produce more vegetation. Once a fire started, the mixed conifer sites would have more fuel to allow the fire to continue to burn and increase in size. The fires would not generally be as large as fires in the ponderosa pine as there are wetter sites in the mixed conifer that would slow the fires and keep them smaller. After a fire, the fine dead fuels needed to carry fire are more rapidly replaced in the mixed conifer plant associations. This would allow fires to burn more frequently.

In the wet mixed conifer plant associations, the fire return intervals would be longer than in the dry mixed conifer. These sites have wetter, more productive site conditions that allow vegetation to grow rapidly

but also retards the effects of fires. The wetter soils and fuel conditions reduce the spread and intensity of fires on these sites.

Fire return intervals in the mixed conifer plant association groups were estimated by Bork (1985) at 9 to 25 years while Hopkins (1995) estimates them to be 30 to 50 years in the lower elevations (1500 to 4000 feet) and 50 to 80 years in the higher elevations (4000 to 5000 feet) of the mixed conifer on the east side of the Oregon Cascades. McNeil and Zobel (1980) found an increasing fire-return interval with elevation. The average fire return interval was 9 to 42 years along an elevation gradient. The average fire size for low intensity fires ranged from 50 to 150 acres and stand replacement fires were 100 to 1,000 acres in size.

Historical fire intensities and frequencies ranged from frequent, low intensity fires to infrequent, high intensity fires in Mixed-Conifer Dry plant associations. Most of these stands were more open in appearance than they are today and were dominated by ponderosa pine. "Frequent, low intensity fires kept such sites open so that they were less likely to burn intensely even under severe fire weather" (Agee, 1993). As these low intensity fires burned they removed understory ladder fuels and consumed debris on the forest floor. Fires that occurred after an extended fire-free period were generally more intense and consumed more trees and forest floor debris (fuels). These fires created patches and openings where 70 to 80 percent of the overstory trees were killed. The openings varied in size based on the weather, fuel and vegetative conditions on the site.

High Elevation Forest (Mountain Hemlock)

Within the Why-chus Late-Successional Reserve, the mountain hemlock forest has the coolest temperatures, the shortest growing season, and the longest fire-return intervals. Hopkins (1995) estimates fire-return intervals of 100 to 300 years with fire sizes of 5 to 10 acres. Regeneration in this forest type occurs after stand replacement fires that may be 50 to 100 acres in size.

Fire is the primary large-scale disturbance in the high elevation forest. Because the major tree species of these forests are not fire resistant, most fires are stand replacement fires. The estimation of fire intensity in high elevation forests is complicated by the erratic, often weather-driven nature of these fires (Agee, 1993). Crown fires occur when foliar moistures are low and may be aided by lichen draped within the canopy.

"All subalpine plant associations will burn, but not under all conditions. In the Tsuga mertensiana zone, closed or parkland forest has the highest probability of burning, because of the dead fuel loads that can be desiccated during east wind events and the presence of flammable lichens in crowns low to the ground (Agee and Smith, 1994)."

"Subalpine fires tend to be erratic and unpredictable. Although they are infrequent in most Pacific Northwest subalpine forests, fires have been important in shaping the landscapes we see today. Many subalpine meadows bordering forest were created by fire, ... The fire suppression period during the twentieth century so far has not had much impact on landscape structure in subalpine zones because of the fairly long fire-return intervals" (Agee, 1993).

Lodgepole Pine

Lodgepole pine is usually present as a persistent early seral pioneer that will be replaced by another species such as ponderosa pine, Douglas-fir, grand fir, subalpine fir or white fir. The lodgepole plant association group is the early successional stage of the high elevation forest, due to fire or other major disturbance patterns. Typically these stands persist in locations of poor soils or cold air pockets that other species cannot tolerate, and essentially become the climax species.

The normal fire regime is a high intensity, stand replacement fire associated with dry late summer conditions, high winds, and lightning. The fire return interval is 100-150 years. Pine beetles often intervene and cause extensive mortality, followed by stand replacement fire. After a pine beetle attack or in older stands with lots of large dry wood on the ground, even low intensity fires can cause extensive mortality as fire creeps from log to log damaging roots and tree boles. Patch sizes are usually small, 10 to 100 acres. Lodgepole regenerates easily on these burned sites, and the cycle begins anew. At lower elevations, ponderosa pine or true firs may slowly intrude into these even-aged lodgepole stands due to moderating changes to microsite or climate. Lower intensity fires may favor these species and allow further development, but usually they are lost in the next high intensity fire.

B. CURRENT CONDITION

Fire exclusion has significantly impacted fire regimes of forests on the east side of the Cascade Mountains, including within the Why-chus Late-Successional Reserve. The fire return intervals across the entire Late-Successional Reserve have increased, except in the high elevation forests. The expected fire intensities for all fires in the Late-Successional Reserve have also increased due to increases in fuel loadings and ladder fuels.

*Th*ere have not been any large fires in the Late-Successional Reserve since the early 1900s. An adjacent fire (Park Meadow Fire) burned 600 acres in the Three Sisters Wilderness in 1996. Large fires in the Late-Successional Reserve area generally burn from west to east due to the westerly prevailing winds. There is not sufficient data over a long enough period to establish trends in large fires in the area.

There have been 12 fire starts that have required suppression actions in the Late-Successional Reserve, from 1982 to 2000. 58% of those fires were lightning caused while 42% were human caused. Two of these fires were between 10 and 40 acres. 58% of the fires occurred in July and August, generally under the driest conditions of the year.

Current Conditions by Plant Associations

Ponderosa Pine

In ponderosa pine forests in the Eastern Cascade Province, fire exclusion has increased the fire return interval and increased the expected fire intensities.

> The landscape development pattern of clumped groups of even-aged trees was interrupted by fire protection, allowing regeneration to survive not just in openings but under mature clumps. A wide-spread, fire-protection age of ponderosa pine trees has colonized across the landscape. This

> colonization has created dog-hair thickets of pine trees in many areas, ... This dense understory has created stress on the older trees.... Where once-frequent surface fires were carried through pine stands by needle litter and grass, they are now carried by needle and branch fuels. The vertical continuity of the fuelbed is more continuous now. This allows surface fires to develop into understory or crown fires under less severe weather conditions. At the same time that average fire intensity, due to fuel buildup, is increasing, average fire tolerance of stands has dramatically decreased as a function of overstocking and stagnation (Agee, 1992).

The fire regime has been converted from a frequent, low severity fire regime to a less frequent, moderate to high severity fire regime. Historically fires in this plant association would have been 90% low intensity fires and 10% high intensity fires. Currently fires are approximately 20-30% low intensity and 70-80% moderate to high intensity. As the fire intensities increase, the percentage of large ponderosa pine and late-successional habitat that will be killed by a wildfire increases.

Fire behavior predictions for the ponderosa pine plant associations in the Why-chus Late-Successional Reserve, using 90th percentile weather (not the most extreme conditions), were calculated. These predictions used 10% slope as an average, knowing that many places have higher slope percentages. A 5-hour and 12-hour burning periods were used to estimate fire size.

A combination of fuel model 9 (60% of the area) and fuel model 6 (40% of the area) was used to predict fire behavior (using the fire prediction model, BEHAVE). Fuel model 9 represents the pine needle litter that is found under most mature ponderosa pine stands where concentrations of dead-woody debris are found that contribute to torching, spotting and crowning of trees. Fuel model 6 was used to represent the shrub component (bitterbrush, manzanita and ceanothus) that is found in many of the open canopy ponderosa pine stands. Fires in these stands will carry through the shrub component rather than the pine litter. A free-burning wildfire in these fuel types would be approximately 2,600 acres in 5 hours and approximately 10,000 acres in 12 hours. Flame lengths would vary from 6 to 12 feet in height.

The current conditions in the ponderosa pine and mixed conifer plant associations in the Why-chus LSR are the farthest from their "historic range of variability" of any of the plant associations in Late-Successional Reserve. Under the current conditions, these stands are not sustainable in the long term.

Mixed Conifer (wet and dry)

Structure and fire regime changes have occurred in the mixed conifer plant associations. The increase in understory trees (ladder fuels) has been accompanied by a shift to more shade-tolerant species. There has also been a significant increase in the brush component of these stands, particularly in Squaw Creek Management Strategy Area. The fire regime has changed from a complex fire regime of frequent low, moderate and high intensity fires to one of less frequent, high intensity fires.

The mixed conifer plant associations have changed the most dramatically from their historic condition. In most dry mixed conifer forests, effective fire exclusion resulted in all of the growing space being filled by trees by about 1960 (McNeil and Zobel 1980). These sites have had the largest increase in fuel loadings of any plant association in the Late-Successional Reserve. This can be attributed to the high quality sites that produce great amounts of ladder fuels (understory vegetation), and a brush component that could enable ground fires to move into the canopy and increase fire intensities. Frequent low to moderate fires

in the past would remove some of this material periodically so there would not be this buildup of fuels. The combination of increased fuel loadings and increased brush component have combined to significantly change the fire regimes and expected fire intensities in mixed conifer plant associations.

In the healthy mixed conifer stands, using 90th percentile weather and 10% slope, fire behavior was predicted, assuming no treatments had occurred. A ratio of 51% fuel model 10 (timber litter and understory) and 49% fuel model 2 (grass understory) predicts a 4,000 acre wildfire in 5 hours and a 9,000 acre wildfire in 12 hours. Flame lengths would range from 9 feet to 13 feet.

High Elevation Mountain Hemlock and Lodgepole Pine

There appears to be few changes to the fire regimes for the high elevation and lodgepole pine plant associations due to their high elevations and long fire-return intervals. "The changes of the last century have been least significant, of all the elevation zones, in the Eastside high elevation forests.... Although a fire exclusion policy has been in effect for almost a century, the naturally long fire return intervals have resulted in little noticeable change in these ecosystems at the stand level. At the landscape level, the absence of fire has probably resulted in a slight shift towards later seral communities and away from earlier seral communities" (Agee, 1992). The high elevation forests of the Why-chus Late-Successional Reserve have not been significantly effected by the fire exclusion. These forests are in a condition that represents the "natural" end of their fire cycle and stand replacement fires should be expected in these plant associations.

TRENDS AND CONSEQUENCES

There are many consequences of the trends toward higher fuel loadings and fire intensities, including risks to firefighters and public safety, and more severe impacts to late-successional and other forest resources. Following is a summary of these consequences.

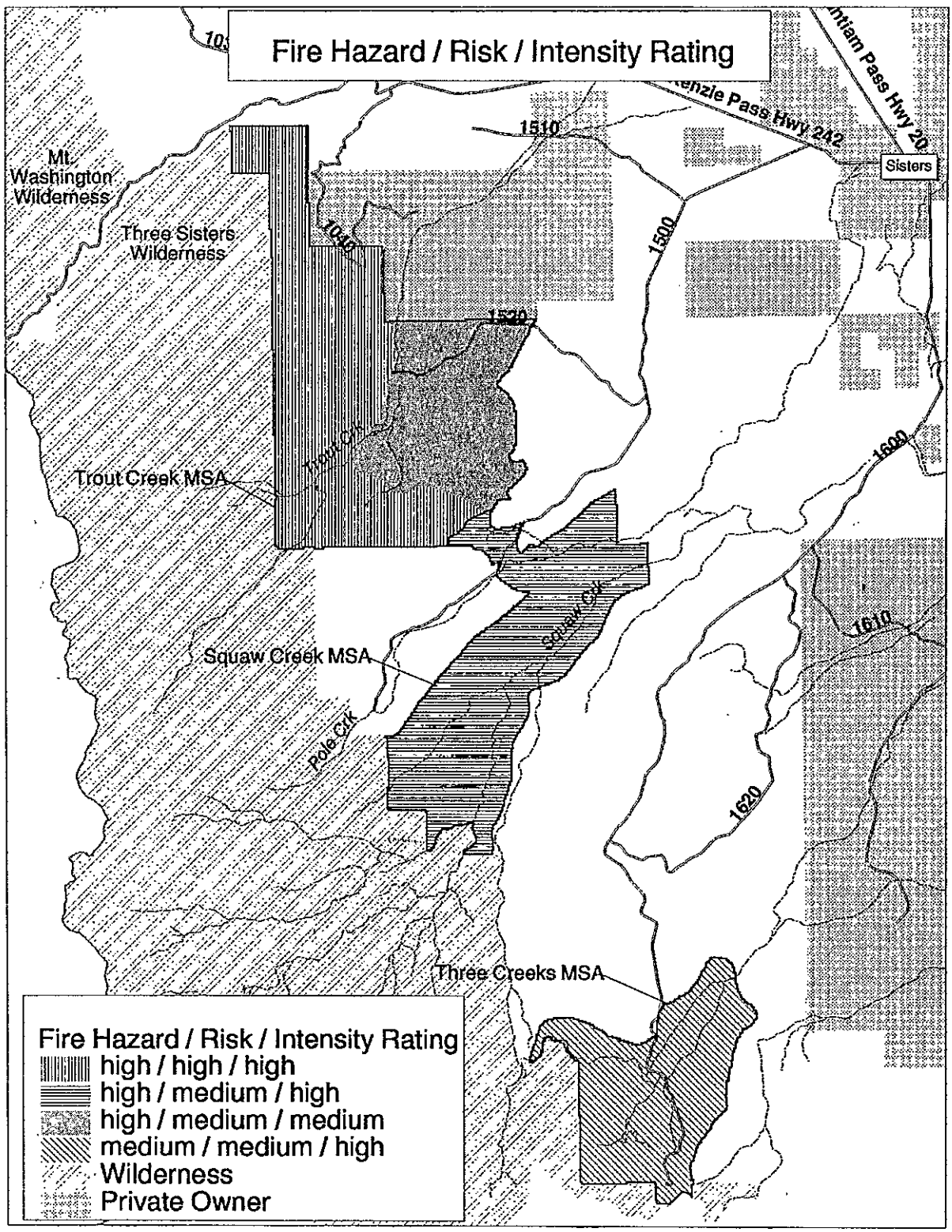
- As the amount of climatic climax conditions increase within the Why-chus LSR, the amount of fire suppression resources needed to maintain that condition would increase. On the east side of the Cascades, the most effective method of creating climatic climax conditions is aggressive fire suppression. The opportunities to use prescribed fire and confine or contain suppression strategies on low intensity fires decrease as climatic climax increases. The ability to effectively protect sensitive late-successional habitat, such as riparian areas and nesting, roosting, and foraging habitat, will continue to decrease
- The potential impacts from smoke are increasing. Smoke produced by one acre of high intensity wildfire generally contains 10 to 100 times as much particulate matter as the same acre burned under low intensity conditions.
- The cost of fire suppression has also increased significantly over historic suppression costs. High intensity wildfire suppression costs can reach a million dollars or more (Cache Creek Fire, August 1999, 380 acres, $1.6 million; Hash Rock Fire, August 2000, 18,500 acres, $6 million), depending upon the difficulty of suppression and risk to public and firefighter safety.

- There is an increase in the likelihood that fires will escape initial attack, due to the significant decrease in the number and availability of fire suppression resources over the last 10 years. A complicating factor for estimating response times for resources is the nature of the lightning storms that produce approximately 58% of the fires in the Why-chus Late-Successional Reserve. Most commonly, lightning storms reach the south end of the Deschutes National Forest and work their way north. As resources are assigned to existing fires, the amount of resources available for fires on the Sisters District (the northern most district) decrease. If resources are available and dispatched to fires in the Why-chus Late-Successional Reserve, the 5-hour burning period will represent the approximate final fire size. If resources are not available due to higher priority fires or more fires than resources are available to suppress, the 12-hour burning period final fire size will be representative of fires in the Late-Successional Reserve.
- Higher fire intensities means less effective and safe direct attack by hand crews or equipment (dozers). Once flame lengths exceed 8 feet, direct tactics cannot safely be employed. Indirect attack using retardant, dozer lines and backfiring techniques would be the tactics used for suppression. Indirect attack is more dangerous to firefighters than direct attack and it significantly increases the acreage burned.
- Heavier fuel loadings, heavier brush components and ladder fuels all contribute to soil impacts, including hydrophobic soils (soils that are water-repellent and do not allow rain to soak into the ground), increased erodibility due to vegetation loss, altered nutrient cycling and soil productivity, increased soil temperatures due to the death of understory and overstory vegetation, and oxidation of soil nutrients. The highest potential for detrimental soil effects generally occurs under each large log or concentration of fuels.
- Spotting from high intensity fires is common in these plant association groups and has a significant effect on firefighter safety, public safety, fire size, suppression costs, and resources required to control the fire. The primary safety concern of the Black Crater fire, which occurred in July 1997 and was located adjacent to the north portion of the LSR, was spotting. Spot fires were found up to one-half mile in front of the fire. Spotting can significantly increase the hazards to the firefighters by trapping them between the main fire and the spot fires.
- Denser forest and shrub stands increase ladder fuels, which contribute to the severity of a wildfire by moving the fire from the ground up into the crowns of the trees. Fires that move along the ground are less difficult to suppress, generally have lower intensities and fire behavior, and can more accurately be predicted. Crown fires can produce their own weather. This allows them to move in any direction, until they run out of fuel to burn. Crown fires are dangerous for firefighters, the public and late-successional resources.

C. HAZARD/RISK ANALYSIS

A hazard/risk analysis was completed for the Why-chus Late-Successional Reserve (see Table V-1 and Figure V-1). The area was analyzed at a landscape-scale. Within each of the rating areas, there may be stands that do not fit that rating. As project level analysis is completed, these stands can be identified.

Figure V-1. Fire Hazard/ Risk/ Intensity Rating



The ratings of Low, Moderate and High were based upon the relative conditions within the Late-Successional Reserve and did not consider conditions outside the area.

Information used for this analysis included fuel loading (information was gathered through fuels inventories from stand exams and interpretation of 1980 photos), fire occurrence information from 1982 to 1996, plant association groups, crown fire potential mapping from satellite imagery, personal knowledge of district employees who have extensive knowledge about the sisters ranger district and fire suppression.

Table V-1. Hazard/Risk/Intensity Rating by Management Strategy Area

Rating Component	Trout Creek Management Strategy Area	Squaw Creek Management Strategy Area	Three Creeks Management Strategy Area
Hazard	High	High	Moderate
Risk	High in west half of area; Moderate in east half of area	Moderate	Moderate
Intensity	High in west half of area; Moderate in east half of area	High	Moderate

Hazard Rating

The hazard rating is based on the fuel loadings, current stand conditions and existence of mortality in the shrub component. This classification rates the difficulty of fire suppression.

Fuel loading is a measure of the down, and dead woody debris on a site.

- Low = 5 to 15 tons per acre
- Medium = 15 to 25 tons per acre
- High = 25+ tons per acre

Current stand conditions relate to the number of canopy layers and amount of ladder fuels.

- Low = open (widely spaced), 1-storied, and/or healthy stands. These stands would be the least complicated in terms of ease of fire suppression.
- Medium = 2-storied, healthy stands where ladder fuels will have some impact on ease of suppression but will not be the primary concern.
- High = 2 to 3-storied stands, ladder fuels and brush component are present and some level of stand mortality.

Mortality in the Shrub Component. An area with a high percentage of frost-killed manzanita or with greater than half of the brush patch dead, would result in a stand with a moderate or high rating, just as if

the stand had that same level of mortality in the trees. The criteria for mortality are based on the level of mortality that begins to effect suppression capabilities and not silvicultural or other resource concerns.

- Low = less than 20% of a stand
- Medium = 20 to 40% of a stand
- High = 40%+ of a stand

The majority of the Late-Successional Reserve is classified as a medium hazard. The low hazard areas include the lodgepole pine flats in the Three Creeks Management Strategy Area. A few areas along Black Crater and the upper reaches in Squaw Creek are classified as high, based upon the fuel loadings, ladder fuel presence and brush component

Risk Rating

Values at Risk and Current Policy. Priorities for protection from fire are life, property and resources, in that order (National Fire Management Policy). Fire suppression resources for the Forest Service are allocated through the National Fire Management Analysis System (NFMAS), which considers easily identifiable investments, such as money spent to establish a plantation, house costs. The system considers resource value changes and availability of initial attack suppression forces on a broad scale.

Though it is recognized as a limitation in this system, spotted owl home range and nesting, roosting, and foraging habitat areas are not specifically identified as a "high value" in the risk factor using the NFMAS analysis. They are only valued for their timber. Plantations, on the other hand, are valued higher due to the capital investment, than timbered stands that were not prepared and planted. Local fire managers and suppression forces do consider site-specific intangible values such as old growth and endangered species during the initial attack phase of firefighting. However, multiple fire starts with limited suppression forces may force hard choices.

Risk Rating. The Risk Rating for the Why-chus Late-Successional Reserve is a rating of the chance of a fire occurring, and when one does occur, what values are at risk from that fire. The Risk Rating was based upon recreational use, adjacent private property, plantations, and lightning and human-caused fire occurrence.

The Why-chus Late-Successional Reserve was rated as medium and high risk. Plantations and the area within one-half to one mile of private property was rated as High risk due to the high "values at risk". The rest of the Late-Successional Reserve is rated as Medium risk because of the moderate amount of recreation use (the higher recreation use in the Three Creeks Management Strategy Area has not showed a trend in higher human-caused ignitions, perhaps due to the absence of understory vegetation), lack of specific "lightning paths"(excluding Black Crater), or other risks.

Fire Intensities

Fire intensities, measured as flame length, were predicted based upon existing fuel loadings and stand conditions, the fire occurring in July or August under average summer weather conditions, presence of ladder fuels and their potential to move the fire from the ground into the crowns of the trees, and presence and species of the brush component.

- Low = 2 to 4 foot flame lengths
- Moderate = 4 to 8 foot flame lengths
- High = 8+ or more feet flame lengths

The Why-chus Late-Successional Reserve has fire intensity ratings of High and Low (Figure V-1). Most of the area was rated as High due to the abundance of multi-storied, stands with ladder fuels that contribute to crown fires. The brush component in the area also contributes to the potential for crown fires. The rest of the Late-Successional Reserve had predicted Low Fire Intensity rating.

D. FIRE MANAGEMENT STRATEGIES

The objectives for the Why-chus Late Successional Reserve Fire Management Plan, are to:

1. Develop fire suppression strategies that protect human life and property while sustaining late-successional habitats and protecting other resource values.
2. Identify fire hazard reduction activities that will reduce the potential for large-scale, high intensity wildfires.
3. Recommend activities that facilitate the reintroduction of fire into fire adapted ecosystems.
4. Prepare to use fire for resource benefits in the Three Sisters Wilderness

Based upon direction provided in the Northwest Forest Plan, Deschutes Land and Resource Management Plan, Federal Wildland Fire Management Policy and Program Review, Why-chus Late-Successional Reserve goals and objectives, Hazard and Risk Analysis ratings, and resource needs and values, fire management strategies have been developed for each of the Management Strategy Areas. The fire management strategies include fire suppression strategies and priorities, hazard reduction recommendations to protect and sustain late-successional habitats, and opportunities to use prescribed fire to enhance other resource values within the Late-Successional Reserve.

All fire management suppression strategies are based upon the principle that firefighter safety is the highest priority during all wildfire suppression activities. Aggressive control strategies in some locations may be necessary to protect known Proposed, Threatened, Endangered or Sensitive species habitat or reproductive sites. Generally, the protection of habitat is a priority over the protection of individual reproductive sites, however, consultation with the USFWS should be conducted when Proposed, Threatened and Endangered species are involved.

Potential Conflicts with Late-Successional Reserve Objectives

Treatments recommended for reducing fire risk and for fire suppression may impact late-successional habitat and species. Actions which reduce fuel levels and modify fuel arrangements would open up forest stands, result in drier microsite conditions, and reduce the ability of species associated with interior forests (e.g. spotted owls) and species with limited mobility to safely disperse through the landscape.

Fire suppression actions may result in localized disturbance to late-successional habitat and species, but these impacts are expected to be less extensive or severe than impacts from a high intensity wildfire.

Local suppression forces would confer with the District biologists to determine what unique late-successional resources should be protected or avoided, if possible.

SUPPRESSION STRATEGIES BY MANAGEMENT STRATEGY AREA

TROUT CREEK MANAGEMENT STRATEGY AREA 7,576 Acres

Plant association groups. Mixed conifer (wet and dry) in most of the Management Strategy Area. Some high elevation mountain hemlock and lodgepole pine in the upper elevations.

Fire Hazard Rating. High (figure V-1). Hazards are higher in the multi-storied, dense stands in the spotted owl nesting, roosting, and foraging habitat.

Fire Risk Rating. Moderate to high due to low to moderate amounts of human use and no particular lightning attraction, though there is a concern about a fire start in the wilderness and the spread into the Late-Successional Reserve down the flanks of Black Crater.

Values at Risk

- Spotted owls - Home range for two pair of owls (one home range is only partially contained within the Late-Successional Reserve). There is one known nest site.
- Adjacent to private property to the east.
- Whispering Pine Campground
- Forest visitors and travelers along Forest Roads (especially 1018 and 1520)

Fire intensity rating. Moderate to high in most areas.

Fire Suppression Strategies

The following list of suppression strategies are listed in order of priority:

1. **Protect firefighter and public safety. Aggressive control of all high intensity wildfires.** All suppression tactics are acceptable when wildfires have the potential to effect public or firefighter safety.
2. **Aggressive control of all wildfires that threaten private property or threaten Forest Service lands from fire starts on private property.** All suppression tactics are acceptable when wildfires have the potential to enter private property. Suppression tactics used for wildfires that start on private property and threaten Forest Service lands should be consistent with the resource values at risk. The use of low impact tactics should be considered when existing or future nesting, roosting, and foraging habitat is threatened.
3. **Aggressive control of all wildfires that may threaten home ranges of the spotted owl.** The appropriate suppression tactics used to meet this goal, while minimizing the use of dozers and retardant in and adjacent to nesting, roosting, and foraging habitat, will be determined by the Initial Attack Incident Commander and Fire Duty Officer at the time of the fire response.

4. **Aggressive control of all wildfires that occur in areas that will be managed for climatic climax.**

5. **Consider the use of confine and contain suppression strategies for low intensity wildfires.** This decision should be based upon weather conditions, predicted fire behavior, suppression resource availability, fire location, social concerns, and other information important to the selection of an appropriate suppression response. Roads and other natural barriers may be used for confinement or containment lines. Burning out from natural barriers may also be acceptable. Currently, this suppression strategy has limited opportunities.

SQUAW CREEK MANAGEMENT STRATEGY AREA **4,284 acres**

Plant Association Groups. Mixed Conifer and Ponderosa Pine

Fire Hazard Rating. High due to stand densities, fine fuel loadings, shrub component and multi-storied, dense stands in nesting, roosting, and foraging habitat. Also, dense mistletoe in the ponderosa pine understories put the overstory ponderosa pine at risk from high intensity wildfires.

Fire Risk Rating Moderate. Well traveled road corridors increase the risk of human caused fires but should not contribute to a higher risk rating.

Values at Risk.

- Spotted Owl nesting, roosting, and foraging habitat in lower portion of Management Strategy Area
- Squaw Creek Wild and Scenic River corridor, and water quality.
- Forest visitors and travelers along Forest Roads (especially 1514)

Fire Intensity Rating. High due to stand densities that contain a large amount of ladder fuels and heavy fine fuel loadings. The shrub fields and needle drape under the ponderosa pine stands can quickly develop into high intensity wildfires shortly after they start.

Fire suppression strategies

The following list of suppression strategies are listed in order of priority:

1. **Protect firefighter and public safety. Aggressive control of all high intensity wildfires.** All suppression tactics are acceptable when wildfires have the potential to effect public or firefighter safety. In the long term, once fuels profiles and stand structures have been modified to allow them to absorb the effects of low intensity wildfire, the use of confine and contain suppression strategies will be acceptable.

2. **Aggressive control of all high intensity wildfires that threaten the survival of the large overstory ponderosa pine or areas managed for climatic climax.** The suppression tactics to be used if climatic climax habitat or large overstory ponderosa pine are threatened by wildfire

will be determined by the Initial Attack Incident Commander based upon weather conditions and fire behavior. All suppression tactics will be acceptable in this situation.

3. **Consider the use of confine and contain suppression strategies for low intensity wildfires.** This decision should be based upon weather conditions, predicted fire behavior, suppression resource availability, fire location, social concerns, and other information important to the selection of an appropriate suppression response. Roads and other natural barriers may be used for confinement or containment lines. Burning out from natural barriers may also be acceptable. Currently, this suppression strategy has limited opportunities. In the long term, once fuels and stand modifications have occurred, this strategy will be the preferred suppression strategy for wildfires in this Management Strategy Area.

THREE CREEKS MANAGEMENT STRATEGY AREA 3,045 acres

Plant Association Groups Primarily Lodgepole Pine and Dry Mixed Conifer. Wet Mixed Conifer around Three Creeks. Some Mt. Hemlock near the wilderness and in higher elevations.

Fire Hazard Rating. Moderate - fuel loadings will increase as the lodgepole stand ages.

Fire Risk Rating. Moderate due to infrequent lightning occurrence and small amount of human use of the area except near Three Creeks Lake and Trapper Meadow where there is high recreation use.

Values at Risk

- Forest Visitors and travelers along forest roads (especially 1600).
- Driftwood and Trapper Meadow Campgrounds
- Three Creeks Store
- Long-toed salamander in the seasonal ponds

Fire Intensity Rating Moderate depending upon the age of the lodgepole pine stand. A stand replacement, high intensity fire is the lodgepole pine plant association is inevitable.

Fire Suppression Strategies And Priorities

The following list of suppression strategies are listed in order of priority:

1. **Protect firefighter and public safety.** All suppression tactics are acceptable when wildfires have the potential to effect public or firefighter safety.

   As the lodgepole pine stands continue aging and "falling down", the risk to firefighter safety during fire suppression increases. Direct or indirect tactics may be necessary depending upon the conditions at the time of the fire ignition and suppression response. Larger numbers of acres burned are acceptable to protect firefighter or public safety. It is acceptable to back off from a fire and catch it when it moves into areas where fire intensity decreases, snag numbers are lower or there are opportunities to "take a stand".

2. **Aggressive control of all high intensity wildfires that threaten areas managed for climatic climax.**

3. **Consider the use of confine and contain suppression strategies for low intensity wildfires.** This decision should be based upon weather conditions, predicted fire behavior, suppression resource availability, fire location, social concerns, and other information important to the selection of an appropriate suppression response. Roads and other natural barriers may be used for confinement or containment lines. Burning out from natural barriers would be acceptable. Currently, this suppression strategy has limited opportunities.

4. **Consider minimizing the use of dozer fireline and aerial retardant where firefighter or public safety will not be compromised.** Aggressive suppression, with the use of low impact suppression tactics is preferred on wildfires that occur in or threaten to enter nesting, roosting, and foraging habitat. Larger numbers of acres burned are acceptable to protect firefighter and public safety. This decision should be made by the Initial Attack Incident Commander at the time of the fire response.

REFERENCES

Bailey, V. 1936. The mammals and life zones of Oregon. North American Fauna 55, USDA, Bureau Biological Survey, Washington, DC. 416 pp.

Banci, V. 1994. Wolverine. In: Rugerrio, L.F., Aubry, K.B., Buskirk, S.W., Lyon, L.J. and Zielinski, W.J. eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States. USDA Forest Service Gen. Tech. Rep. RM-254. 184 pp.

Bate, L. 1995. Monitoring woodpecker abundance and habitat in the central Oregon Cascades In Bull, E.L., Parks, C.G., and Torgersen, T.R. 1997. Trees and logs important to wildlife in the interior Columbia River basin. Gen. Tech. Rep. PNW-GTR-391. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55p.

Brown, C. 1997. Habitat structure and occupancy patterns of the montane frog, *Rana cascadae*, in the Cascade range, Oregon, at multiple scales: implications for population dynamics in patchy landscapes. M.S. Thesis, Oregon State University, Corvallis. 161 pp.

Bryan, T. and Forsman, E.D. 1987. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. Murrelet 68:45-49.

Bull, E.L. and Cooper, H.D. 1991. Vaux's swifts nests in hollow trees. Western Birds, 22:85-91.

Bull, E.L. and Henjum, M.G. 1990. Ecology of the great gray owl. USDA Forest Service General Technical Report PNW-GTR-265.

Bull, E.L. and Holthausen, R.S. 1992. Population density, home range size, and habitat use of pileated woodpeckers in eastern Oregon.

Buskirk, S.W. and Powell, R.A. 1994. Habitat ecology of fishers and American martens. In: Buskirk, S.W., Harestad, A.S., Raphael, M.G., comps eds. Martens, sables, and fishers: biology and conservation. Ithaca, NY: Cornell University Press: 283-296.

DeMars, D.J. 1980. Estimates of the occurrence of dwarf mistletoe on the Deschutes National Forest. Research Note. PNW-364. 8pp.

Dixon, R.D. 1995. Density, nest-site and roost-site characteristics, home range, habitat use, and behavior of white-headed woodpeckers: Deschutes and Winema National Forests, Oregon. M.S. Thesis.

Duncan, J.R. 1992. Influence of prey abundance and snow cover on great gray owl breeding dispersal. Dissertation. University of Manitoba, Winnipeg, Manitoba, Canada.

Franklin, A.B. 1988. Breeding biology of the great gray owl in southeastern Idaho and northwestern Wyoming. Condor 90:370-375.

Frenzel, R.W. 1999. Nest-sites, nesting success, and turnover rates of white-headed woodpeckers on the Deschutes and Winema National Forests, Oregon in 1999. Oregon Natural Heritage Program. 49pp.

Goggans, R. 1986. Habitat use by flammulated owls in northeastern Oregon. Thesis. Oregon State University, Corvallis, Oregon, USA.

Goggans, R., Dixon, R.D., and Seminara, L.C. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon.

Hawksworth, F.G. and D. Wiens. 1996. Dwarf Mistletoe: Biology, pathology, and systematics. USDA Forest Service. Agriculture Handbook 709.

Hayward, G.D., and Verner, J., tech eds. 1994. Flammulated, boreal, and great gray owls in the United States: A technical conservation assessment. Gen. Tech. Rep. RM-253. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station. 214 pp.

Hall, F.L. 1987. Growth Basal Area Handbook. USDA Forest Service, PNW, R6-Ecol-181b-1984. 84pp.

Hornocker, M.G. and Hash, H.S. 1981. Ecology of the wolverine in northwestern Montana. Canadian Journal of Zoology. 59:1286-1301.

Ingles, L.G. 1965. Mammals of the Pacific states. Stanford University Press, Stanford, California. 506 pp.

Ingram, R. 1973. Wolverine, fisher, and marten in central Oregon. Oregon State Game Commission Report No. 73-2.

Koonce, A.L. and L.F. Roth. 1985. The effects of dwarf mistletoe on fuel in precommercial ponderosa pine stands. Pp. 8-72 *in* Confernece on Fire and Forest Meterology. Detroit, MI.

Mikkola, H. 1983. Owls of Europe. Buteo Books, Vermillion, South Dakota.

Neitro, W.A., Binkley, V.W., and Cline, S.P. 1985. Snags, In: Brown, E., Reade tech ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. Part 1: Chapter narratives. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region: 129-169.

Nero, R.W. 1980. The Great Gray Owl: phantom of the northern forest. Smithsonian Institution Press, Washington, DC.

Pollock, M.M. and K.Suckling. 1995. An ecologically integrated approach to management of dwarf mistletoe in southwestern forests. SW Center for Biological Diversity. http:\www.sw-center.org\swcbd\papers\mistletoe.

Reynolds, R.T., Graham, R.T., Hedegard Reiser, M., Bassett, P.L., Kennedy, D.A., Boyce Jr., D.A., Goodwin, G., Smith, R., and Fisher, E.L. 1992. Management recommendations for the northern goshawk in the southwestern United States. USDA Forest Service Gen. Tech. Rep. RM-217. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 90 pp.

Reynolds, R.T. and Linkhart, B.D. 1987. The nesting biology of flammulated owls in Colorado. Pages 239-248 IN: R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre, editors. Biology and conservation of northern forest owls. Proceedings of a symposium. USDA Forest Service Gen. Tech. Rpt. RM-142.

Ruggerio, L.F., Aubry, K.B., Buskirk, S.W., Lyon, L.J., and Zielinski, W.J. tech eds. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. General Tech Rep RM-254. Fort Collins, CO, US Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station. 184 pp.

Saab, V.A. and Dudley, J. 1997. Responses by cavity-nesting birds to high-intensity wildfire and post-slavage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho IN Bull, E.L., Parks, C.G., and Torgersen, T.R. 1997. Trees and logs important to wildlife in the interior Columbia River basin. Gen. Tech. Rep. PNW-GTR-391. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55p.

Sisters Ranger District. District Files.

Soutiere, E.C. 1979. Effects of timber harvesting on marten in Maine. Journal of Wildlife Management. 43:850-860.

Thomas, Lord Walsingham. 1873. Lord Walsingham on deer. Proceedings of the Scientific Meetings of the Zoological Society of London for the year.

Thompson, I.D. and Harestad, A.S. 1994. Effects of logging on American martens with models for habitat management. In: Buskirk, S.W., Harestad, A.S., Raphael, M.G. comps eds. Martens, sables, and fishers: biology and conservation. Ithaca, NY: Cornell University Press: 355-367.

USDA Forest Service. 1992. Survey protocol for northern goshawk on National Forest lands in the Pacific Northwest region, September, 1992.

USDA Forest Service. 1995. Survey protocol for the great gray owl (Strix nubulosa).

USDA Forest Service. 1995. Deschutes National Forest: A Late Successional Overview. Deschutes National Forest, Bend, Oregon.

USDA Forest Service. 1996. Jack Canyon and Santiam Corridor Environmental Assessments. Sisters Ranger District. Deschutes National Forest.

USDA Forest Service. 1997. Santiam Restoration Environmental Assessment. Sisters Ranger District. Deschutes National Forest.

USDA Forest Service. 2000. Joint Aquatic and Terrestrial Programmatic Biological Assessment for the Deschutes and Ochoco National Forests.

USDA, USDI. 1994. Record of Decision and Standards and Guidelines for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owls (NW Forest Plan). Portland, Oregon. April.

USDA, USDI. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures. Portland, Oregon. January.

Washington Department of Wildlife. 1990. Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington. Olympia, WA.

Williams, G.W. 1992. Judge John B. Waldo: Letters and Journals from the High Cascades of Oregon, 1877-1907. USDA, Forest Service, Umpqua and Willamette National Forests.

Wilson, T. and Scott, A. 1976. That was yesterday: A history of the town of Sisters, Oregon and the surrounding area. Midstate Printing Inc., Redmond, Oregon. 113 pp.

APPENDIX A

DESIRED FUTURE CONDITION FOR LATE-SUCCESSIONAL RESERVE (Deschutes National Forest)

United States Department of Agriculture | Forest Service | Deschutes National Forest | 1645 Highway 20 East Bend, OR 97701

II-R-6 003

FILE COPY

File Code: 2400
Route To: 2600

Date: JUN 7 1995

Subject: Desired Future Conditions for Late Successional Reserve Assessments

To: Executive Team

Management of our Late Successional Reserves (LSRs) is one of our biggest challenges given our current forest health situations. Determining how much suitable habitat is appropriate, where to position it on the landscape, and how much risk is appropriate with unsustainable conditions requires a clearly defined process.

In order to insure a proper first step in determining the appropriate balance of desired and sustainable habitat in our LSRs, the Deschutes National Forest Executive Board (for the Forest Health Restoration program) requested the Deschutes Science Team (for the Forest Health Restoration Program) to prepare a process that addresses these needs.

The enclosed paper is the culmination of our science team's response to this request. Bear in mind that each site specific LSR will need analysis to determine the appropriate levels of both desired and sustainable habitat. Please use the science team's work in preparing assessments for your LSRs.

SALLY COLLINS
Forest Supervisor

Enclosure

DESIRED LATE SUCCESSIONAL RESERVE CONDITION

6/5/96

INTRODUCTION

According to the Northwest Forest Plan, the objective for Late Successional Reserves (LSRs) is to protect and maintain late successional and old growth habitats for the species dependent or are associated with them, including the northern spotted owl. However, the functional structural elements (snags/logs, canopy cover, canopy layers, size structure and any other special features) of this habitat have not been described. These descriptions have been left to individual Forests and ID teams to develop so that they could be appropriately site specific.

For many dry eastside plant associations, the very stand characteristics that define suitable habitat conditions for climatic climax late successional old growth dependent and associated species are often unsustainable. This is because these conditions have high susceptibility to epidemic insect attack and catastrophic wildfire. Thus, "protecting and maintaining" as much of this habitat as we can in the short term leads to not being able to maintain it in the long term. Since long term maintenance of late successional old growth habitat, distributed functionally across the landscape is essential for species viability, the dilemma of maintaining habitat conditions in the short term versus a continual supply of suitable habitat for the long term needs to be addressed.

The intent of the paper is to provide information in three topic areas to assist the Deschutes National Forest Late Successional Reserve Assessment teams while addressing the above issues in their analysis efforts:

First, specific descriptions of structural elements which comprise suitable habitat (both in terms of fire climax and climatic climax) will be provided for late successional old growth dependent and associated species for plant association groups (PAGs) specific to the Deschutes NF. The intent of these descriptions for suitable habitat is to present a range of conditions that provide habitat for successful reproduction and dispersal of young. They are not meant to be minimum habitat conditions.

Second, density levels and fuel profiles for suitable habitat conditions will be compared to density levels and fuel profiles required to sustain the stand (or landscape) over the long term. The degree of over lap between these two conditions will be clearly displayed.

Third, where there is little or no overlap between suitable habitat and sustainable vegetative conditions, a process for, as well as a prototype of "desired apportioning of successional stages", by plant association group will be provided. This apportioning seems to assure, at least to the best of our ability to analyze it, a continued supply of late successional old growth habitat in our LSRs over time.

DEFINITION OF LATE SUCCESSIONAL HABITAT

If we are to manage the LSRs to protect and maintain late successional old growth forests, it is critical that we have a clear understanding of what the term "late successional old growth" means in terms of the vegetation on the Deschutes NF. In otherwords, what types of forest structures and associated characteristics are we labeling as suitable late successional old growth habitat? A clear definition of the desired condition will result in more effective communication and evaluation of our efforts.

In the frequent fire adapted forests of the east Cascades, we (the science team) propose that there are actually two types of late successional old growth forests: climatic climax forests and fire climax forests. These two

states are very different both in terms of the species that use them and their relative sustainability. Thus, descriptions of specific key structural characteristics need to be provided for both types of conditions.

Climatic climax forests develop in the absence of fire. These forests are characterized by dense stands dominated by climax species (true fir and Douglas-fir on mixed conifer sites), but early seral species may be dominate in the overstory for a period of time, until high densities of late seral species use most of the moisture and nutrients so the early seral species cannot survive. All size classes are usually present and understories are often very dense. This climax community takes a long time to develop, perhaps several hundred years, primarily because combinations of local weather, elevations, aspects, productivity and disturbance agents do not provide conditions for frequent community level disturbance and change. A series of low or moderate intensity fires can change these stands to a fire climax condition. However, the more typical loss of the climatic climax condition occurs with stand replacement fires, or when the stand is converted to a pole sized condition as the larger trees die and the dense stand conditions prevent growth of replacement large trees.

Conversely, fire climax forests develop with frequent light to moderate intensity ground fires. These stands are characterized by open forests dominated by large trees of early seral species (most often ponderosa pine and Douglas-fir on the mixed conifer sites on the Deschutes NF). With the absence or suppression of fires, climax species (true fir) will increase on these sites and move them towards a climatic climax condition.

SUITABLE HABITAT BY PLANT ASSOCIATION GROUP

Methods: Individual Forest plant associations groups were identified. APPENDIX I provides an updated description and discussion of these plant association groups. The major PAG groups on the Forest consist of: Mountain Hemlock, Wet Mixed Conifer, Dry Mixed Conifer, Wet Ponderosa Pine, Dry Ponderosa Pine, Wet Lodgepole Pine, and Dry Lodgepole Pine. These descriptions can be modified in individual planning areas where other groupings make more sense for clarity of analysis.

Within select PAGs, the science team felt that there were two types of late successional old growth habitats: climatic climax and fire climax. All the PAGs were considered to have climatic climax conditions with 3 PAGs also having the fire climax condition: the dry mixed conifer, wet ponderosa pine and dry ponderosa pine PAGS. These three PAGs had frequent low intensity fires that maintained the late successional old growth fire climax habitat conditions historically.

The suitable late successional old growth habitat conditions for each plant association group were based on 10 selected mammalian and avian indicator species that utilize climatic climax and fire climax habitats. These species depend on or are associated with late and old structural characteristics for primary and secondary nesting, denning, roosting and foraging. Botanical species were not used as indicators due to insufficient data on late successional old growth habitat conditions. However, in the future, using plant indicators may add a dimension that is more closely tied to soil condition and mycorrhizal habitats. We started with approximately 118 wildlife species are dependent on or are associated with climatic climax and fire climax habitat conditions. Of these, only 40 species demonstrate selection for late successional old growth structural habitat and do not utilize earlier seral stages. Then through criteria determined through research, monitoring, and evaluation of habitat characteristics that provide essential habitat components for other late successional old growth dependent or associated species, we reduced the list of 40 species to 10 species.

We then translated key habitat features into measurable habitat characteristics. Structural characteristics that describe suitable late successional old growth habitat and that can be quantified include: snags/logs, canopy cover, canopy layers, trees per acre associated with a range of structural sizes, and special features. APPENDIX II describes the 10 indicator species structural habitat characteristics by individual plant

association group. These characteristics were based on literature that best describes eastside biological habitat conditions and on Forest habitat research. Using the habitat characteristics identified for each indicator species, a suitable habitat condition table for each plant association group could be built.

TABLE I displays the suitable habitat conditions for each plant association group, using the Cultus/Sheridan LSR data as a prototype.

Results: Habitat characteristics identified for each indicator species by plant association group are displayed in TABLE I, using the Cultus/Sheridan LSR data as a prototype. It is VERY IMPORTANT to review this table carefully. This table displays a range of suitable habitat conditions. This DOES NOT mean that the low end of the range is what should be managed for. In some instances when desirable and sustainable conditions do not over lap, choosing the lower end of the range may be appropriate but it should not be used across the landscape. Landscape level considerations and site specific analysis will help make those determinations. The table will be used by each LSR Assessment team. **Site specifically, the LSR Assessment teams will need to modify the contents depending on the actual plant associations that are most common within each PAG.**

Climatic climax habitat featured numerous canopy layers, a high degree of snag and log accumulations, and high stand densities. Conversely, suitable fire climax habitat featured a range of single to multiple canopy layers, low amounts of snags and logs, and lower stand densities. In both of these late successional old growth types, the large trees component was a significant structural element. In fact, it was a critical structural element.

TABLE I: SUITABLE HABITAT CONDITIONS BY PLANT ASSOCIATION GROUP

Suitable Habitat Condition by Plant Association Group

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥ 32"	Special Features and Key Tree Species
MH (Climatic)	25 - 40 tons/ac. or 2700 - 4300 ft²/ac.			TPA	275	80	80	17	24	24	25	25	AM - Within PAG retain ≥ 50% of forest stand in mature/old growth for linkage, blocks of mature/old growth must be linked to provide connectivity.
	Snags: 85% > 21" dbh (ex. 6-15/ac), 15% 15-21" dbh (ex. 2-3/ac)			BA	433	4	21	13	42	69	107	177	Tree Species: PIMO - Blister rust ABMAS - Heartrot
Indicators: AM, BO	Logs: 100% > 31" dia. and 33' long (ex. 7-24/ac)	ave 70%	2 - 3	Stand SDI	620	10	43	23	66	101	148	≥ 187	

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥32"	Special Features and Key Tree Species
MCW (Climatic) Indicators: PWP, NSO	25 - 35 tons/ac. or 2200 - 3100 ft³/ac. Snags: 60% 9-16" dbh (ex. 9-17/ac), 20% 16-25 dbh (ex. 1-2/ac), 20% >25"dbh (ex. 1-2/ac) Logs: 60% 16-25" dia. (ex. 7-16/ac), 40% >25" dia. (ex. 3-6/ac)	> 70%	2 - 3	TPA	357	150	70	70	30	15	12	10	PWP - Roosts stands of white fir with > 4 TPA >20" live or dead. NSO - ≥ 40% of white fir understory > 8" dbh. Tree Species: PIPO and PSME - Large Tree component LOAC, TSME, TABR - Species diversity
				BA	270	7	19	55	53	14	51	71	
				Stand SDI	476	18	37	97	85	66	74	≥ 78	

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥ 32"	Special Features and Key Tree Species
MCD (Climatic) Indicators: PWP, GGO, NG, BE, FO, BBWP	12 - 24 tons/ac. or 1100 - 2100 ft³/ac. **Snags:** 70% 12-20" dbh (ex. 3-9/ac), 30% > 20" dbh (ex. .75-2/ac) **Logs:** 100% > 15" dia. (ex. 5-14/ac)	ave 50%	2 - 3	TPA	218	80	50	35	20	15	11	7	PWP - Roosts stands of white fir with > 4 TPA >20" live or dead. GGO - Young owlets require dense cover and/or leaning trees to escape predation. NG - Maintain a diversity of large trees scattered through the stands, especially near small breaks in the canopy. BE - Insure large ponderosa pine and Douglas fir trees of the super canopy provide an open flight path from tree. Maintain large trees, especially snags along riparian edges that provide panoramic views and open exposure on at least one side. BBWP - Maintain trees with heart rot, gall rust cankers, trunk scars or mistletoe at just less than epidemic levels. Provide areas of dead or burned trees < 5 years old for foraging and roosting. **Tree Species:** PIPO, PSME - Large tree component PILA, LAOC, CADE3, TABR, ABMAS - species diversity
				BA	218	4	13	27	35	43	47	49	
				Stand SDI	343	9	27	48	57	66	68	≥ 55	
MCD (Fire) Indicators: BE, WHWP, FO	**Snags:** BE 1-2 > 25" WHWP,FO 1-5 > 25" **Logs:** BE 1-2 > 25" WHWP,FO 1-5 > 25"	30-50%	≥ 1	TPA	35+	0-80 ± 50%	0-50 ± 50%	0-35 ± 50%	10 ± 50%	7 ± 50%	11	7	
				BA	144	10 total			18	20	47	49	
				Stand SDI	195+	x	x	x	28	31	68	68	

PAG's	Snags/Logs (Tons/Acre & Ft³/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥ 32"	Special Features and Key Tree Species
PPW (Climatic) Indicators: FO, WHWP	12 - 24 tons/ac. or 500 - 2200 ft³/ac. Snags: 50% 18-28" dbh (ex. .5-3/ac) 50% > 28" dbh (ex. .25-1.5/ac) Logs: 100% > 20" dia. (ex. 1-9/ac)	> 40%	≥ 1	TPA	187	40	40	40	20	17	20	10	WHWP - Old growth should be maintain at > 37% over the PAG. Tree Species: PIPO - Large tree component PICO - species diversity
				BA	285	2	11	31	35	49	86	71	
				Stand SDI	433	5	21	55	57	74	124	≥ 78	
PPW (Fire) Indicators: BE, WHWP, FO	Snags: BE 1-2 > 25" WHWP,FO 1-5 > 25" Logs: BE 1-2 > 25" WHWP,FO 1-5 > 25"	30 - 50%	≥ 1	TPA	35+	0-80 ± 50%	0-50 ± 50%	0-35 ± 50%	10 ± 50%	7 ± 50%	11	7	
				BA	144	10 total			18	20	47	49	
				Stand SDI	195+	x	x	x	28	31	68	68	

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥ 32"	Special Features and Key Tree Species
PPD (Climatic) Indicators: WHWP, NG	10-15 tons/ac. or 900 - 1300 ft²/ac. Snags: 15% 10-12"dbh (ex. 2.5-5/ac), 30% 12-20"dbh (ex. 1-2.5/ac), 25% 20-31"dbh (ex. .25-.75/ac) 30% > 31" dbh (ex. .25-.5/ac) Logs: 100% >20" dia. (ex. 7-15/ac)	ave 40%	≥ 1	TPA	180	40	40	40	20	15	15	10	WHWP - Old growth should be maintain at > 37% over the PAG. NG - Maintain a diversity of large trees scattered through the stands, especially near small breaks in the canopy. Tree Species: PIPO - Large tree component PICO - Species diversity
				BA	232	2	11	31	35	18	64	71	
				Stand SDI	394	5	21	55	57	66	93	≥ 78	
PPD (Fire) Indicators: BE, WHWP, FO	Snags: BE 1-2 > 25" WHWP,FO 1-5 > 25" Logs: BE 1-2 > 25" WHWP,FO 1-5 > 25"	30 -50%	≥ 1	TPA	35+	0-80 ± 50%	0-50 ± 50%	0-35 ± 50%	10 ± 50%	7 ± 50%			
				BA	144	10 total			18	20	47	49	
				Stand SDI	195+	x	x	x	28	31	68	68	

3e

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥32"	Special Features and Key Tree Species
LPW (Climatic) Indicators: BBWP, GGO, NG	12 - 24 tons/ac. or 1000 - 2150 ft²/ac. **Snags:** 50% 11-20" dbh (ex. 3-8.5/ac) 50% > 20" dbh (ex. 1-3.5/ac) **Logs:** 50% 11-15" dia. (ex. 13-43/ac) 50% > 15" dia. (ex. 6-19/ac)	ave 60%	≥ 1	TPA	370	150	120	70	20	10			BBWP - Maintain trees with heart rot, gall rust cankers, trunk scars or mistletoe at just less than epidemic levels. Provide areas of dead or burned trees < 5 years old for foraging and roosting. GGO - Young owlets require dense cover and/or leaning trees to escape predation. NG - Maintain a diversity of large trees scattered through the stands, especially near small breaks in the canopy. **Tree Species:** PIEN PICO
				BA	158	7	32	55	35	29			
				Stand SDI	278	18	65	96	56	43			

3d

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥ 32"	Special Features and Key Tree Species
LPD (Climatic) (High elevation Lodgepole pine plant associations including those adjacent to Mt. Hemlock) Indicators: BBWP	8 - 12 tons/ac. or 700 - 1000 ft²/ac. Snags: 100% ≥ 11" dbh (ex. 13-27/ac) Logs: 100% ≥ 11" dia. (ex. 34-72/ac)	ave 40%	≥ 1	TPA	360	150	170	40					BBWP - Maintain trees with heart rot, gall rust cankers, trunk scars or mistletoe at just less than epidemic levels. Provide areas of dead or burned trees < 5 years old for foraging and roosting. Tree Species: PICO ABMAS PIAL PIMO
				BA	83	7	45	31					
				Stand SDI	164	18	91	55					

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥32"	Special Features and Key Tree Species
LPD (Climatic) (Lower elevations of Lodgepole pine plant associations) Indicators: BBWP, GGO, NG	8 - 12 tons/ac. or 700- 1000 ft³/ac. Snags: 100% ≥ 11" dbh (ex. 13-27/ac) Logs: 100% ≥ 11" dia. (ex. 34-72/ac)	ave 40%	≥ 1	TPA	353	150	120	70	13				BBWP - Maintain trees with heart rot, gall rust cankers, trunk scars or mistletoe at just less than epidemic levels. Provide areas of dead or burned trees < 5 years old for foraging and roosting. GGO - Young owlets require dense cover and/or leaning trees to escape predation. NG - Maintain a diversity of large trees scattered through the stands, especially near small breaks in the canopy. Tree Species: PICO
				BA	117	7	32	55	23				
				Stand SDI	214	18	64	96	36				

35

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	Pole 5.0 - 8.9"	Small 1 9.0 - 14.9"	Small 2 15.0 - 20.9"	Med 1 21 - 24.9"	Med 2 25 -31.9"	Large ≥32"	Special Features and Key Tree Species
Unique Habitats (Climatic)													
Engelmann Spruce	25 - 35 tons/ac. or 2700 - 3700 ft³/ac. **Snags:** 50% 15-20" dbh (ex. 5.5-11/ac) 50% > 20" dbh (ex. 2.5-5/ac) **Logs:** 100% ≥ 15" dia. (ex. 21-43/ac)	50 - 100%	2 - 3	TPA	275	100	70	40	25	15	15	10	Tree Species: PIEN PICO
				BA	277	5	19	31	44	43	64	71	
				Stand SDI	418	12	38	55	69	63	89	≥75	
Aspen	When regeneration is no longer occurring, manipulation would occur in a mosaic pattern throughtout stand.												
Meadows	When tree encroachment reaches a 30% loss of meadow when compared to 1959 photos, meadow restoration would occur.												
Willow Patches	When willow patches reach 80% decadence, treatment of 20% of the willows would occur. This would be random shrubs throughout the patch.												

COMPARISON OF SUITABLE HABITAT WITH SUSTAINABILITY

Methods: For our purposes, we defined on site vegetation sustainability as a condition that:

> Is not likely to experience significant negative change in habitat quality as a result of epidemic insect or disease attack or catastrophic wildfire.

Suitable habitat (both climatic climax and fire climax) was compared with on site vegetative sustainability by individual plant association group. Stand density index and fuel profile descriptions were used as quantifiers of sustainability. These factors best determine the Deschutes NF vegetative conditions and best represent the risk of bark beetle epidemics and or extreme crown fire behavior. Bark beetle attack and high intensity wildfires were chosen as indicators since these disturbance agents are the most common cause of significant and unexpected large tree mortality (large trees are a critical element of both climatic climax and fire climax types, and also take the longest time to replace). Risk to bark beetle attack was measured using stand density index stocking guides developed by Cochran et al, 1994, for the Blue Mountains, together with adjustments and equations for plant associations groups found on the Deschutes NF but not included in Cochran's guide, (Booser et al. 1996). Fuel profiles were determined using the Morehead and Vickery model, equating tons per acre/cubic feet with wildlife habitat. Then photo series for quantifying forest residues (tons per acre) and the risk of catastrophic wildfire was displayed by plant association group.

Results: We found that suitable climatic climax habitat and densities required for on site vegetative sustainability did not overlap. For example, in mixed conifer dry, suitable climatic climax habitat is almost twice the upper management zone! Therefore, some process of cycling of the suitable habitat (habitat that is not vegetatively sustainable) and sustainable stand densities across the landscape overtime needs to be developed

TABLE II, compares suitable late successional old growth habitat (climatic climax and fire climax) conditions, with on site sustainable vegetative conditions and with existing LSR conditions by plant association groups. Suitable habitat conditions are displayed using trees per acre, the stand density index value, species composition and fuel loadings (snags and logs). These numbers are the summation of the values indicated on the suitable habitat condition table. On site sustainable vegetative conditions are defined by the Deschutes SDI values for the upper management zone (UMZ). "Sustainability" is defined by PAG and is a measure of a percent of stocking (SDI UMZ) that an individual plant association may be able to support. This SDI UMZ figure may be different than the SDI values shown in the first column for suitable habitat conditions. Remember, suitable habitat is based on species biological requirements, and sustainable forest conditions (DNF index) are based on what an individual plant association may be able to support overtime. These calculations of sustainability were intended to be a prototype since they were made using the specific vegetative conditions within the Cultus and Sheridan LSR. Existing Cultus and Sheridan LSR conditions in terms of density and fuel loading form the final column. Each LSR Assessment team will then need to adjust the range for suitable habitat based on adjustments to TABLE I and the range of sustainable forest conditions compatible with their unique mix of plant association within each PAG and the ranges in site quality of each plant association group.

It is important to note that TABLE II provides a rough comparison of suitable habitat versus sustainable forest conditions pertinent to the Cultus and Sheridan LSRs. The table does, however, represent the process we would like the LSR Assessment teams to use. **Thus, each LSR Assessment team will need to modify the columns based on individual plant associations that are most common within each PAG within their specific locations, as well as the site potential of those plant association groups.**

From these results, it appears that some process of cycling of the transient suitable habitat within the LSR overtime needs to be developed.

TABLE II: summary and comparison of conditions quantifiable between suitable habitat conditions, on site sustainable vegetative forest conditions and LSR existing conditions based on the best available data, using the Cultus/Sheridan LSR as a prototype.

PAG	SUITABLE HABITAT (1) DENSITY		FUELS	SUSTAINABLE (2) DENSITY	FUELS	EXISTING CONDITION (3)	
	TPA	SDI	TONS/AC	UMZ (SDI)	TONS/AC	SDI	TOT ACRES
MH	220-330	411-620	25-40 tons	256	< 40 tons	xxx	xxx
climatic MCW	284-430	365-581	25-35 tons	202	< 35 tons	xxx	4925
climatic MCD	175-261	279-405	12-24tons	156	<24 tons	xxx	9698
fire MCD	23-294	141-373	LOW	156	LOW	xxx	xxx
climatic PPW	150-224	347-535	12-24 tons	145	< 24 tons	xxx	487
fire PPW	23-294	141-373	LOW	145	LOW	xxx	xxx
climatic PPD	144-216	313-472	10-15 tons	102	< 15 tons	xxx	2802
fire PPD	8-273	27-216	LOW	102	LOW	xxx	xxx
LPW	296-444	222-353	12-24 tons	161	< 24 tons	xxx	1310
LPD	288-432	132-198	8-12 tons	80	< 12 tons	xxx	303
mid - low elev LPD	282-424	172-259	8-12 tons	161	< 12 tons	xxx	618

(1)Within the PAG, the plant association that was predominant within the LSRs is identified. This major plant association was used to identify which DNF indexes were used for the PAG. IF there are several major plant associations, a range of UMZ's could be used here. For subsequent site specific project analysis, the best site specific data available will be used for density prescriptions, keeping areas below the UMZ in order to sustain or create future suitable conditions, wherever possible, while still providing current, but perhaps unsustainable habitat as well, to meet current suitable late successional old growth habitat needs.

(2) Based on Cochran et al. 1994, Joanna Booser and Jim White developed the paper "Calculating Maximum Stand Density Indexes (SDI) for the Deschutes National Forest Plant Associations", 1996, that was used in determining the above table's values. Cochran advised using the lowest plant association values within the PAGs as the index. Again, the approach here was to use the UMZ of the major plant association (or major plant associations) in the PAG, which pushes management closer to the unsustainable level, but allows leaving more short term suitable habitat. The best available site specific density values will be used when managing specific stands overtime across the landscape, not the lumped PAG value used here for broadscale planning purposes.

UMZ - For most species, the upper management zone is defined as the density level at which a suppressed class of trees begins to develop (Cochran et al. 1994). This is the point at which sufficient competition is happening between trees to cause some trees to begin to slow down in growth, even to the point of death. The primary cause is that, on any given piece of ground, there are limits to the resources available for plant growth. These resources include light, water, nutrients, and growing space. When these limits are reached, loss of plant growth and/or mortality are common elements of the stand. These conditions can be ideal for certain late successional old growth plant and animal species. However, they are often providing the ideal habitat conditions only after there has been sufficient limitations of previous density levels that allowed a large tree component to develop. Historically, these limitations were provided in drier plant associations by frequent fire intervals which tended to limit development of understories and favored growth of the forest with overstory trees.

In ponderosa pine or lodgepole pine, the UMZ is calculated somewhat differently from the other species. This was recommended by Cochran et al. 1994, to show the level above which higher levels of large tree mortality are much more likely to occur. For these tree species, the UMZ correlates to a high risk threshold for markedly increased tree mortality due to many of the forest pests which are dependent on density and lower tree growth for epidemic levels to be reached. Other factors besides density, such as species composition, must be considered for the density independent forest pests such as the fir engraver beetles and spruce budworm. However, the use of UMZ in stands which are typically not hosts to density dependent pests is still recommended if the desire is to let small trees grow to large trees more quickly and safely

especially where large trees are in short supply. This is because the presence of a suppressed class of trees would indicate average tree growth in the stand is beginning to slow down, perhaps significantly.

(3) SDI and Total Acres - These numbers only relate to the Cultus/Sheridan LSR Assessment. Each site specific LSR Assessment team will need to determine their appropriate existing vegetative conditions.

CRITERIA USED TO CYCLE AND SUSTAIN DESIRED LATE SUCCESSIONAL OLD GROWTH CONDITIONS WITHIN THE LSRS

We believe that successful management of the Forest LSRs should result in the satisfaction of two criteria: 1) minimum critical thresholds should be maintained over the short term and 2) sustaining habitat above this threshold over the long term. This section reviews whether we can simultaneously satisfy both criteria at the same time.

Methods:

Critical Minimum Thresholds:

Minimum critical habitat thresholds for the northern spotted owl (climatic climax indicator species) have been set by the U.S. Fish and Wildlife Service, USDI, 1992. These thresholds were used in determining the amount and size/structure distribution of suitable late successional old growth habitat for the owl and other dependent and associated wildlife species within the LSR. The USFWS thresholds are a measure of suitable habitat within the owls home range radius. Calculations indicate that a minimum number of suitable climatic climax habitat acres for each LSR. The number of northern spotted owl pairs within the LSR were determined using the USDI Final Draft Recovery Plan for the Northern spotted Owl, December 1992. The minimum acres within each LSR are as follows: Davis LSR, 9,264 acres or 19 % of LSR; Metolius LSR, 10,422 acres or 14 % of LSR; and Cultus/ Sheridan LSR, 6948 acres, 13 % of LSR.

For fire climax species, like the northern bald eagle, there are no exact numbers that can be calculated. However, there are guidelines that do provide sideboards. For example, Bald Eagle Management Areas (DNF LRMP), and the US Fish and Wildlife Service recovery plan population density criteria provide specific management direction.

Historic Range of Variability was used as a frame of reference when addressing all species viability. A pivotal assumption in the use of HRV is that an element or process that is outside the range or natural variability cannot be sustained naturally (Caraher et al. 1992). Native species have adapted to the natural disturbance events of the Holocene (the past 10,000 years) environment and require those conditions for their survival (Swanson et al. 1993). Thus, through the watershed analysis process, we developed ranges of variability for our plant association groups.

Suitable habitat was examined from a spatial standpoint. Basically we were looking at quantity of, distribution and fragmentation of that habitat on a landscape level. This element was used to adjust critical habitat threshold levels above the minimum levels set by the USFWS and levels described by HRV. This was a very important element in the decision matrix since critical habitat must also be functionally distributed.

In summary, the above 4 elements were considered in and were used to develop estimated species thresholds. For example, in the mixed conifer wet plant association group, we first factored the USFWS habitat threshold for the northern spotted owl of 40 % suitable habitat within the owl's home range radius. By LSR this varies from 13 - 19 percent of the total LSR acreage, see above. We then estimated the distribution and amount of suitable habitat, without regard to land allocation, on a landscape level. This gave a picture of how suitable habitat was distributed on the Deschutes NF and adjoining Forests. Lastly using to the Historic Range of Variability, a range from 11-43 % was in either climatic climax or fire climax habitats. Thus, when these elements were factored together, along with an additional factor of how little the mixed conifer wet PAG made up of the LSR, we determined the percentage for the suitable habitat threshold.

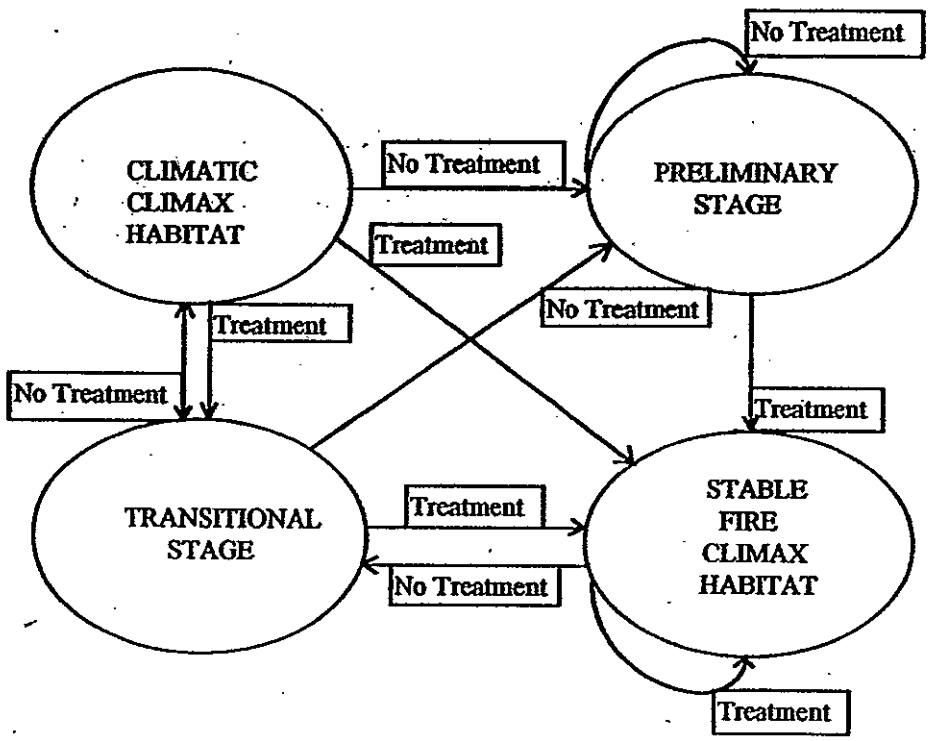
Cycling Suitable Habitat:

In order estimate how much suitable habitat could be consistently sustained in the LSR overtime, we used two approaches. First we developed a conceptual flow model to visualize how we might approach cycling of late

successional old growth habitat across the landscape, FIGURE I. In this model landscape vegetation was divided into four stages: 1) preliminary vegetation stage; 2) stable fire climax suitable habitat stage; 3) transition vegetation stage; and 4) climatic climax suitable habitat stage. Movement between the 4 vegetation stages, as a result of no management versus management (thinning to below the upper management zone) was also theorized. Rates of flow between the 4 vegetation stages were assumed based on general forest growth relationships and general forest pest behavior and impacts specific to central Oregon.

Second, we used the Historic Range of Variability to visualize how natural processes cycled the vegetation. The HRV numbers were taken from the watershed analysis for Odell and Metolius WA.

FIGURE I - Conceptual Flow Model of cycling suitable habitat in response to treatment (1) or no treatment.



(1) Treatment consists of stocking control measures that result in on site stability and this promotes the growth and retention of large tree dominated forests.

The 4 vegetation stages are described in detail as follows:

Preliminary vegetation: Stands falling into this group, do not satisfy the requirements of either climatic climax or fire climax dependent or associated species. These stands encompass a wide range of structures and densities but share the common characteristic that large trees are not prevalent.

Management of these stands should emphasized growth into the late successional old growth condition as quickly as possible. Management activities in high risk stands could move them towards this group by thinning to lower susceptibility to bark beetles so existing trees can rapidly continue their development towards large trees. It may also take the form of a prescribe burn to remove

hazardous levels of fuels. In the frequent fire adapted ecosystems, lack of management will result in cycling from other categories back to this category for many stands as a result of insect and disease attack and catastrophic wildfire.

Stable fire climax suitable habitat: Stands falling into this group of vegetation satisfy the requirements for suitable fire climax habitat and they are below the upper management zones. Without density management, or the re-introduction of fire, these stand types often progress into the unstable fire climax stage described below and may progress into unstable climatic climax suitable habitat. Continued density reduction through mechanical thinning or thinning by prescribed fire will maintain stands in this category.

Transitional vegetation: The condition that exists when stable fire climax vegetation transitions increases in density and becomes unstable fire climax but not yet suitable climatic climax. This condition is above the upper management zone but below the density levels or large tree sizes required to achieve the necessary structural attributes for climatic climax suitable habitat. Management in these stands should focus on developing the large tree component for climatic climax, developing the understory conditions needed for climatic climax when the large tree structure is already present, or density reduction to return the stand to suitable fire climax conditions.

Climatic climax suitable habitat: This group has the structural attributes necessary for climatic climax late successional old growth habitat, i.e. nesting, roosting and foraging habitat for the northern spotted owl. In most situations, this habitat cannot be managed both to retain these essential characteristics and be below the upper management zone. In some cases, however, it could be thinned, prior to some natural endemic advent, to a fire climax late successional old growth condition which is stable and could, in a relatively short period of time once again be suitable climatic climax. This action might be appropriate if there are disproportionately large amounts of climatic climax and small amounts of fire climax. Without treatment this vegetation group will revert to some variation of the preliminary vegetation stage or less likely to transitional vegetation.

Under active management and no management scenarios, it is very likely that the stand would not remain over time as climatic climax habitat. The difference would be that under active management the desired large tree structure could likely be retained over time; under no management it would likely not be retained.

Using one to several rotation cycles for each plant association group, we cycled structural stages through time, so there will be habitat on line to replace existing habitat when it no longer functions. Estimated growth, the use of the upper management zone (UMZ) to help determine levels of sustainability, and mortality rates were used to help determine realistic cycles. Suitable habitat decline will most likely be as a result of insect, and/or disease attack or wildfire.

TABLE III represents a visual display of the criteria, giving a quantitative representation to these criteria and size structure groups using percentages or a range of percentages.. Because the landscape was so fragmented and the amount of remaining suitable habitat was only found within the LSR, we found that spatial considerations were very important when determining suitable habitat thresholds. Concerns about the spatial distribution of habitat resulted in higher levels of habitat compared to the USFWS thresholds and historic levels. These concerns only applied to the mixed conifer plant association groups.

TABLE III EVALUATION CRITERIA,USING THE CULTUS/SHERIDAN LSR AS A PROTOTYPE.

SIZE STRUCTURE	SUIT HAB. THRESHOLDS, .% of Acres in ea size class				CYCLING (1) % of Acres in ea size class				HRV % of Acres in ea size class				
	MCW	MCD	PPW/D	LPPW/D	MCW	MCD	PPW/D	LPPW/D	MCW	MCD	PPW/D	LPPW/D	HM
SEED/SAP (2) 0-5"	-	*	*	25	6	7	5	25	0-40 0-25	0-40*	5-50	0-80 0-60	0-3
POLE (2) 5-9"	-	*	*	25	7	7	5	25	3-30* 23-80*	*	28-100*	10-80	0-40
SMALL (2) 9-21"	40	30*	40*	50	12	15	10	50	0-32 *	32-100* *	* 2-50	10-100 10-60	0-50
MEDIUM (3) 21-32"	60*	60c/10f*	5c/55f*	-	25	38	20	-	11-43*	23-90*	20-70*	0+	5-20*
LATE/OLD (3) >32"	*	*	*	-	50	33	60	-	*	*	*	-	*

(1) Different rotation lengths were used for each plant association group. These rotation lengths (untill regeneration is required) are as follows: MH, 600-1200 + years; MCW, 400 years; MCD 350 years; PPW/D, 500 years and LPPW/D, 100 years. The number of years within each structural group maybe calculated by multiplying the percent (as a decimal) in the table by the rotation length.

(2) These two size/structure classes represent the preliminary stage.

(3) These size/structure class represents either the stable fire climax habitat stage, transitional stage or the climatic climax habitat stage.

* - Percentage is shared between size structure classes, either up or down the size scale.
c - Climatic climax.
f - Fire climax.

Within the HRV column, note 2 sets of numbers. These represent figures from the Cascade Lakes and Odell Watershed Analysis.

Results: TABLE IV represents the integration of the above criteria to achieve a proposed distribution of vegetative conditions by plant association group across the landscape. Vegetation conditions are divided into 4 groups: 1) Preliminary vegetative conditions that are not large tree dominated. It recommended that these preliminary stage stands be managed below the upper management zone to hasten the development of large; 2) Suitable habitat -- fire climax; 3) Vegetative conditions that are above the upper management zone but are less than suitable habitat and is transitional stage in Figure I; and 4) Suitable habitat-- climatic climax. We propose that if the four conditions are well distributed in the displayed proportions across the LSR, that with management, a continual supply of suitable habitat can be maintained over the long term.

These percentages, since they are derived from integration of the species and tree growth data specific to each LSR, will vary somewhat based on the plant associations that make up the majority of each PAG, and the wildlife species that use these habitats.

TABLE IV: DESIRED AMOUNTS OF 4 TYPES OF VEGETATIVE CONDITIONS

PAG (1)	PRELIMINARY STAGE (2)	SUITABLE HABITAT % FIRE (3)	TRANSITIONAL STAGE (4)	SUITABLE HABITAT % CLIMATIC (5)
MH	15 (0-30)	NA	15 (0-30)	70 (40-70)
MCW	30 (20-40)	NA	10 (0-20)	60 (50-70)
MCD	25 (20-30)	10 (5-10)	25 (20-30)	40 (30-50)
PPW/D	20 (10-30)	55 (40-70)	20 (10-30)	5 (0-10)
PPW/D FORESTED LAVAS	20 (10-30)	5 (0-10)	20 (10-30)	55 (40-70)
LPW/D	40 (20-60)	NA	10 (0-20)	50 (30-70)

DESCRIPTION OF THE COLUMNS

(1) Plant Association Groups - are the combinations of plant associations, described by Volland, 1988, grouped according to productivity and growth potential. All plant association groups are the groupings defined by the science team meeting of February 22, 1996. Those groupings match the groupings in the WEAVE document with a few changes/exception as noted in the notes from the February 22 meeting. It should be noted that while PAGs work well as guidelines for landscape analysis, specific plant associations or individual stand measurements where available, must be used for site specific prescriptions to best meet long term habitat objectives

(2) vegetative conditions that are below the upper management zone, thus, sustainable. See figure I, this column relates to the preliminary stage. UMZ defines the point at which a suppressed class of trees begins to develop or high risk threshold of density related insect - indexed mortality for large pines is reached. In other words, the stand can maximize growth with little or no threat from insect attack. When prescribing management in these stands, consideration should be given to the conifer species and diameter mix desired to move these stands towards late successional old growth suitable habitat conditions.

(3) Suitable habitat -- fire climax conditions - as quantitatively described in TABLE I. See figure I, this column relates to the stable fire climax habitat stage.

(4) vegetative conditions that are above the upper management zone but are less than suitable habitat, describes a range of conditions between these two quantitative points. See figure I, this column relates to the transitional stage.

(5) Suitable habitat -- climatic climax conditions - as quantitatively described in TABLE I. See figure I, this column relates to the climatic climax stage.

It is important for readers to understand that the objective of all management within the LSRs, is to provide suitable late successional old growth habitat for the long term. Stands in column 5 (less than the UMZ) must be managed to provide big trees of long-lived species like ponderosa pine and Douglas fir in a short period of time. Wise management of these stands will set the stage for moving into column 4 (above the UMZ) where these stands should meet the large tree criteria of suitable habitat. Stands in column 4 should continue to be managed to encourage development of large tree structure to replace loss of habitat in column 1 over time.

The mixed conifer dry PAG generated the most discussion and discomfort with relative percentages generated for columns 2-4, both in terms of suitability and sustainability.

> The minimum critical thresholds of suitable habitat were the base starting point in building the desired condition table for late successional old growth habitat conditions. **It is very important to note that the LSR should not be managed for the minimums but rather as optimal habitat for late successional old growth habitats for those dependent or associated species.**
>
> Estimated time frames for how long those late successional old growth conditions might last and how long it would take to grow those conditions back from a regenerated stand were considered for various structural stages and the length of time in each of those stages.
>
> > In mixed conifer dry, it was estimated that it would take 250 to 350 years to grow late successional old growth conditions from a regenerated stand (if managed).
> >
> > Depending upon the plant association group, it was estimated that the suitable habitat conditions would last in the mixed conifer wet PAGs approximately 60 years and within the mixed conifer dry PAGs approximately 30 years.
> >
> > It was also determined that on a 300 year rotation, you could only have 1/6 (about 17%) of the land area in suitable habitat on a sustainable basis.
>
> With management, stands in the mixed conifer PAGs could have the species mix kept to a fairly resistant mix for defoliators, and could allow manageable losses of bark-beetle susceptible trees. This might then let us get up to 40% of the PAG in a fairly sustainable suitable habitat connotation, with replacement stands coming along in the appropriate structural conditions.

SUMMARY

Several important conclusions may be drawn as a result of this paper. First, in order to effectively manage our LSRs, we must be able to define what the late successional old growth suitable habitat conditions are for both climatic climax and fire climax forests. The definition must make ecological sense, and must be measurable and practical on the ground. TABLE I provides the framework to fully describe suitable habitat conditions for the plant association groups on the Deschutes NF, based on the characteristics of the major plant associations within those groups. **Each LSR Assessment team will need to adjust the contents of TABLE I to fit the actual plant associations that are most common within their LSR, for each plant association group.**

Second, most of our suitable climatic climax habitat conditions within our LSRs are often not sustainable for any period of time. Meeting suitable climatic climax habitat conditions for late successional old growth species and keeping the stands below the upper management zone are not compatible as clearly displayed in TABLE II.

Lastly, a strategy of rotating late successional old growth habitat through several vegetative structural stages and across the landscape through management seems to be appropriate. It also appears doable using the USFWS minimum thresholds and historic range of variability. However, it may not be achievable at this time due to quantity of -, distribution and fragmentation of the suitable mixed conifer late successional old growth habitats on a landscape level that currently exists within our LSRs. An aerial view of our landscape shows that almost all of our late successional old growth habitat is within our LSRs. Even inside our LSRs, the landscape is heavily fragmented. The balance of the landscape is also heavily fragmented with few residual stands of late successional old growth habitat.

Most of the plant association groups on the Forest and in general, eastside forests, are not able to provide large sustainable contiguous blocks of suitable northern spotted owl habitat, i.e. climatic climax habitat. Historically, on the Deschutes NF it is believed that owl habitat was limited to the wet mixed conifer and moist north aspect dry mixed conifer PAGs. The pattern of this habitat was in a mosaic distribution, intermixed with earlier seral stages. The number of owls on the Forest probably varied significantly through time depending on the amount of available habitat. Currently, the Deschutes NF has 34 owl pairs utilizing fragmented habitat, of which only a few are reproductively successful on an annual basis. This number may be the highest density of owls the Deschutes NF has yet experienced and may not be sustainable overtime. Never-the-less, this plan is designed to provide enough suitable habitat for all current owl pairs within the LSRs. The consequence of this strategy is that a large percentage of several PAGs are in an unstable condition which means that they are at high risk of epidemic insect and disease attack and catastrophic wildfire. In the short term this may not be a problem because there is an excess amount of habitat in the Transitional and Suitable Climatic Climax Habitat Stage (TABLE IV). Therefore, it will take several years of vegetative treatments just to get these PAGs down to the upper limits desplayed in TABLE IV. In the long term, however, the Forest will need to evaluate the risks of maintaining large protions of the Forest in an unstable condition. This may result in a lowering of the percentages of various PAGs in the unstable categories. This, in turn, will result in a re-calculation of the number of northern spotted owls the Forest can support.

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APPENDIX II: HABITAT STRUCTURE CHARACTERISTICS FOR THE 10 INDICATOR SPECIES.

Habitat Structure Characteristics Summary Sheet

Species	PAG's	Snags	Logs	Canopy Cover	Canopy Layers	Tree Size/ Trees per Acre	Basal Area	Home Range	Special Features
American Marten (AM)	MH	*18 >31" 13' tall (E), *class 2 & 3 (G) * 20-35/ac (H) *>20" at rest sites >31" at den sites (C)	*8-20/ac (H) * > 31" and 33' (E) 16/acre *>20" at rest sites >31" at den sites Intermediate decay class (C)	*40-60% at rest and forage sites Avoids stands <30% (F) *71% ave 83% (G)	*2-3	*Rest Sites >20"dbh - 50% *>39"dbh- 50% (C) *20-30" dbh (G) Den Sites *>31" dbh (C) *31-49" dbh (I)	*131-262 ft²/ac (D), *126-252 ft²/ac (I) *167-192 ft²/ac (G)	Female *3.9 mi² (C), *1.8-9.6 mi² (D), *1 mi² (H) Male * 6.7 mi² (C), *4.4-21.2 mi² (D), *2-4 mi² (H) *1-2 mi² (I)	*w/in 1-5 mi² retain ≥50% of forest stand in mature/OG for linkage, blocks of mature/OG must be linked to provide connectivity (H) *Needs at least 160 acre blocks of suitable habitat (E)
Boreal owl (BO)	MH	*2-3 > 15" 1-7/acre >15" at nest sites 2.4/acre >15" at roost sites (J)		*30-63% *Roosting- Winter-58% Summer-63% 44% average at roost sites 26-34% at nest sites (J)	*2-3	Nest Sites *23 (± 6) TPA >15" 1-9" (161± 66 TPA)) *Roosts: Winter 656 TPA 1-9":67 TPA >9" Summer 1060 TPA 1-9" 84 TPA >9" Combined 6 tpa >15" (J)	*78 (± 14) ft²/ac Roosting- Winter 113 ft²/ac Summer 130ft²/ac (J)	Winter *5.6 mi², Summer 4.5 mi² (J)	
Pileated Woodpecker (PWP)	MCW & MCD	* ≥3/ac >20" (K) *Forage >12" (I)	*Recommended 40/ac ≥ 15" (K) *Mean density 117/acre ≥ 15"	* ≥ 60% (K)	*2-3	*28", roosts (L) *>8" >20", roost >9", foraging >21", nest tree (I)		*1.6 mi²(K) *543 acres/pair (I)	*Roost stands of Grand fir >4/ac > 20" live & dead (L)

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Species	PAG's	Snags	Logs	Canopy Cover	Canopy Layers	Tree Size/ Trees per Acre	Basal Area	Home Range	Special Features
Northern Spotted Owl (NSO)	MCW	*8/ac ≥ 16" (M) * >5/ac (>25") >6/ac (16-25") 16 >25" (N) *>16/ac (9-16") 12/ac >15" (O)	*15/ac ≥ 10" (M) * >8/ac (16-25") >5/ac (>25") (N) *15/ac >15" (O)	*60-65% (M) *70-100% 63-67% (N) *75% (O)	*2-3	*OS - ≥ 8 TPA ≥ 21" 2L - ≥ 82 TPA ≤ 21" (M) *70-90 tpa (5-9") 50-70 (9-16") 20-30 (16-25") 12-19 (>25") (N) * OS -22 TPA ≥25" 2L - 280 TPA (O)	*180-210 ft²/acre (Range 135-350) (N)		*>40% white fir understory > 8", Patch size, 40-200 acres of suitable habitat (M)
Bald Eagle (BE)	MCD			*OS <20% (Range 20-40%) 2L-20-40% Overall - 20-40% (<70%) (R)	*1-2 (R)	*OS- 8.5 TPA >44"(Range 1-30 TPA) 2L - 40 TPA 20" (R)		*10-15 mi² Distance between occupied nests .6-2 miles (Q)	*Nest tree has open flight path and panoramic view, Perching w/in 165' of H2O, typically in snags, tallest tree along shoreline w/panoramic view & open exposure on at least one side (Q)
Flammulated Owl (FO)	PPW MCD	* > 28" dbh (S) * 22 ± 4.7", 28 ± 5.7" 11.8 - 22.8, nests in snags(J)		* <50% (T) *35-70% (J)	* >1 Roosts >2 (J)	*28" dbh, nest trees 134 ± 59 TPA, 238 ± 182 TPA Roosts - 800 TPA (J) >19.6" dbh (S) *7.8-19.6" surrounding stand (T)	*103 ± 84.6 ft²/ac Roosts - 562 ft²/ac (J)	Male * 25 acres (I)	*Roost- select PP w/in MC stands, avoids pure PP (J)

Species	PAG's	Snags	Logs	Canopy Cover	Canopy Layers	Tree Size/ Trees per Acre	Basal Area	Home Range	Special Features
White-headed Woodpecker (WHWP)	PPW PPD	Nests * >31" (V) * > 18" (Range 9-39), nests(I) *1 snag/ac, 26" nests, (W) Roosts * >24" (V) *45/100 ac 10", 82/100 ac 12", 45/100 ac 20" (X) *Decay Class 2-4 (V)		* Nest < 26% (W) * 24%(mean) Roosts, 44% (V)	* > 1 (W)	*Nest Areas ≤166 TPA (X) * Foraging > 20" (I) *10 TPA > 21" or 2 TPA > 31" >24" dbh, forage nest av. 26" ,range, 8-31" (W) *Mean 31" dbh, nest 24" dbh, roost 29" dbh, forage (Y)	* ≥ 40 ft²/ac lg trees Nest sites, 15-22 ft²/acre (V)	*.8-1.3 mi². In contiguous stands, 524 acres (V) *1.7 mi² (0.18-3mi²) 261 acres in pur OG stands (W)	* home ranges should contain > 37% OG (V) * Forages in live trees, secondarily use snags (W)
Black-backed Woodpecker (BBWP)	LPW LPD MCD	* >11" dbh (I) *>60% mpp (Y)		* Nest - mean in uncut stands, 24% Roost - mean >40% (Y,Z)		*Mean 11" dbh of nest trees; Mean 8" stem size at nest sites (Y,Z) Mean 14.6", nest (Y) *Mean forage stands, 10"; all trees used for foraging, 15"; lpp used for foraging, 14"; roost trees, 11" > 4" -503 TPA,(Z)	*Mean roost sites, 115 ft²/acre Forage Sites -mixed conifer, 363 ft²/acre; mixed conifer dominated by lpp, 413 ft²/acre; lpp, 411 ft²/acre; Nest sites -lpp, 79-112 ft²/acre; mixed conifer dominated by lpp, 136 ft²/acre (AD)	*1.5 mi² 956 acre/pair (Y) *Mean 430 acres (I)	*Roosts in gall rust cankers, trunk scars, or mistletoe (I), Nests in snags dead < 5 years, Heart rot critical key factor in nest selection (Y)

Species	PAG's	Snags	Logs	Canopy Cover	Canopy Layers	Tree Size/ Trees per Acre	Basal Area	Home Range	Special Features
Great Gray Owl (GGO)	LPW LPD MCD		* >8" dia.w/in forage sites (AC)	*Foraging - 11-50% (I) *Nesting > 60% (range 52-99%) (J) *11-59%, males at forage & roost sites (AC, J) *Juveniles, 50%, ≥60% (AC)		*Mean dbh of stick nests, 23" Mean dbh of broken top nests, 31" (I,AC) *Perch and forage trees, 10" (AC)		Adults *11.6 mi² (J) *30 mi² (I), *26 mi² (AB) Juvenile *60 mi² (I) *61 mi² (AB)	*Owlets need dense cover or leaning trees (I) Openings *Nests w/in 0.2 mi of opening (I) * Size range15-247 ac (AA) *Plant height averages 8", grass dominated (AC)

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Species	PAG's	Snags	Logs	Canopy Cover	Canopy Layers	Tree Size/ Trees per Acre	Basal Area	Home Range	Special Features
Northern Goshawk (NG)	LPW LPD MCD	*25-75/acre, 8-10", pine forest type 5-15/acre, 7-12", pine/fir forest type 5-70/acre, 6-20", fir forest type (U)	*50-85/acre, 9-10", pine forest type 65-70/acre, 9-11", pine/fir forest type 40-190/acre, 5-9", fir forest type (U)	Nesting *44-85% (AD) *>40% (AF) *79%, good (AG) *≥70% Recommend >90% (AE) *49-74%, pine forest type 71-91%, pine/fir forest type 70-94%, fir forest type (U)	* > 1 (AK, AL)	*Nest Stands Mean dbh,11" 526 TPA (AD) *Nest Area Mean nest tree dbh 12.4 (7-20") Mean nest tree, 29" Mean nest area, 13" 53.8 tpa (AD) *Ave dbh on the east side, 14" (AE) *Ave. stand size, 17" (AF) *MC, >25/acre >20", good nesting habitat (AG) *2.5-4.9", 86tpa 4.9-8.9", 225 tpa 8.9-15.9", 192 tpa >15.9", 7 tpa (AD) *Nest dbh pine forest type, 20-33"; pine/fir forest type 28-39"; fir forest type, 19-39" TPA pine forest type >11", 30-40; >20", 10-25; TPA pine/fir forest type >11" 45-110, >20", 20-25; TPA fir forest type >11" 35-110, >20", 20-45	*217 (range 148-283) ft²/ac 221 ft²/acre in nest areas (AD) *30-92 ft²/ac, live trees (AF) *152-179 ft²/acre, live & dead, pine forest type 116-181 ft²/acre, l &d, pine/fir forest type 143-262 ft²/acre, l&d, fir forest type Pine forest type, 1-4.9", 20-25; 5-8.9", 95-160; 9-14.9", 15-20; 15-20.9", 0-10; 21-24.9", 10-20; 25-31.9", 5-10; 32"+, 0-10 Pine/fir forest type, 1-4.9", 25-35; 5-8.9", 30-95; 9-14.9", 55-105; 15-20.9", 10-35; 21-24.9", 0-10; 25-31.9", 5-10; 32"+, 0-15 Fir forest type 1-4.9", 5-45; 5-8.9", 25-70; 9-14.9", 5-115; 15-20.9", 5-40; 21-24.9", 5-20; 25-31.9", 5-25; 32"+, 0-10(U)	*6-15 mi² (AE, AF) *0.8 mi² if there is a lot of suitable habitat (AE)	*Nest tree is usually the largerst w/in the stand and near small breaks in canopy (I) *Fully suitable stands contain 2 alternate nest stands within 0.6 miles of each other >20 acres (AG)

Appendix I -- Plant Association Groups and Data Sources for Vegetative Information

Plant Association Groups	Plant	Associations	Eco-class	Prod Class
Meadows	* MW	Wet Meadow	MW	7
	* MM	Moist (Hairgrass) Meadow	MM	7
	* MM	Moist (Bluegrass) Meadow	MM	7
	MD	Dry Meadow	MD	7
Xeric Shrublands	SD	Low sagebrush/Idaho fescue	S1	7
	SD	Big sagebrush/bunchgrass	S1	7
	SD	Big sagebrush/needlegrass	S1	7
	SD	Big sagebrush-bitterbrush/bunchgrass	S1	7
	SD	Buckwheat Flats	BF	7
	GB	Bluegrass Scabland	G1	7
Mesic/Wet Shrublands	* SW22	Associations within forest zone or one topographic positions such as flood plains and canyons which accumulate subsurface moisture. Stands have either alder, willow, or spirea as dominant woody vegetation; could be forest lands if fire has been suppressed.	SW	
	* SW11	Associations within riparian areas with standing or running water. Soils imperfectly drained through much of the growing season. Shrubs commonly alder, willows huckleberries or spirea.	SW	
Alpine Shrublands	SS15-11	High elevation; above timberline; soils imperfectly drained early in the growing season or well drained.		
Subalpine/Alpine Meadows	MS21	Associations dominated by sedges and occurring at high elevations; soils imperfectly drained-moist into summer		
Juniper Woodlands	CJ-S3-11	Juniper/bitterbrush/bunchgrass	J1	7
Ponderosa Dry	CP-S1-12	Ponderosa pine/bitterbrush-big sage/squirrel tail	PS	7
	CP-S2-17	Ponderosa pine/bitterbrush-manzanita/fescue	P3	6
	CP-S2-12	Ponderosa pine/bitterbrush/needlegrass	P5	6
	CP-S2-15	Ponderosa pine/bitterbrush/sedge	P1	6
	CP-S2-18	Ponderosa pine/bitterbrush/squirrel tail	PN	6
	CP-S3-12	Ponderosa pine/bitterbrush-snowbrush/sedge	P4	6
	CP-S2-13	Ponderosa pine/bitterbrush-manzanita/needlegrass	P2	6
	CP-S2-16	Ponderosa pine/bitterbrush/bluebunch wheatgrass	P8	6
	CP-S1-11	Ponderosa pine/bitterbrush-big sage/fescue	P8	6
	CP-S2-11	Ponderosa pine/bitterbrush/fescue	P1	6
	CP-S2-14	Ponderosa pine/bitterbrush-manzanita/sedge		6

Plant Association Groups	Plant	Associations	Eco-class	Prod
Ponderson Wet	CP-S3-14	Ponderosa pine/bitterbrush-snowbrush/fescue	P3	6
	CP-S3-11	Ponderosa pine/bitterbrush-snowbrush/needlegrass	P7	6
	CP-G2-12	Ponderosa pine/sedge-fescue-peavine	PF	4
Lodgepole Dry	CL-G3-11	Lodgepole pine/needlegrass basins	L6	7
	CL-G4-13	Lodgepole pine/sedge-needlegrass basins	L6	7
	CL-S2-14	Lodgepole pine/bitterbrush/fescue	L3	6
	CL-S9-11	Lodgepole pine snowbrush-manzanita	P2	6
	CL-G3-14	Lodgepole pine/needlegrass-lupine	L7	6
	CL-S2-15	Lodgepole pine/gooseberry-bitterbrush/needlegrass	L5	6
	CL-S2-11	Lodgepole pine/bitterbrush/needlegrass	L5	6
	CL-S2-16	Lodgepole pine/bitterbrush (rhyolite)	L9	6
	CL-S1-12	Lodgepole pine/big sage (rhyolite)	L0	6
	CL-S1-11	Lodgepole pine/big sage/fescue	L	
	CL-G3-13	Lodgepole pine/needlegrass-lupine-linanthastrum	L7	6
	CL-S4-12	Lodgepole pine/grouse huckleberry	L8	5
	CL-S3-11	Lodgepole pine/pinemat manzanita	L6	7
Lodgepole Moist/Wet	CL-M4-11	Lodgepole pine/beargrass	M2	5
	CL-G4-12	Lodgepole pine/sedge-penstemon-lupine	M1	5
	CL-G4-11	Lodgepole pine/sedge-lupine	L8	5
	CL-M2-11	Lodgepole pine/bearberry	L2	6
	CL-S2-12	Lodgepole pine/bitterbrush/sedge	L4	5
	CL-S2-13	Lodgepole pine/bitterbrush/forb	L2	
	CL-M1-11	Lodgepole pine/sedge-grass wetland	L1	
	* CL-M1-12	Lodgepole pine/kentucky bluegrass		
	* CL-M1-13	Lodgepole pine/widefruit sedge		
	* CL-M1-15	Lodgepole pine/tufted hairgrass		
	* CL-M3-11	Lodgepole pine/grouse huckleberry/forb wetland	L1	5
	* CL-M3-12	Lodgepole pine/bog blueberry/widefruit sedge		
	* CL-M3-13	Lodgepole pine/Douglas spirea/forb		
	* CL-M3-14	Lodgepole pine/Douglas spirea/widefruit sedge		
	* CL-M9-11	Lodgepole pine-Engleman spruce/few flowered spikerush		
Mixed Conifer Dry	CR-S1-11	Mixed Conifer/Manzanita		
	CW-H1-11	CW/snowbrush-chinkapin	W2	6
	CW-S1-14	CW/snowbrush	W1	5
	CW-S1-12	CW/snowbrush-manzanita	W1	5
	CW-C2-11	CW/snowbrush-chinkapin/bracken fern	W3	5
	CW-C2-13	CW/snowbrush/sedge-bracken fern	W5	5
	CW-S1-15	CW/snowbrush/sedge	W6	5
Mixed Conifer Wet	CW-C2-12	CW/snowbrush-chinkapin/pinegrass	W3	5
	CW-S1-13	CW/manzanita-snowbrush/sedge-penstemon	W0	4
	CD-S6-13	CW/snowberryforb	W8	3
	CD-S6-12	CW/snowberry/twinflower flatlands	W9	4

Plant Association Groups	Plant	Associations	Eco-class	Prod. Class
	CD-S6-14	CW/snowberry/elk sedge	W7	4
	* CW-S9-11	Englemann spruce bottom lands	E1	4
	* CW-F4-31	White fir/queencup beadlily		
	* CW-M2-22	Engleman spruce/queencup beadlily		
	* CE-M3-11	Engleman spruce/bog blueberry/forb		
	* CE-M3-12	Engleman spruce/bog blueberry/widefruit sedge		
	* CE-M1-11	Engleman spruce/widefruit sedge		
	* CE-M2-21	Engleman spruce/common horsetail-twisted stalk		
Mountain Hemlock +	CM-S1-11	Mt. hemlock/grouse huckleberry	M1	5
Whitebark pine		Zones above Mt. Hemlock		
Riparian	HQ-S2-21	Quaking aspen/common snowberry/blue wildrye		
	HQ-M1-21	Quaking aspen/blue wildrye		
	HQ-M4-11	Quaking aspen-lodgepole pine/Douglas spirea/widefruit		

* Plant associations marked with * can be found adjacent to streams and can be included in the riparian plant association group for mapping ecological units.

DATA SOURCES FOR VEGETATIVE INFORMATION

a. Data Sources for Potential Natural Vegetation (Plant Association Groups)

1. Timber stand exam field verified plant associations
2. 1976 Soil Resource Inventory Ecoclass Map, 2"/mi. USGS Topographic Maps
3. Vegetation Resource Survey (Forest Timber Type Mapping from 1982)
   - Photo typing was completed on 1981 resource photos
   - TRI/GIS Database includes stratification codes on ecotype codes which correspond to the 4"/mi. GIS stand maps.
   - SO Timber Inventory has original 4"/mi, Orthophoto Stand Maps
4. Aerial Photo Interpretation
5. Ecology Plots, Inventory Plots, Managed Stand Survey Plots
6. Forest Ecomapping Contract (Available at the end of 1995)
7. Local Knowledge
8. 1908/1916 Timber Type Map located in 1908/1916 Fire Records.

b. Data Sources for Current Vegetation

1. Timber stand exam information – Stand data base
2. PMR
3. Aerial Photo Interpretation (complete set of 1989 infra-red available).
4. Activity data and mapping since 1988 to update PMR
   - Stand database and IADB
   - Harvest Layer
   - Reforestation Layer
   - Timber Stand Improvement Layer
   - Fuels Layer
5. Fires since 1988 to update PMR
6. Forest Decline Layer

c. Data Sources for Historical Vegetation Patterns

1. Forest Ecologist, Bill Hopkins
2. Forest Fire Atlas Maps which date back to the early 1900's
3. Cadastral survey notes which date mid to late 1800's
4. Historic literature
5. Forest fire lookout panoramic photos taken in the 1930's
6. 1943 and 1959 aerial photos
7. Stand reconstruction field data
8. Fire History studies and analysis (see Appendix E)

Literature References

A. USDA, Forest Service. 1994. American Marten, Fisher, Lynx, and Wolverine in the United States. General Technical Report RM-254. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

B. Ingram, Rod. 1973. Wolverine, Fisher, and Marten in Central Oregon, Central Region Administrative Report No. 73-2. Oregon State Game Commission, Bend, Oregon.

C. Jones, Larry and Martin Raphael. 1992. Unknown title, a study conducted on the Mt. Baker-Snoqualamie N.F. PNW Lab, Olympia, Washington.

D. Martin, Sandra. 1989. Report on Ecology and Habitat Requirements of Marten.

E. Martin, Sandra, and Reginald Barrett. 1991. Resting Site Selection By Marten At Sagehen Creek, California. Northwest Naturalist, 72:37-42.

F. Spencer, Wayne, Reginald Barrett and William Zielinski. 1983. Marten Habitat Preferences in the Northern Sierra Nevada. Journal of Wildlife Management. 47(4):1983.

G. Jones, Lawrence. 1990. Ecology and Management of Marten in Fragmented Habitats of the Pacific Northwest. Pacific Northwest Research Station, Olympia, Washington.

H. Stuff from Lew Becker's notes.

I. Marshall, David. 1992. Sensitive Vertebrates of Oregon. Oregon Department of Fish and Wildlife, Portland, Oregon.

J. Hayward, G.D. and J. Verner, tech. editors. 1994. Flammulated, boreal, and great gray owls int he United States: A technical conservation assessment. General Technical Report RM-253. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

K. Bull, Evelyn, and Richard Holthausen. 1985. Habitat use and Management of Pileated Woodpeckers in Northeastern Oregon. Journal of Wildlife Management 57(2):335-345(1993).

L. Bull, Evelyn, and Richard Holthausen. 1992. Roost Trees Used By Pileated Woodpeckers in Northeastern Oregon. Journal of Wildlife Management, 56(4):786-793.

M. Gerdes, Michael. 1991. Suitable Spotted Owl Habitat Definitions, Deschutes National Forest.

N. Gerdes, Michael. 1995. Deschutes National Forest Northern Spotted Owl Habitat Study on Upper Canyon Creek. On file at the Deschutes National Forest Supervisor's Office and the Bend/Ft. Rock Ranger District. (On Sisters Ranger District, habitat is the lower end of MCW PAG)

O. USDA. 1995. Deschutes National Forest Late Successional Reserves. USDA, Pacific Northwest Region.

P. Call, Mayo. 1978. Nesting Habitats and Surveying Techniques for Common Western Raptors, Technical Note TN-316. USDI BLM, Denver Service Center, Denver, Colorado.

Q. Stalmaster, Mark. 1987. The Bald Eagle. Universe Books; New York, New York.

R. Lehman, Robert. 1980. An Analysis of Habitat Requirements and Site Selection Criteria for Nesting Bald Eagles in California. Wilderness Research Institute, Arcata, California.

S. Bull, Evelyn L., Anthony L. Wright, and Mark G. Henjum. 1990. Nesting habitat of flammulated owls in Oregon. Journal of Raport Res. 24(3):52-55.

T. Goggans, Rebecca. 1985. Habitat use by flammulated owls in northeastern Oregon. MS thesis, Oregon State University. 54 p.

U. Gerdes, Michael. 1993. Deschutes National Forest Northern Goshawk Reproductive Nest Site Study. On file at the Deschutes Supervisor's Office and the Bend/Ft. Rock Ranger District.

V. Dixon, Rita. 1995. Density, Nest-Site and Roost-Site Characteristics, Home-Range, Habitat-Use, and Behavior of White-Headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Nongame Project Number 93-3-01. Oregon Department of Fish and Wildlife, USDA Deschutes and Winema National Forests.

W. Blair, Glen, and IDFG. 1993. Species Conservation Plan for the White-Headed Woodpecker. USDA, Forest Service (R-1), Nez Perce National Forest and Idaho Department of Fish and Game (R-II).

X. Frederick, Glenn, and Teresa Moore. 1991. Distribution and Habitat of WHWP (Picoides albolarvatus) in West-Central Idaho. Idaho Department of Fish and Game, Boise, Idaho.

Y. Marshall, David. 1992. Status of the BBWP in Oregon and Washington. Audubon Society, Portland, OR.

Z. Goggans, Rebecca, Rita Dixon, and Claire Seminara. 1988. Habitat Use By TT and BB Woodpeckers, Deschutes National Forest, Oregon. Nongame Project Number 87-3-02. Oregon Department of Fish and Wildlife, and the USDA Deschutes National Forest.

AA. Bryan, T. and Eric Forsman. 1987. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. The Murrelet 68:45-49.

AB. Bull, Evelyn L., Mark Henjum and Ronald Rohweder. 1988. Home range and dispersal of great gray owls in northeastern Oregon. J. Raptor Res. 22(4): 101-106.

AC. Bull, Evelyn L., Mark Henjum and Ronald Rohweder. 1988. Nesting and foraging habitat of great gray owls. J. Raptor Res. 22(4): 107-115.

AD. Squires, John R., and Leonard F. Ruggiero. 1996. Nest-site preference of northern goshawks in southcentral Wyoming. J. Wildl. Manage. 60(1): 170-177.

AE. Unknown author. DocID 3378C/161A. Info from the Gifford Pinchot NF.

AF. 1988. Goshawks As Indicators of Mature Forest Types, Gifford Pinchot National Forest, Washington.

AG. Crocker-Bedford, D.C., and B. Chaney. 1988. Characteristics of goshawk nesting stands. pp 210-217 In R.L. Glinski et al (eds.). The Proceedings of the Southwest Raptor Symposium. The Nat. Wildl. Fed. Washington, D.D. 395 pp.

APPENDIX B

LATE-SUCCESSIONAL SPECIES ASSOCIATED WITH THE WHY-CHUS LSR

APPENDIX B

LATE-SUCCESSIONAL SPECIES ASSOCIATED WITH THE WHY-CHUS LATE-SUCCESSIONAL RESERVE

PLANT SPECIES

Plant species known to occur in the Late-Successional Reserve are listed in Table 1. Most of the area has not been surveyed and many rare species have the potential to occur. Species with potential to occur in the Late-Successional Reserve are listed in Table 2.

Status Definitions

Endangered, Threatened, and Sensitive Species. The Regional Foresters Sensitive List was revised in 1999 and now bases rankings of rarity on the system used by the Oregon Natural Heritage Program (ORNHP). Additional ranking definitions can be found in the March 1998 ORNHP Report- Rare, Threatened and Endangered Species of Oregon

G= refers to Global ranking of the population

S= refers to State ranking

Numbers of the ranking include:

1. Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction, typically with 5 or less occurrences.
2. Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction, typically with 6-20 occurrences.
3. Rare or threatened, but not immediately imperiled, typically with 21-100 occurrences.
4. Not rare and apparently secure, but with cause for concern, usually with more than 100 occurrences.
5. Demonstrably widespread, abundant, and secure.

Survey and Manage These are species listed under the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures (USDA, USDI 2001).

Focal Species. Certain plants or groups of plants have been selected as focal species for the LSR. Focal plant species are found in a certain habitat type within the LSR and represent a variety of other species with similar habitat needs. They are identified in the following tables as "Focal Species".

Table App. B - 1. Rare Plant Species found in the Why-chus Late-Successional Reserve

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Carex capitata	Vascular plant	ORNHP list 3-Review list	Circumboreal G5, S-unknown	Alpine	High montane areas. Three Creeks Lake.
Castilleja chlorotica	Vascular plant	Sensitive	Central Oregon endemic S3, G3	PP,LP	Dry open ponderosa forests, frequently growing on lava scab. Historic report- could not be relocated. **Site may be mis-mapped.** Generally found south of Sisters.
Gentiana newberryi •focal species	Vascular plant	Sensitive	Regional endemic S2, G4	Riparian	Moist subalpine and alpine meadows in the Three Creeks Lake area and nearby.
Utricularia minor	Vascular plant	ORNHP list 2-threatened or extripated in OR	Circumboreal S2, G5	Riparian	Wet meadows in shallow water Alder Creek bog, Trout Creek Swamp
Elaphomyces subviscidus focal species rare fungi group	Rare truffle	SM	1 of 2 known sites in OR,	LP, High Elev Forest	Mycorrhizal association with lodgepole Hemlock. Three Creek.
Helvella crassitunicata focal species rare fungi group	Rare cup fungus	SM	North America	Riparian MCW	Montane forests containing *Abies* species. Three Creek.
Nivatogastrium nubigenum focal species rare fungi group	False truffle	SM	Regional endemic	MCD MCW	Surface rotten Abies logs at high elevations >4000 ft. Three Creek.
Rhizopgon flavo-fibrillosus focal species rare fungi group	Rare false truffle	SM	Regional endemic	MCW MCD	Mycorrhizal association Pinus spp, PSME, or ABCO. Three Creek.
Rhizopogon evadens var. subalpinus focal species rare fungi group	Rare false truffle	SM	Regional endemic	High elev forest	Mycorrhizal association with high-elevation TSME and Abies.. Soap Creek.

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Calicium sp. * focal species	Pin lichens	SM	N. Europe, PNW	PP, MCW	On medium /large snags w/out bark, generally near water. Trout Creek Swamp and Round Lake.
Cladonia norvegica focal species	Lichen on soil	SM	PNW	PP, MCW	On rotten wood in humid forests Snow Creek.
Lobaria pulmonaria	Nitrogen -fixing lichen		PNW	MCW	Large foliose lichen found on vine maple, cottonwoods and mossy rock. Pole Creek.
Peltigera collina	Nitrogen -fixing lichen on soil		PNW	MCW, MCD	Found on mossy bark and rock. Or riparian settings on mossy bark of cottonwoods and vine maple and some sites on mossy rock on the desert fringe. Pole Creek.
Pseudo-cyphellaria anomala	Nitrogen fixing lichen		PNW	MCD MCW	Moist forests, most often on hardwoods and shrubs or rocks. Pole Creek.

Table App. B – 2. Plant Species with potential to occur in the Why-chus Late-Successional Reserve

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Agoseris elata	Vascular plant	Sensitive	PNW endemic S1, G4	PP	Meadows and open woods, dry edges of moist ecotones. Metolius River.
Allotropa virgata	Vascular plant	SM	North America	MCD, MCW, LP	Symbiotic w/ conifers and their ectomycorrhizal fungi. Associated with closed canopy Douglas fir or old growth ponderosa pine.
Arnica viscosa	Vascular plant	Sensitive	OR and CA S2, G4	High elev. forest &, lava	Rocky places, scree and talus slopes, at or above timberline.
Aster gormanii	Vascular plant	Sensitive	Oregon endemic S3, G3	High elev. forest	Rocky ridges, outcrops, or rocky slopes
Astragalus peckii	Vascular plant	Sensitive	Central Oregon endemic	LP	Lodgepole forest openings
Botrychium minganense	Vascular plant	SM and Sensitive	S2, G4	Riparian, LP, High elev	Within riparian corridors not directly adjacent to stream
Botrychium montanum	Vascular plant	SM and Sensitive	S2, G3	LP	Within riparian corridors not directly adjacent to stream
Botrychium pumicola	Vascular plant	Sensitive	Central Oregon endemic S3, G3	LP, Alpine	Pumice substrate in dry exposed habitats. West ridge of Broken Top. Northern most population.
Calachortus longebarbatus var. longebarbatus	Vascular plant	Sensitive	Regional endemic S2, G3T3	LP, PP	LP/PP forest openings and edges of vernally moist meadows, stream edges
Calamagrostis brewerii	Vascular plant	Sensitive	Regional endemic S2, G4	High elev. forest, LP, riparian	Meadows, open slopes, streambanks, lake margins
Carex hystericina	Vascular plant	Sensitive	S2, G5	MCD. MCW, riparian	Riparian zones in forest areas
Carex livida	Vascular plant	Sensitive	S2, G5	PP, MCD, MCW, high elev	Wet meadows with still or channelled water
Cicuta bulbifera	Vascular plant	Sensitive	SH, G5	Riparian	Shoreline marshes
Collomia debilis var. larsenii	Vascular plant	Watch list	Cascades WA to CA	Lava rock	Talus slopes on the high peaks of the Cascades. Cache Mountain

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Collomia mazama	Vascular plant	Sensitive	S3, G3	High elev. Forest, LP, MCD, MCW, riparian	Higher elevation mixed conifer forest riparian areas and forest edges and openings, meadows dry to wet
Cypripedium montanum	Vascular plant	SM	Within the range of the NWFP	MCD, PP	Can be found in scattered sites on both sides of the Cascades. Mainly in moist woods. Abbot Creek.
Draba aurea	Vascular plant	Watch list??	Regional endemic S1S2, G5	LP, Alpine	On volcanic rock above timberline. Three Sisters and Broken Top.
Lobelia dortmanna	Vascular plant	Sensitive	1 known site in OR Sisters RD S1, G4	Lake, Riparian	In shallow water.
Lycopodiella inundata	Vascular plant	Sensitive	S2, G5	Riparian	Montane bogs, wet meadows
Lycopodium complanatum	Vascular plant	Sensitive	S2, G5	PP, MCD, MCW, LP, high elev forest, riparian	Edges of wet meadows, dry forest midslope w/25% canopy cover
Ophioglossum pusillum	Vascular plant	Sensitive	S1, G5	Riparian	Vernal ponds and stream terraces in moist meadows
Penstemon peckii	Vascular plant	Sensitive	Sisters endemic S3, G3	PP, MCD, MCW, riparian	PP/ MC forest openings, recovering fluvial surfaces, moist/wet meadows, moist areas
Pilularia americana	Vascular plant	Sensitive	S1, G5	Riparian	Vernal pools, old stock ponds
Rorippa columbiae	Vascular plant	Sensitive	S3, G3	PP	Wet to vernally moist sites, intermittent stream beds
Scheuchzeria palustris ssp. americana	Vascular plant	Sensitive	S2, G5,T5	PP, MCD, MCW, Riparian	Wetlands in forested areas
Scirpus subterminalis	Vascular plant	Sensitive	S1, G4G5	LP, high elev forest Riparian	Generally submerged in quiet water or creeks
Thelypodium howellii ssp. howellii	Vascular plant	Sensitive	SH, G3, T3	PP, MCD, MCW, riparian	Meadows in forests
Alpova alexsmithii	Rare false truffle	SM	Cascade endemic G2 S1	High elevation forest	With roots of conifers, particularly Hemlock. Near Cabot Lake in the Mt. Jefferson Wilderness.
Bondarzewia mesenterica (=B. montana)	Rare fungus	SM	G3 S1	All forest types	Snags, stumps, or on soil near them
Bridgeoporous nobilissimus	Rare fungus	SM	G2 S1	High elev. forest	Mesic to wet microsites On large diameter silver or noble fir

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Cantharellus subalbidus	Fungi	SM	Regional endemic	MCD, MCW	On ground, often with *Armillaria ponderosa.*
Elaphomyces anthracinus	Rare truffle	SM	Sisters G2? S1	PP	One known site in N America, near the Metolius River, associated with old growth ponderosa pine.
Gastroboletus ruber	Rare Boletus fungi	SM	Cascade endemic	High elevation forest	Above 4,000 ft with the roots of conifers, esp. mountain hemlock, silver and noble fir and western white pine. Near Cabot, Carl and Shirley Lakes in the Mt. Jefferson Wilderness.
Hygrophorus caeruleus	Uncommo n gilled mushroom	SM	PNW endemic G2? S1	MCW	Mid-elevation to montane conifer forests. May be restricted to *Abies.* Jack Creek.
Hydnotryna inordinata	Rare truffle	SM	Rare local endemic	High elevation forest	With the roots of silver fir, Douglas fir, lodgepole, and mountain hemlock. Shirley Lake, Mt Jefferson Wilderness.
Gymnomyces abietis	Rare false truffle	SM	Rare local endemic	High elevation forest	With the roots of Abies and other conifers above 3,000 feet. Shirley Lake, Mt Jefferson Wilderness.
Otidea leporina	Cup fungi	SM	G 3 S1	All forest types	
Otidea onotica	Cup fungi	SM		All forest types	
Otidea smithii	Cup fungi	SM		All forest types	
Polyozellus multiplex	Rare chanterelle	SM		PP, MCD, MCW, high elev. forest	Associated with roots of Abies, spruce, aspen. Topographically moist places- depressions, etc.
Sarcosoma mexicana	Rare fungi-polypore			All forest types	
Sowerbyella (=Aleuria) rhenana	Cup fungi	SM		All forest types	
Collema sp.	Riparian lichen	SM	Americas	Riparian	Moist riparian forests, often on hardwoods.
Hydrothyria venosa	Aquatic lichen		North American endemic	Aquatic	On rocks in very cold clean streams. Metolius Basin, Canyon creek.
Lobaria halli	Nitrogen-fixing lichen		Regional endemic	MCW, Riparian forests	With old cottonwoods, maple, moist forest areas. Trout Creek.

SPECIES	TYPE	STATUS	OCCURRENCE	PAG	HABITAT NOTES
Nephroma helveticum	Nitrogen-fixing lichen		PNW	MCW	Moist riparian forests. First Creek.
Pseudo-cyphellaria anthrapsis	Nitrogen-fixing lichen		PNW	MCW	Moist riparian forests. First Creek.
Pseudo-cyphellaria rainierensis	Rare Nitrogen-fixing lichen		G3 S2	High elev. Forest, riparian zones in all forest types	Epiphytic in forests w/old growth forest structure, cool humid microsites
Buxbaumia viridis	Moss	SM	Interruptedly circumboreal	Riparian, MCW	Shady humid forests, rotten logs Stream terraces, floodplains.
Marsupella emarginata var. aquatica	Aquatic Liverwort	SM	1 known site Waldo Lake/ Central Cascades G5T3 S1	Aquatic	Submerged in shaded, cold perennial streams.
Schistostega pennata	Moss	SM	G4 S1	All forest types	In caves, crevices, and root wads. Humid, shady microsites.
Tetraphis geniculata	Moss	SM	Interruptedly Circumboreal G4 S1	Riparian, MCW	Dense shady humid forests rotten logs , Stream terraces, floodplains.
Tritomeria exsectiformis	Liverwort	SM	PNW, 1 site Okanogan, 6 sites Deschutes G5 S2	Riparian	On peaty or humic soil, or rotting wood, often on creek banks where perpetually shady and moist.
Ulota megalospora	Moss		PNW endemic	Riparian, MCW	Epiphytic on conifers and hardwoods.

- Sensitive= Region 6 USFS List
- SM = Survey and Manage Species List, NW Forest Plan,
- Watch List= Oregon Natural Heritage Database List

ANIMALS

A. Wildlife Species Known to Occur

Following are the wildlife species known to occur in Why-chus Late-Successional Reserve, listed by Management Strategy Area in which they were found. The location where the species have been sighted is also listed (Range, Township and Section). This is in no way an exhaustive list but a list of what has been documented in the files. Sightings go back as far as the early 1970's.

Trout Management Strategy Area

Northern spotted owl	15S, 9E, 29	
Northern goshawk	15S, 9E, 21	
Pileated woodpecker	15S, 9E, 29 and 31	
Cascades frog	15S, 9E, 29 and 33	15S, 8E, 36
Sharp-shinned hawk	15S, 9E, 19 and 20	
Great-horned owl	15S, 9E, 30, 32, 33	16S, 9E, 4
Black bear	15S, 9E, 29 and 32	
Downy woodpecker	15S, 9E, 20	
Black-tail deer	15S, 9E, 18	
Northern pygmy owl	15S, 9E, 28	
Red-tail hawk	15S, 9E, 30 and 32	
Williamson's sapsucker	15S, 9E, 32	
Chipping Sparrow	15S, 9E, 20	
Yellow-rumped warbler	15S, 9E, 20	
Western tanager	15S, 9E, 32	
White-winged crossbills	15S, 9E, 34	
Bald eagle	15S, 9E, 20	
Stellars jay	15S, 9E, 29	
Pacific tree frog	15S, 9E, 18 and 29	
N. Saw-whet owl	15S, 9E, 29 and 33	
Western screech owl	15S, 9E, 30	
Great gray owl	15S, 9E, 29 and 32	

Squaw Management Strategy Area

Bald eagle	16S, 9E, 20

Bobcat	16S, 9E, 17	
Black bear	16S, 9E, 4	
Flammulated owl	16S, 9E, 8	
White-headed woodpecker	16S, 9E, 16	
Great gray owl	16S, 9E, 17	
Cascades frog	15S, 9E, 20 and 29	16S, 9E, 16 and 17
Northern goshawk	16S, 9E, 9 and 10	
Turkey	15S, 9E, 29	16S, 9E, 3
Great horned owl	16S, 9E, 9	
Pacific tree frog	16S, 9E, 17	

Three Creeks MSA

California Wolverine	17S, 9E, 14 and 23
American marten	17S, 9E, 10, 11, and 14
Long-toed salamander	17S, 9E, 11
Rough-skinned newt	17S, 9E, 15
Western Toad	17S, 9E, 11, 14, 15
Pacific tree frog	17S, 9E, 11 and 15
Cascades frog	17S, 9E, 10, 11, 14, and 15
Tailed frog	17S, 9E, 10 and 15
Spotted sandpiper	17S, 9E, 11and 15
Mallard	17S, 9E, 11
Osprey	17S, 9E, 14 and 15
Cougar	17S, 9E, 14
Bald eagle	17S, 9E, 14 and 15

B. Species of Concern List and Reason Why They Are Considered Focal Species

Table App. B-3. Why Species are Considered Focal

Reason for Species of Concern/Focal Species designation	Species
Threatened	Bald Eagle
	Northern Spotted Owl
	Canada Lynx
Large home ranges, fragmentation, loss of some habitat quality	California Wolverine
	Fisher
	American Marten
Conversion of mature and late-successional habitats to younger even-aged stands and loss of large snags	Northern Goshawk
	Great Gray Owl
	Pileated Woodpecker
	White-headed woodpecker
	Black-backed Woodpecker
	Bats
Loss of habitat quality, fish stocking, hydrology alteration, and recreation pressure	Amphibians
	Long-toed Salamander

Acres capable of sustaining desired habitat conditions over the long-term

C. Focal Species and Amount of Habitat in Excess or Deficit.

Table App. B-4. Focal Species and Amount of Habitat in Excess or Deficit

Focal Species	Existing Habitat Acres	Acres able to become habitat (sustainable)	Optimum Acres Needed	+/- Acres
Spotted Owl Nesting, Roosting, and Foraging Habitat	1796	1100	1500 (1.25 home ranges)	+296 acres
Goshawk Nesting	2350	1100	1440 (3 home ranges)	+910
Goshawk Foraging	2389		16,200 (3 home ranges)*	
Black-backed Woodpecker Nesting and Roosting	8248		2868**	+5380
White-headed Woodpecker Nesting	389		1000-3000	-611 to -2611

*Refers to 5400 acres of foraging habitat per home range. Each pair may not need this entire amount or home ranges may overlap.

**Refers to managing the Three Creeks area only. Additional habitat exists in the other MSA's and will provide additional habitat.

APPENDIX C

Snag and Green Tree Recommendations

Relate to Table 1 - App A.

where available leave whatever size class that is there

APPENDIX C
Snag and Green Tree Recommendations

Climatic Climax Mixed Conifer			
Snags Needed	GTR Size Class	GTRs[1] Needed – Regeneration	GTRs Needed - Thinning
1.92	10" – 14.9"	10.86	6.08
6	15" – 24.9"	24	12.75
5	25"+	11.66	5.42
12.92	Totals/Acre	46.52	24.25
Fire Climax Mixed Conifer			
Snags Needed	GTR Size Class	GTRs Needed – Regeneration	GTRs Needed - Thinning
1.04	10" – 14.9"	5.88	3.28
2.14	15" – 24.9"	8.56	4.55
3.33	25"+	7.66	3.59
6.51	Totals/Acre	22.1	11.26
Ponderosa Pine >30% Canopy Cover			
Snags Needed	GTR Size Class	GTRs Needed – Regeneration	GTRs Needed - Thinning
0.96	10" – 14.9"	5.43	2.95
2.08	15" – 24.9"	8.32	4.36
1.33 (2.33)*	25"+	3.06	1.44 (2.52)*
4.37 (5.37)*	Totals/Acre	16.81 (19.11)*	8.75 (9.83)*
Ponderosa Pine <30% Canopy Cover			
Snags Needed	GTR Size Class	GTRs Needed – Regeneration	GTRs Needed - Thinning
0	10" – 14.9"	6.66	4.16
1.48	15" – 24.9"	5.92	3.15
1 (2)	25"+	2.3 (4.6)	1.08 (2.16)
2.48 (3.48)	Totals/Acre	14.88 (17.18)	8.38 (9.46)

* Where bald eagles occur provide 1 additional snag/acre

Down wood material levels should follow ROD Standards and Guidelines listed on page C-40. For eastern Oregon, a minimum of 120 linear feet of logs per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained. Decay class 1 and 2 logs can be counted towards these totals. Down logs should reflect the species mix of the original stand. In areas of partial harvest, standards and guidelines should be applied, but they should be modified to reflect the timing of stand development cycles.

Pt Size 11

[1] GTRs = "Green Tree Replacement" for future snags; the recommended number of live/green trees that should be retained during tree removal activities in order to provide future snags.