USDA FOREST SERVICE
Deschutes National Forest, Sisters Ranger District

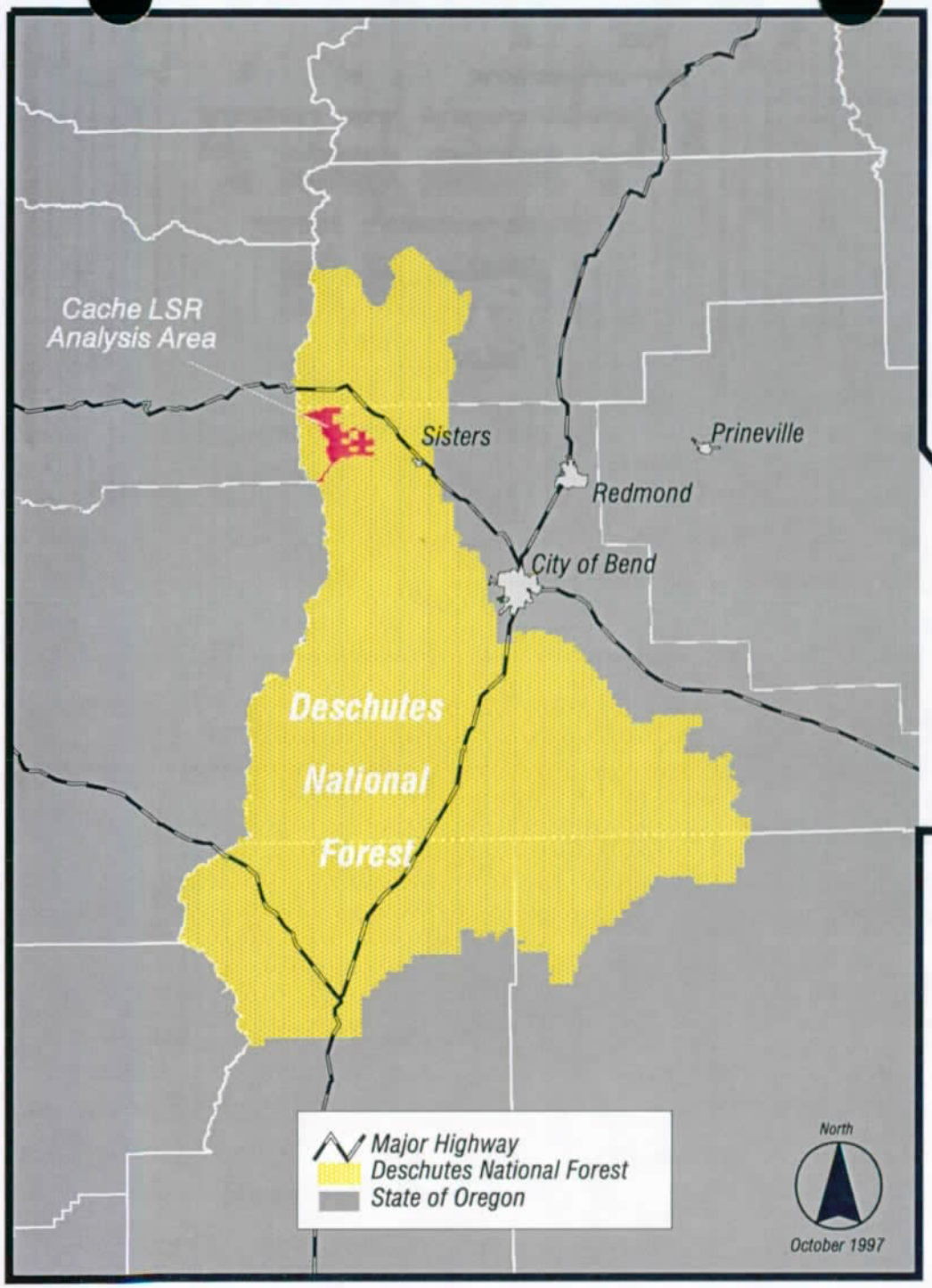
Cache Late Successional Reserve

LSR Assessment

May 30, 2000

Locator Map- Cache Late Successional Reserve Assessment with Deschutes National Forest and State of Oregon

Deschutes National Forest
Sisters Ranger District



I. INTRODUCTION AND BACKGROUND

The Cache Late-Successional Reserve (CLSR) #0-52(A), comprises the north half of the Cache/Trout LSR. It is located within the Eastern Oregon Cascade Physiographic Province on the Deschutes National Forest.

The Cache LSR (Map 1 and 2) is located northwest of Sisters, Oregon and encompasses 17,145 acres or slightly more than 5% of the Sisters Ranger District. There are about 1600 acres of private land within the LSR boundary. The CLSR is separated from the Metolius LSR by a band of Matrix lands to the north. It borders the Mt. Washington Wilderness to the west, the Three Sisters Wilderness, Matrix, and private lands to the south; and has a half-mile wide connection to the south half of the Cache/Trout LSR. To the east, the LSR intermingles with Matrix and private lands along the eastern boundary of the Owl Range. The LSR includes most (1614 acres) of the recently established Cache Mountain Research Natural Area.

This assessment is a strategic document that addresses the ecological significance of eastern Cascade disturbance regimes and the need to provide late-successional habitat conditions for species such as the northern spotted owl. The assessment identifies management activities needed to: (1) reduce the risk of habitat loss from catastrophic disturbances such as fire, insects and disease, and (2) sustain late-successional habitats whether the goal is to provide fire or climatic late-successional conditions. In addition, this assessment addresses activities currently occurring within the LSR, and provides recommendations for maintaining, restricting or eliminating activities to meet LSR objectives.

The assessment sets the framework for projects, but does not make any decisions to undertake a project. It helps us decide where we should be going with the LSR and what the best ways are to get there. The assessment is not a NEPA or decision document; it does not make site-specific decisions.

The Northwest Forest Plan and Deschutes NF Forest-Wide LSR Overview create the foundation for the assessment. The Metolius Watershed Analysis covers the Cache Creek drainage, but the rest of the LSR has not been included in any larger scale watershed analysis.

THE NORTHWEST FOREST PLAN

As defined in the Record of Decision (ROD) for Management of Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl (April, 1994), the CLSR should be managed to meet objectives described in the ROD and Attachment A, Standard and Guidelines. As described in the Standards and Guidelines C-11, a management assessment for Late-Successional Reserves should be prepared for each LSR before habitat manipulation activities are designed and implemented. This document provides the management assessment for the Cache LSR, including:

- history and inventory of overall vegetative conditions within the reserve
- list of identified late-successional associated species known to exist within the LSR and information on their locations

- fire management plan
- criteria for developing appropriate treatments
- identification of specific areas that could be treated under those criteria
- proposed implementation schedule tiered to higher order (i.e., larger scale) plans
- proposed monitoring and evaluation components to evaluate if future activities are carried out as intended and achieve desired results.

The Northwest Forest Plan amends the 1990 Deschutes National Forest Land and Resource Management Plan.

1990 DESCHUTES NF LAND AND RESOURCE MANAGEMENT PLAN

The Cache LSR overlaps the following management allocations from the 1990 LRMP: General Forest, Scenic Views, and Spotted Owl. Most of the newly established Cache Research Natural Area is contained within the LSR. See the 1990 LRMP for management area themes, goals and objectives. The ROD directs that standards and guidelines from the ROD be applied to LSRs unless standards and guidelines from the underlying LRMP allocations are "more restrictive or provide greater benefits to late-successional related species."

DESCHUTES NF FOREST-WIDE LSR OVERVIEW

The Deschutes National Forest Overview For Site-Specific Late-Successional Reserve Assessment Teams (September 1995) was completed to set context for the Deschutes NF LSR assessments, by providing general information on forest processes, pattern and structure, and forest function. The Forest Overview establishes a desired condition for LSRs 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 Cache LSR for late-successional associated species such as the Vaux's swift, northern spotted owl, American marten, white-headed woodpecker, northern goshawk, cascade and tailed frog.

METOLIUS WATERSHED ANALYSIS (MWA)

Approximately 50% of the Metolius Watershed is allocated to LSR. The Cache LSR (#0-52) encompasses 6% of the watershed, and the Metolius LSR encompasses 44% of the watershed. The rest of the Cache LSR is outside of the Metolius Key Watershed.

Watershed analysis was required for the Metolius Key Watershed prior to resource management. The analysis is a systematic procedure for characterizing watershed and ecological processes to meet specific resource and social objectives. The Metolius Watershed Analysis (MWA) was completed in October 1995. 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.

Compared to watershed analysis, the LSR assessment provides specific objectives, guidelines and treatment opportunities relative to managing resources to sustain late-successional habitat.

AQUATIC CONSERVATION STRATEGY

The Aquatic Conservation Strategy (ACS) as defined by the Northwest Forest Plan was developed to restore and maintain the ecological health of the watershed and the aquatic ecosystems contained within them. The primary goals are to identify and maintain disturbance regimes within the watersheds, prevent further degradation of habitat, and restore habitats and ecological processes. Management activities proposed for watersheds must meet the ACS objectives as specified in the Northwest Forest Plan (page B-11).

ASSESSMENT OVERVIEW

This LSR Assessment is comprised of four sections:

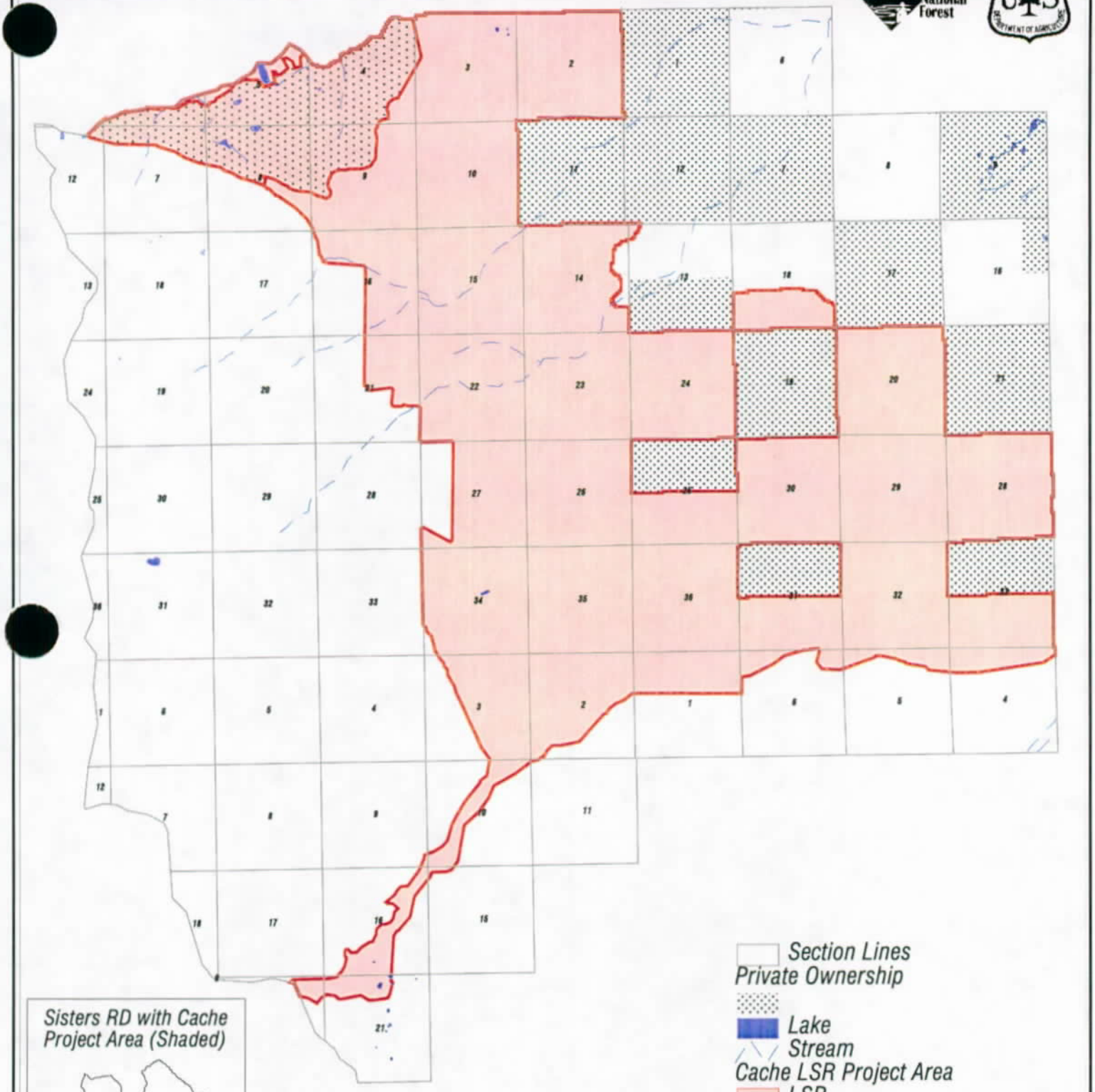
- Chapters I through VI provide the analysis necessary to define goals and objectives. They include discussions of current condition of the natural resources in the LSR, and compares current to historic conditions and processes. Appropriate direction from the NW Forest Plan and the Deschutes LRMP are also outlined here.
- Chapter VII provides overall goals and objectives for the LSR. This chapter provides guidelines for balancing risk reduction and habitat protection, consistent with the objectives of the NW Forest Plan. It also provides direction and guidelines for activities that are common to the entire LSR, particularly those that serve as constraints or that guide activities that are not related to vegetation management.
- Chapter VII divides the LSR into Management Strategy Areas (MSAs), and defines site-specific goals in terms of NRF habitat necessary to meet the broader landscape and LSR goals for maintaining spotted owls and related species. It defines long and short-term paths or management actions necessary to meet the goals, and outlines the amount of risk and choices that decision makers might have to take.
- Chapter VIII provides Treatment Strategies organized by PAG and stand structure stage. It includes a description of desirable landscape conditions based largely on the historic condition used as a baseline to measure long-term success of treatment and stand development. The strategies define what can be done to a specific type of stand to move closer towards a specific MSA objective. The thresholds provide a measurable trigger to define which stands and/or when stands could be treated to move towards a specific objective. Finally, for each treatment strategy, the chapter outlines how the activity meets LSR objectives at both the NWFP and MSA scale.

Using the LSRA to Develop and Guide a Project or Activity

- Use the Goals and Objectives to help identify the Purpose and Need for the project. If the Purpose and Need can't be pulled directly from the LSR objectives, the project is probably not consistent with current direction and objectives for the LSR.

- The MSAs define where the Purpose and Need has the highest priority for action. Short-term objectives outline what the MSA needs for habitat and/or risk reduction in order to meet the broader LSR goals (and broader still, the NWFP goals). Often the MSA goals frame a choice that can be developed into alternatives. Other alternatives follow where resources and/or objectives are in conflict.
- Specific stand data (from stand exams, photo interpretation and field recon) is necessary at this point to determine current habitat conditions and amounts, and where the habitat resides on the structural stage cycle - moving towards LSOG habitat, moving away, or stable.
- The Treatment Strategies define when a stand could be treated to meet a certain objective - thresholds; how it could be treated to meet the objective; and finally the probable outcome of the treatment and how the outcome relates to LSR goals. This chapter also provides habitat and management information pertinent to specific focal species, as well as constraints and mitigation that might be necessary to minimize the effects of activities.

Cache Late Successional Reserve



II. PHYSICAL OVERVIEW

INTRODUCTION

The Cache LSR 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 as evidenced by the prominent lateral and terminal glacial moraines once covered slopes within the Cache LSR. Since the glaciation, a number of basaltic lava flows have occurred covering areas of the glacial till. Following these landscape-shaping events, Sand Mountain erupted and covered the entire landscape with three to four foot of basaltic ash material. After the eruption of Sand Mountain, several recent lava flows from Belnap Crater volcano covered about 1000 acres in the southwest portion of the LSR.

Cache Mountain is a shield type volcano with two smaller cinder cones on its flanks. A large glacial cirque on the western flank of Cache Mountain indicates it was present during at least one of the previous glacial periods. Since the last glaciers, more than 10 small cinder cones have formed throughout the LSR. Sand Mountain ash covers all of the glacial features and most of the lava flows and cinder cones.

Precipitation in the LSR ranges from 60 inches in the higher elevations down to 30 inches at lower elevations. 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.

Water moves differently in areas of basalt bedrock. Rather than perching water like glacial till does, the bedrock has a relatively high capacity to store water and can cause water to flow subsurface. This is due to fractures in the bedrock, bedding characteristics, lava tubes and other cavities in the lava flows. Approximately 60 percent of the soil types in the LSR have basalt bedrock materials rather than glacial till. These bedrock materials and their ability to store and move water subsurface result in a lack of permanently flowing streams in the area.

Due to the hydrology of this area, an assessment using Cumulative Harvested Area Index (CHA) and hydrologic openings would not be appropriate. Created openings and a reduction of forest canopy that concentrate snow deposition and melt is not expected to increase erosion and sediment delivery to streams and lakes. Roads would still be a source of water concentration resulting in erosion and sediment delivery. Also treatments associated with stream channels and riparian buffers have potential for erosion and sediment delivery (see fish and watershed report).

SENSITIVE SOIL AREAS

Criteria for identifying soils sensitive to management are listed in the Deschutes LRMP, Appendix 14, Objective 5. Areas were identified by SRI mapping units and include the following:

- Extremely rocky areas, lava flows and lava flows with low-density forest (SRI units 1, 3, 6, 11, 12, 14 and 18).
- Mapping units where rock outcrops are common across the landscape (SRI unit 64).
- Mapping units with a majority of the area having slopes over 30 percent (SRI units 8A, 9, 12, 21, 22, 23, 68, 81, 82 and 84).
- Mapping units with the potential to have slopes over 30 percent (SRI units 17, 19, 28 and 29). These areas are better defined in the DEM slope-break mapping.
- Bottomlands and wet depressions along streams (SRI units 2 and 8).
- Narrow draws with steep side slopes (SRI unit 10).
- Areas of seasonal high water tables in fluvial glacial outwash soils (SRI units 30).

EXISTING CONDITIONS

Existing condition of the soil resource within the Cache LSR area boundary has been influenced by past management activities. Recent harvest activities include salvage, clear-cut, and uneven-age management prescriptions. These recent operations used primarily mechanized harvesting and yarding systems.

Estimates of impacts to soils from previous harvest activities were determined using aerial photos in combination with ground survey. Selected units with similar patterns on aerial photos were transected with a probe to determine percentage of area compacted. This information was then projected over the entire area. Soil disturbance includes compaction, soil displacement, erosion, and impacts of high intensity burns. The existing condition analysis was categorized into four groups of disturbance classes:

Table 1 – Estimated detrimental soil impacts caused by management activities

Condition Class	Acres in Condition Class	% of the Total Analysis Area	Average Detrimental Condition for the Class
A - None to Slight disturbance (0 to 10% detrimental condition)	2420	14%	0%
B - Light disturbance (10 to 20% detrimental condition)	10728	64%	10%
C - Moderate disturbance (20 to 40% detrimental condition)	3790	22%	30%-
D. Heavy disturbance (>40% detrimental condition).	0	0%	0%

For example, 3790 acres are in Condition Class C, with an average detrimental soil condition of 30% of the area in a compacted or displaced state.

WATERSHED DESCRIPTIONS

The Cache LSR includes portions of the Suttle/Lake Creek, Cache, Indian Ford, and Trout Creek subwatersheds. The largest portion of the LSR consists of the Cache subwatershed, which heads in the Mt. Washington Wilderness and flows into Lake Creek. Lake Creek then flows into the Metolius River near Camp Sherman. Only small segments of the other subwatersheds are included in the Cache LSR. Suttle/Lake Creek subwatershed includes small ponds and lakes within the Cache RNA. These are lower elevation lakes that do not have road access and the associated human impacts, and are significant to the RNA for study purposes.

Much of the Cache subwatershed has been clearcut both on NFS and private lands. The Cache subwatershed has high water infiltration capacity due to surface lava and underlying fractured basalt. As a result, there is little connection between the created openings and runoff effects. Riparian clearcuts, road crossings, and road erosion pose the most risk to watershed condition in the Cache subwatershed. Riparian clearcuts reduce bank stability. The roads can increase sediment delivered to the stream channel. These sediment sources may ultimately contribute to fine sediment loads in the Metolius River. Fine sediment has been identified in the Metolius Watershed Analysis as a high risk to trout habitat due to the spring-fed nature of the river and lack of flushing flows to transport the fine sediment out of the system.

In general, the subwatersheds within the LSR have little surface water other than intermittent streams. There is only one mile of perennial stream, Dry Creek, located in the LSR.

There is little evidence of a surface stream network in the Indian Ford and Trout Creek portions of the LSR. Small catchments in the glacial till zone appear to be groundwater settling basins that support patches of aspen and cottonwood stands. One of the larger aspen stands, 33 acres along Dry Creek near the crossing of Rd 1028, could be considered a wetland.

Table 2. Hydrologic features of subwatersheds that are part of Cache LSR

Watershed	Total Acres	Acres in LSR	Road Density	Riparian Road Density	Road Crossings per mile	% Regen in Riparian Reserve
Suttle/Lake	15,838		4.8	4.2	2.6	11
Cache	27,730		4.3	4.5	1.7	17

RIPARIAN RESERVES

Riparian Reserves are located along Cache Creek, Dry Creek and Upper Link Creek. There are four lake Riparian Reserves and six or more pond Reserves in the Cache RNA. Lakes and ponds have Reserves that extend 320 feet from the high water mark. Generally, the stream Riparian Reserves will be consistent with the interim riparian reserve widths of 160ft for intermittent streams and perennial stream without fish. Some reserves may need larger widths to include the riparian vegetation. The wetland of aspen on Dry Creek near the Rd

1028 crossing is given a 160-foot riparian reserve from the edge of the riparian vegetation. There is a significant wetland associated with Cache Lake that lies just north of the LSR. This wetland has a 160-foot reserve width that extends into the LSR.

Riparian plant communities along the intermittent stream channels commonly have aspen, lodgepole pine and Engelmann spruce. Black cottonwoods occur along some of the channels. Tree mortality has occurred in the white fir and lodgepole pine to some extent from insects, disease, and drought. There are few examples of the widespread conifer mortality that is typical in the drainages to the north of Cache Creek.

Historically, fire played a role in these riparian areas by rejuvenating the aspen and lodgepole pine stands. Although fire intensities may have been lower in these moist riparian microclimates, fire most likely occurred along the intermittent streams in a similar frequency as in the uplands.

Down wood in the floodplains and in stream channels provides habitat diversity for many riparian associated species. Floods in 1996 and 1997 resulted in new wood deposits and channel spreading in the aspen/cottonwood sites. Down wood helps disperse flood flow and reduce the erosion potential of the flood. Small pools and ponds created by the spreading floodwaters provide habitat for amphibians and other associated species.

Table 3. Stream miles, acres of riparian reserves and vegetation in Cache LSR.

Watershed	intermittent stream miles in LSR	perennial stream miles in LSR	acres of riparian vegetation in LSR	acres of riparian reserves in LSR
Suttle/Lake	3	0	7	
Cache	8	3	33	

The Metolius Watershed was selected as a Key Watershed based on the presence of bull trout. High water quality and its contribution to the Deschutes Basin is also an important feature of the watershed. Key watersheds serve as refugia, which are the basis of most species conservation strategies. 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 Metolius Watershed analysis as follows:
- Permanent streams with fish, natural ponds and lakes .....320 ft
- Wetlands, intermittent streams, permanent streams without fish .....160 ft
- created ponds and reservoirs .....160 ft

These widths are based on site-potential tree heights as specified in C-30, and may be adjusted during site specific project analysis where rationale for appropriate widths is presented in the decision making process (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.

The balance of the LSR outside the Cache subwatershed will use the interim Riparian Reserve widths as designated in the NWFP (page C-30).

III. VEGETATION ANALYSIS OVERVIEW

INTRODUCTION

This section contains an introduction to the vegetation in the LSR, and discussion and analysis of potential natural vegetation, disturbance events that have influenced vegetation, and current and historic size, structure, canopy cover, species, and habitat pattern and conditions across the landscape. A discussion of the range of variability and sustainable conditions in the LSR sets the stage for more specific discussions in the following sections on current and historic vegetation conditions and trends in each PAG.

There are four major vegetation trends that apply to all plant associations in the LSR:

- Greatly increased stand densities are putting all sizes of trees at risk.
- Mortality within all size classes (including trees >21" DBH), insect and disease damage, and catastrophic fire risk has increased significantly over the last decade.
- Species composition has been shifting from early to late seral species.
- Stand structure has been shifting from larger tree sizes to smaller tree sizes, and from single or two canopy-layers to multi-canopy-layers.

POTENTIAL NATURAL VEGETATION

The field mapping of the potential natural vegetation (PNV) to the plant association level was done by service contract using the protocol established by Volland (1988), with considerable 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, version 1.12, as shown in Table 4, below and displayed on Map 3.

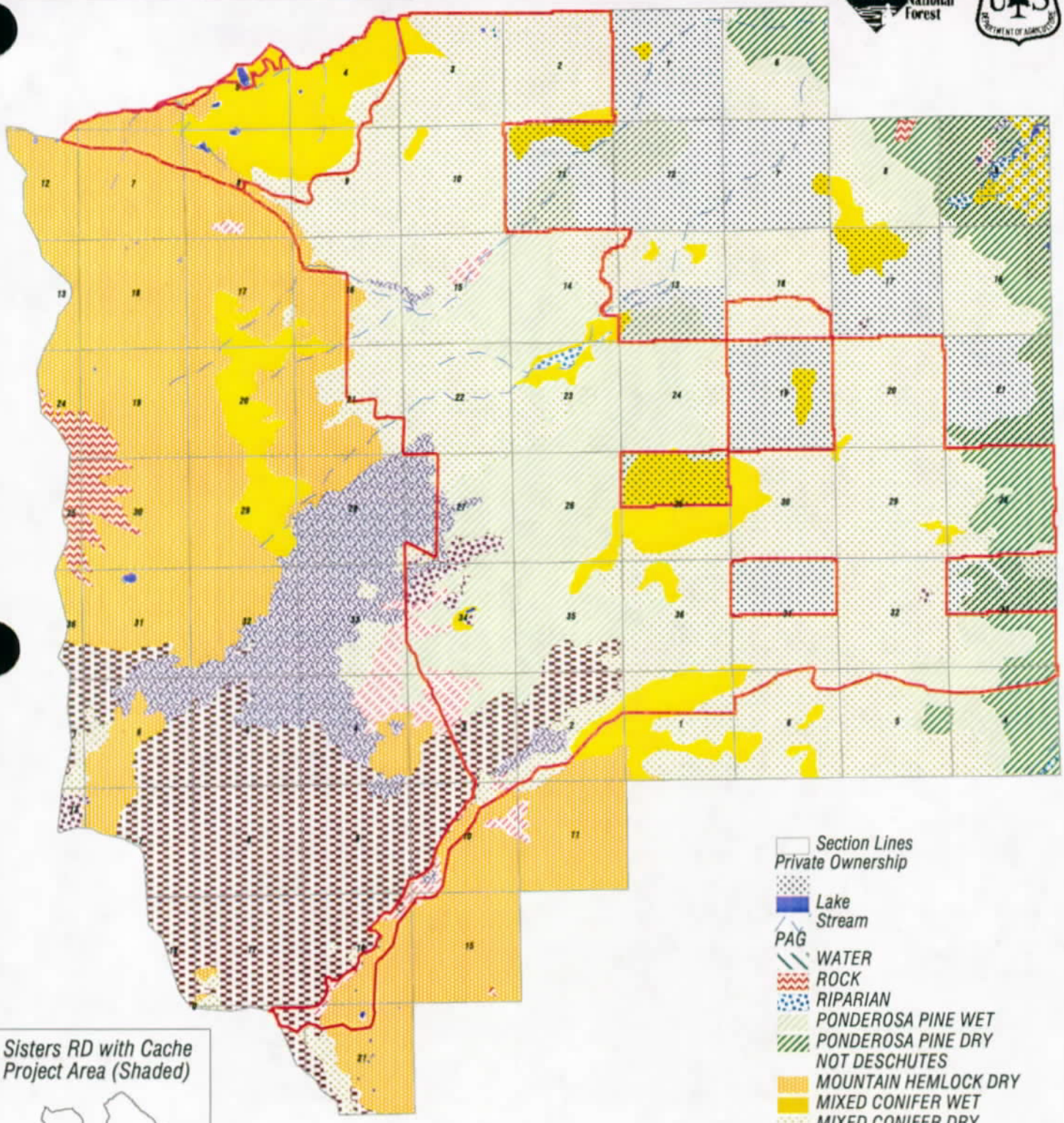
Table 4 - Plant Association Groups

PLANT ASSOCIATION GROUP (PAG)	COMMON ABBREVIATION	LUMPED PAGS FOR ANALYSIS	ACRES	% LSR
Mixed Conifer Wet	MCW	MCW	1,949	11%
Mixed Conifer Dry	MCD	MCD	8525	50%
Ponderosa Pine Wet (CP-G2-12)	PPW	MCD	3593	21%
Mixed Conifer Dry - TOTAL	n/a	MCD	14,067	83%
Ponderosa Pine Wet (Other)	PPW	PP	245	1%
Ponderosa Pine Dry	PPD	PP	604	4%
Ponderosa Pine - TOTAL	n/a	PP	849	5%
Mountain Hemlock Dry	MHD or TSME	HIGH ELEV. FOREST	696	4%
Lodgepole Pine Wet	LPW	LP	266	2%
Lodgepole Pine Dry	LPD	LP	210	1%
Lodgepole Pine- TOTAL	n/a	LP	476	3%
Cinder, Lava, Water	CINDER, LAVA, WATER	NON-FOREST	756	4%
Riparian, Meadow	RIP, MDW	RIPARIAN	44	<1%
GRAND TOTALS			16,878	100%

These "lumped" plant association groups reflect differences in response to disturbances such as fire. The climax species would be the dominant species with little or no disturbance, and in most cases except in Ponderosa pine and Lodgepole pine PAGs, other species would dominate after a disturbance event.

The Plant Association categorized as PPW is almost entirely CP-G2-12, (ponderosa pine/sedge-fescue-peavine). This association has much higher site potential than any other pine association and most dry mixed conifer associations. Also, Volland (1985) notes that in the absence of disturbance from fire or logging, this association would develop to mixed white fir/ponderosa pine. Accordingly, this association has been lumped into MCD rather than PP.

Plant Association Groups for Cache LSRA



Section Lines
Private Ownership
Lake
Stream
PAG
WATER
ROCK
RIPARIAN
PONDEROSA PINE WET
PONDEROSA PINE DRY
NOT DESCHUTES
MOUNTAIN HEMLOCK DRY
MIXED CONIFER WET
MIXED CONIFER DRY
MEADOW
LODGEPOLE PINE WET
LODGEPOLE PINE DRY
LAVA
CINDER

Sisters RD with Cache Project Area (Shaded)

North

1:82,000
October 1997

0.5 0 0.5 Miles

The majority of the LSR (84%) 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 Cache LSR, 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. A significant development in these series between 1984 and 1992 was the defoliation of the true fir and Douglas fir by epidemic numbers of western spruce budworm. Some years were more severe than others but the result of this prolonged defoliation has been significant levels of mortality and a noticeable decline in the vigor of the surviving true fir and Douglas fir. As a result of the combined effects of excessive stocking, insect and disease infestation, and prolonged drought, about 72% of all stands have more than 10% dead basal area, about 35% have more than 30% dead basal area, about 12% have more than 50% dead basal area and about 2% have more than 70% dead basal area. This is significant, but not as severe as in the Metolius LSR to the north.

The Ponderosa Pine plant associations are mostly along the eastern boundary of the LSR, where the land is flatter. Ponderosa pine is the dominant species, but fir is increasing in the zones adjacent to mixed conifer plant associations, especially in the ponderosa pine wet associations, due to adjacent seed sources and protection from fire.

The Lodgepole Pine plant associations are found in high elevation areas adjacent to the lava flows, areas with poor cold air drainage, and in lower elevation frost pockets. These plant associations make up 3% of the area.

The High Elevation Mountain Hemlock forests are primarily along the western fringe of the LSR adjacent to the wilderness areas, along the McKenzie Hwy and within the boundaries of the Cache RNA. The Cache RNA is primarily composed of this PAG (24%) and the mixed conifer wet (64%) PAG.

Riparian areas comprise less than 1% of the LSR. Lava and cinder, primarily from the Belnap flow extending from the west into the LSR along McKenzie Hwy, comprise about 4% of the LSR.

SPECIES COMPOSITION AND STRUCTURE

Species composition was mapped from 1953 photo interpretation (County Timber Type Maps) and current (1998) information using recent (1988 to 1997, primarily 1996 and 1997) stand exams and photo interpretation. The stand exams covered about 11,457 acres (68% of the LSR) in 408 stands. The stand exams do not cover plantations, non-forested areas, or most of the Cache Research Natural Area. A comparison between current primary dominant species and the 1953 overstory species is shown in Table 5 and displayed in maps 4 and 5.

Table 5 - Size/Structure Class and Species Composition/Group.

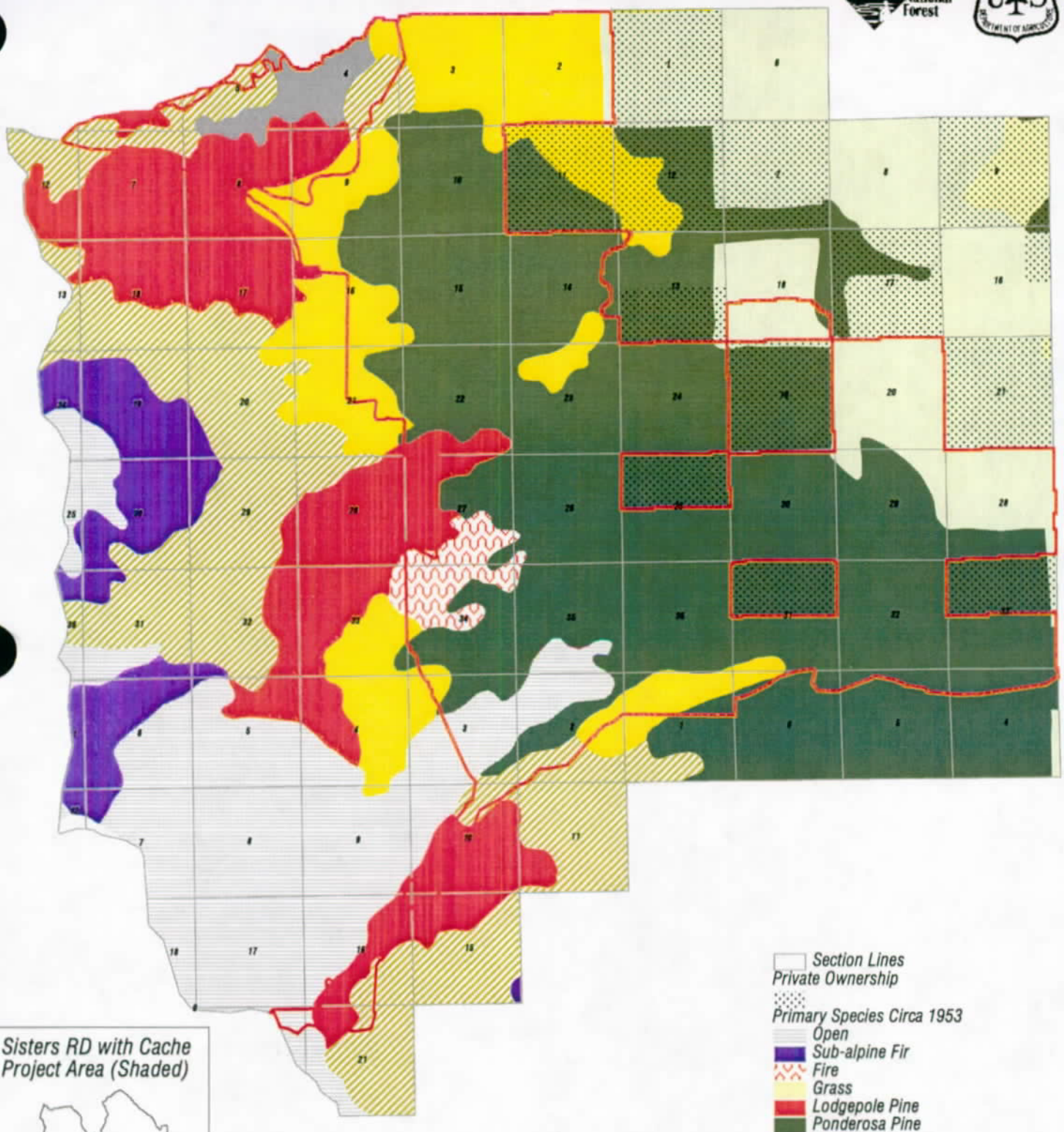
Year -- 1953									
SIZE / STRUCTURE CLASS	SPECIES GROUP* (By % Total LSR Acres)								
	NF	GFS	DF	LPP	MH	PP	WF	OHT	Totals
Unclassified									0
Non-Forest	3								3
Grass / Forb / Shrub		3							3
Seedling / Sapling (0-4.9")									0
Pole(5-8.9")				2					2
Small(9-20.9")				4	5	3			12
Medium / Large (21"+)			2			78			80
TOTALS	3	3	2	6	5	81	0	0	100

Year -- 1998										
SIZE / STRUCTURE CLASS	SPECIES GROUP* (By % Total LSR Acres)									
	NF	GFS	DF	LPP	MH	PP	WF	OHT	Totals	Change
Unclassified	<1				2	<1	7	<1	10	+10
Non-Forest	4				<1		<1	<1	4	+1
Grass / Forb / Shrub	1								1	-2
Seedling / Sapling (0-4.9")						16			16	+16
Pole(5-8.9")				1	<1	1	<1		2	0
Small(9-20.9")			1	4	<1	9	15	1	30	+18
Medium / Large (21"+)**			1		<1	24	13	<1	38	-42
TOTALS	5	0	2	5	3	49	35	1	100	
Change from 1953	+2	+3	0	-1	-2	-32	+35	+1		

* NF=Non-Forest; GFS=Grass/Forb/Shrub; DF=Douglas-Fir; LPP=Lodgepole Pine; MH=Mt. Hemlock; PP=Ponderosa Pine; WF=White Fir; OTH=Other Species.

** Stands that are classified as the medium/large size class are not necessarily **potential** late-successional old growth (PLSOG). This classification simply means that medium/large trees represent the dominant basal area on those acres. See section VI. Late-Successional and O/G Habitat Conditions, for an estimate of acres of PLSOG.

Primary Species Circa 1953 for Cache LSR



Section Lines
Private Ownership

Primary Species Circa 1953
Open
Sub-alpine Fir
Fire
Grass
Lodgepole Pine
Ponderosa Pine
Douglas Fir
Residual Ponderosa Pine
Mountain Hemlock

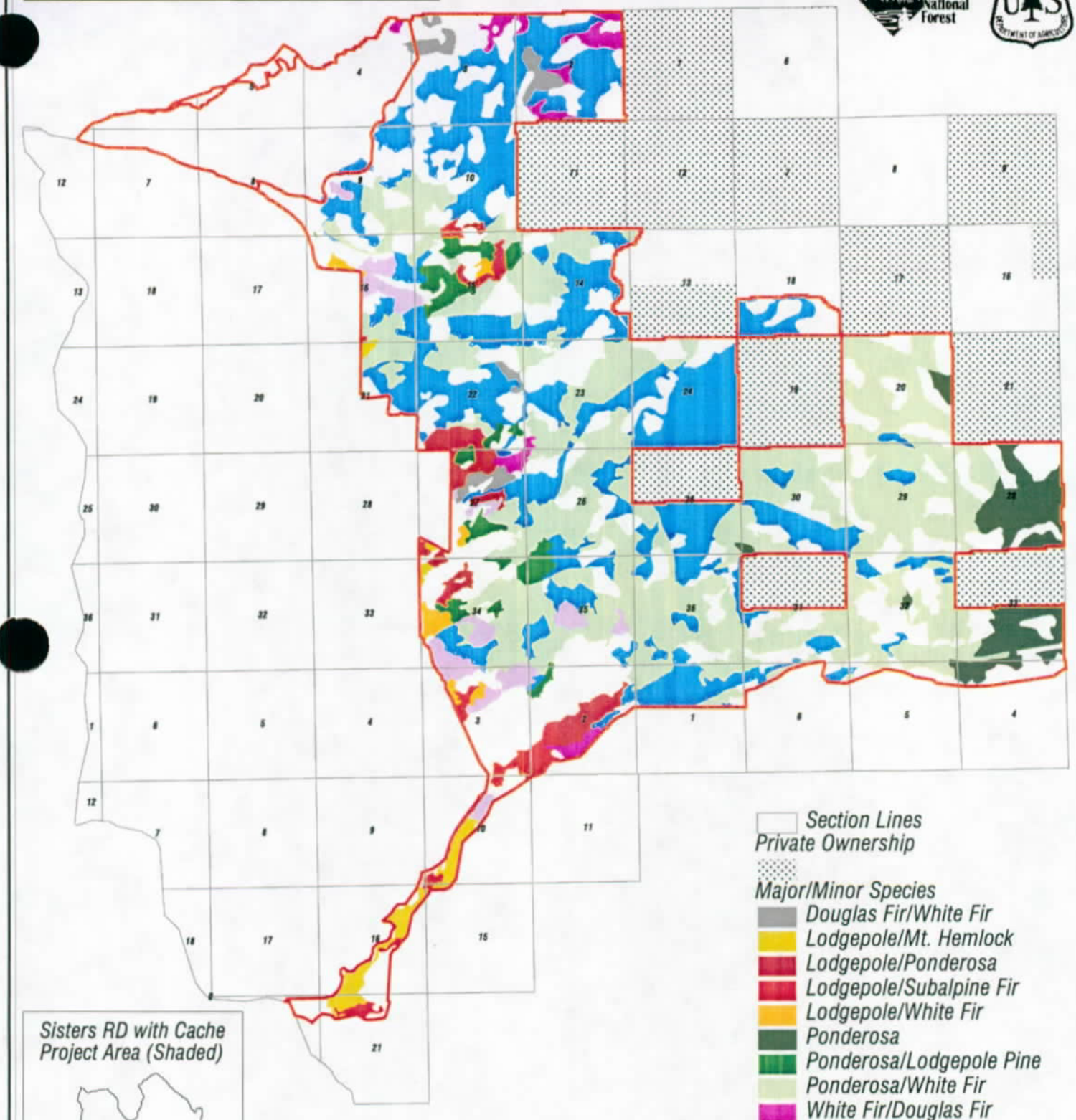
Sisters RD with Cache Project Area (Shaded)

North

1:82,000
October 1997

0.5 0 0.5 Miles

Major/Minor Species for Cache LSRA



Species composition/group was classified by primary and secondary species. Primary and secondary species classifications were simply the species with the first and second most basal area in the stands, respectively. Size/structure were classified similarly as the size class with the most basal area in the stand regardless of the total basal area.

Species Composition/Group

The most dramatic changes in species composition are the differences between the number of acres dominated by ponderosa pine and white fir between 1953 and 1998. The acres dominated by ponderosa pine have decreased 32% and the acres dominated by white fir have increased 34%. These increases and decreases could have been up to 14% greater if approximately 2,400 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.

For acres on which the primary species was ponderosa pine in 1953, climax species (primarily white fir and Douglas-fir) were noted as the secondary species on only 15% of the acres. In 1998, climax species were the secondary species, when ponderosa pine was the primary species, on 83% of the acres, excluding regeneration harvest acres.

In 1953, white fir was the primary species on 0 acres. In 1998, white fir was noted as the primary species on 35% of the acres. Also, ponderosa pine was classified as the secondary species on 83% of the acres on which white fir was classified as the primary species.

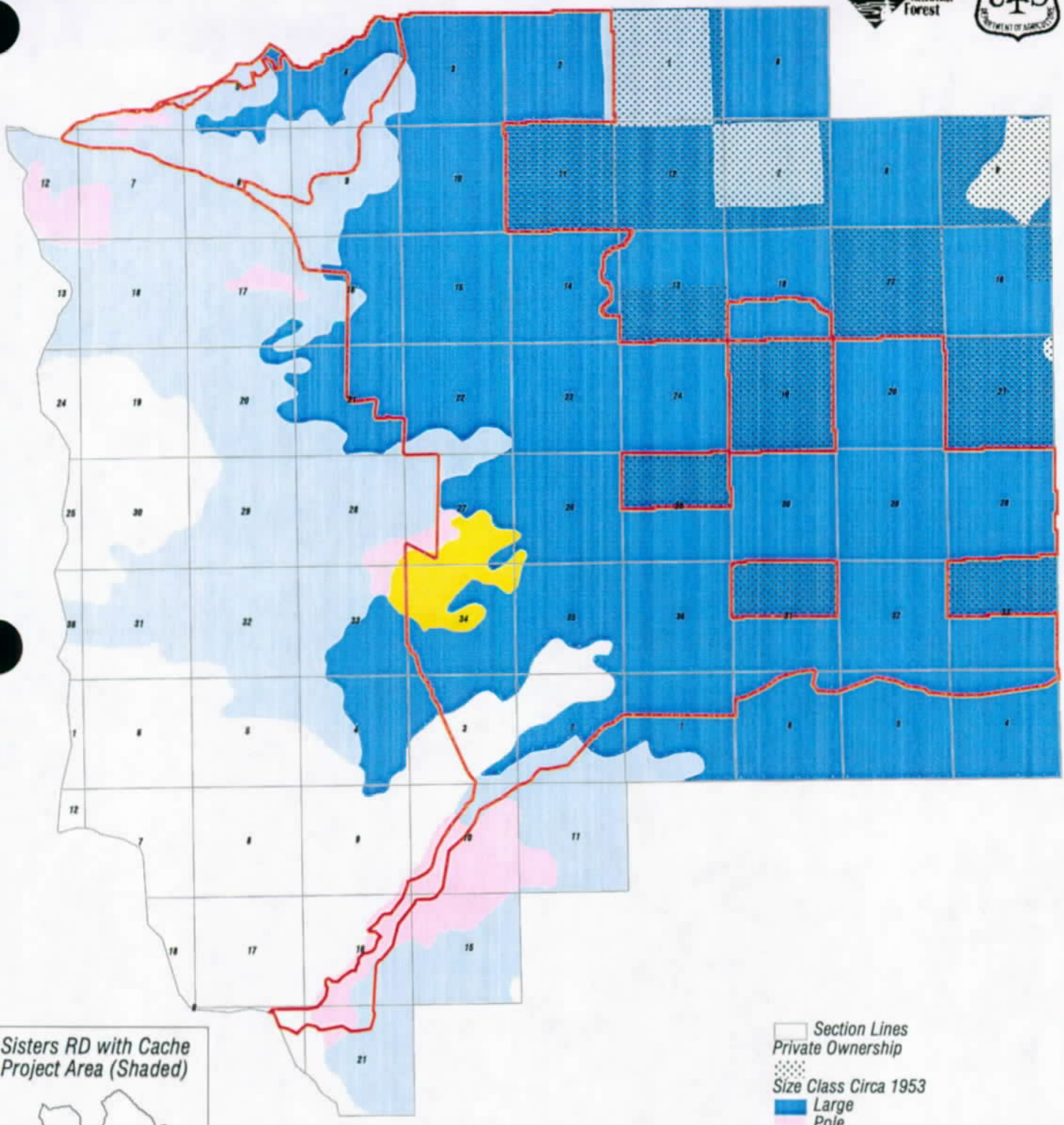
In general, these dramatic shifts in species composition have occurred in the mixed conifer plant associations. These shifts can be attributed primarily to the exclusion of fire which allowed the shade tolerant, fire intolerant white fir to reproduce and grow successfully to the exclusion of the early seral species such as ponderosa pine, and to the selective harvest of the early seral species (i.e., ponderosa pine) overstory component. See specific mixed conifer PAGs for more detail.

Size/Structure Class

There have also been dramatic shifts in size/structure class over the last 45 years. 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. The acres dominated by medium/large trees have decreased by 42% from 81% in 1953 to 38% in 1998. The acres dominated by small trees have increased by 18% from 12% in 1953 to 30% in 1998. The acres dominated by seedlings/saplings have increased by 16% from 0% in 1953 to 16% in 1998.

The shifts in size/structure classes can be attributed primarily to harvesting most or all of the overstory component across most of the analysis area, and to regeneration harvests on approximately 16% 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" DBH across the analysis area. (Maps 6 and 7).

Size Class Circa 1953 for Cache LSR



Sisters RD with Cache Project Area (Shaded)

Section Lines
Private Ownership

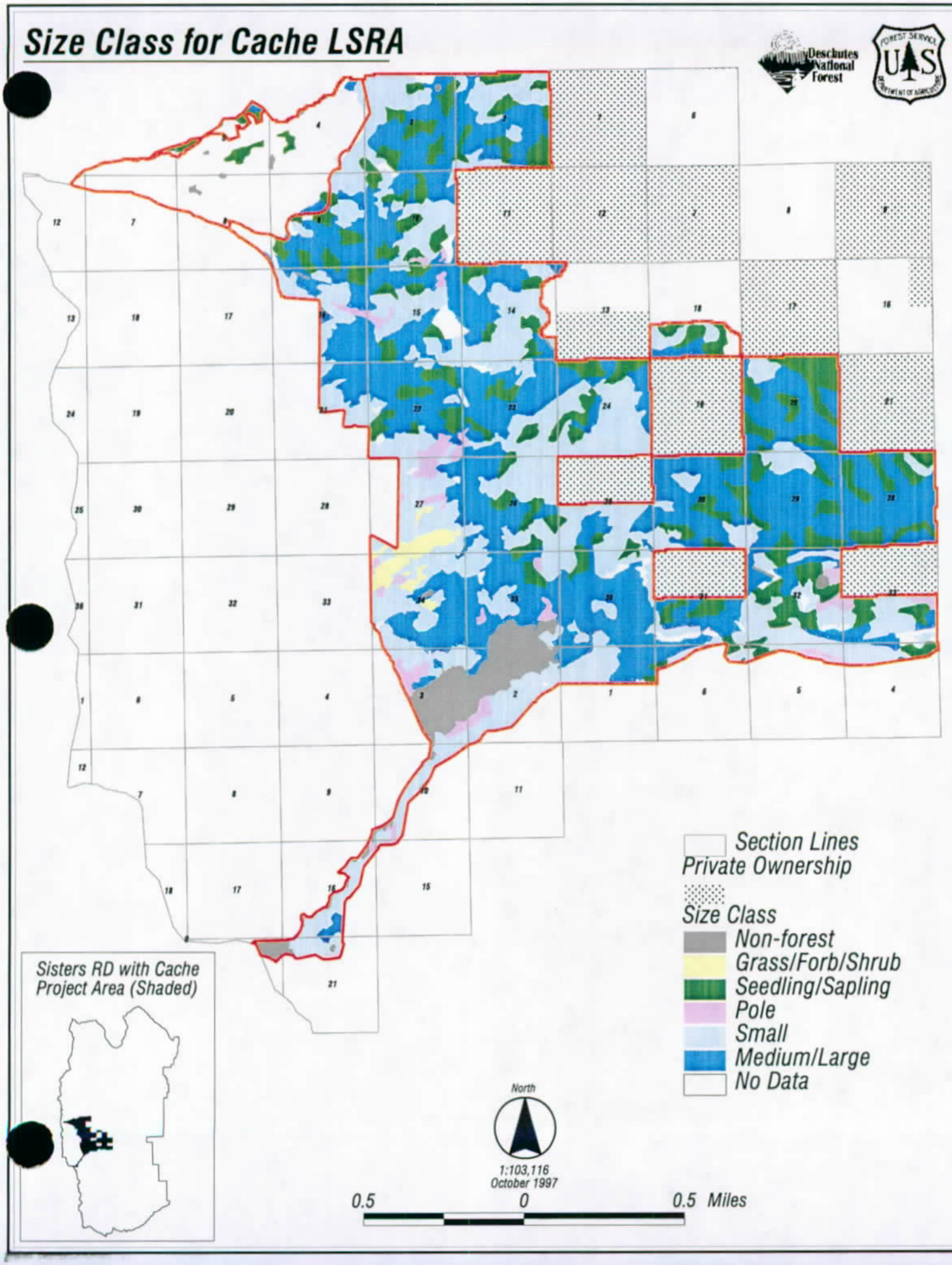
Size Class Circa 1953
- Large
- Pole
- Small
- Grass, Forb, Shrub
- Not Classified

North

1:82,000
October 1997

0.5 0 0.5 Miles

Size Class for Cache LSRA



CANOPY COVER

Canopy cover has decreased in mixed conifer areas in the last ten years because of the spruce budworm infestation and associated mortality. There are no historical records of canopy cover, but we can estimate that with lower densities maintained by frequent underburns in much of the LSR, historical canopy cover was lower historically than it is at present. Except in some of the budworm defoliated areas, canopy cover in current unmanaged stands exceeds historical canopy cover levels. The thinned and regenerated stands are more representative of the lower canopy cover found historically in areas with frequent underburns, or in areas following stand replacement fires. Table 6 shows the percent distribution of acres by percent canopy cover class within each plant association group.

Table 6 - Distribution of Acres by Canopy Cover Class within Plant Association Groups

PLANT ASSOCIATION GROUPS (PAGs)	PERCENT CANOPY COVER						
	Not Classified	0%	1-10%	11-39%	40-59%	60-100%	TOTALS
Aquatic		100					100
High Elevation	53		2	3	19	24	100
Lodgepole Pine	4		1	29	30	36	100
Meadow		100					100
Mixed Conifer Dry	11	0	8	38	35	8	100
Mixed Conifer Wet	52	0	8	15	10	15	100
Ponderosa Pine	4		7	28	43	19	100
Riparian		9			22	68	100
Special	2	71	27				100
TOTALS	16	3	8	32	31	11	100

RANGE OF HISTORICAL VARIABILITY AND SUSTAINABILITY

The historical ranges of variability for vegetation within PAGs, shown in tables 9 through 13, were derived from vegetation information mapped from the late 1800's, from 1953 maps of vegetation that developed with fire exclusion and risk cutting, from information on past disturbance events, successional pathways, current stand ages, and ranges of variability already calculated for the Ochoco National Forest, and the Davis and Metolius LSRs on the Deschutes National Forest, and from discussions among ecologists, silviculturists, fire managers, entomologists and pathologists. **The primary assumption of this analysis is**

that landscapes within the historical range of conditions are more likely to provide healthy, sustainable, resilient ecosystems and habitats than landscapes outside of the historical range of conditions.

For Cache LSR mixed conifer and ponderosa pine plant association groups, we describe species composition and structure, maximum densities, and historical fire periodicity focusing on the stand-level. Landscape level conditions, particularly structure and composition, are considered by noting where the current conditions are outside the range of historical variability, and are integrated into the goals and opportunities for this LSR.

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 on the east side of the Cascades in the Dry Mixed Conifer PAG. Because of limited moisture, these habitats cannot be maintained over time without some density reduction, either natural or human-induced, but can provide short-term habitat at high risk and probability of loss. Eventually, a combination of drought and some form of disturbance bring densities and species composition back to more historic levels. This has already occurred in many areas of the Sisters RD over the last 10 years due to insect and disease infestations. The risk is still very high for losing much of this habitat to large catastrophic fires, or even more wide-scale insect and disease outbreaks.

SUSTAINABLE CONDITIONS

For both lodgepole pine and ponderosa pine plant associations, lodgepole pine and ponderosa pine are the primary species, both at early seral stages and climax stages. For mixed conifer associations, determining species composition for long-term healthy conditions is more difficult. In most of the mixed conifer associations, ponderosa pine is the major early seral tree species. Maintenance of early seral species in mixed conifer sites is recommended in the Deschutes LRMP for biological and social reasons (LRMP page 4-47). Maintenance of stands at slightly higher densities is possible, but there would be a greater risk of losing medium and large ponderosa pine and Douglas fir trees, and growth would be slower, making all trees more susceptible to insects and diseases.

Maintaining stand densities at manageable levels is essential for promoting forest health and maintaining or creating large trees and habitats in dry areas. Stand Density Index (Cochran, et al. 1993) 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). The UMZ is a site-specific threshold density, above which forest health conditions and large tree health are likely to deteriorate.

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, the understories need to be thinned to reduce competition for moisture. These treatments may also decrease the risk of catastrophic crown fires.

Descriptions of sustainable size and structure, species, and densities for each PAG in the following sections are based on the concept of moving conditions toward the historic range of variability. The maximum healthy density determinations (UMZ) for each PAG (see Appendix 1) were calculated using a revised draft paper by Cochran, et al, (January 1994

draft), which describes a method of setting maximum SDI to sustain healthy stand conditions for forest stands in northeastern Oregon and southeastern Washington. These procedures were adapted for the Deschutes National Forest, with review by Pat Cochran and Fred Hall. The descriptions and recommendations for species composition shown in each PAG 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.

Stand Densities

Stand densities were calculated from stand exams. Table 7 below shows the percent examined acres in each PAG that are above and below the upper management zone (i.e., above sustainable densities).

Table 7. Percent of stand examined acres above and below UMZ for each PAG.

PLANT ASSOCIATION GROUP (PAG)	UPPER MANAGEMENT ZONE (UMZ) CLASS			
	No UMZ Established	Below UMZ	Above UMZ	Totals
High Elevation, Mountain Hemlock	89%	<1%	10%	100%
Lodgepole Pine	27%	8%	65%	100%
Mixed Conifer Wet	6%	39%	56%	100%
Mixed Conifer Dry	3%	50%	46%	100%
Ponderosa Pine		15%	85%	100%
Riparian	87%	2%	11%	100%
GRAND TOTALS	8%	36%	56%	100%
TOTAL ACRES	930	4,141	6,385	11,457

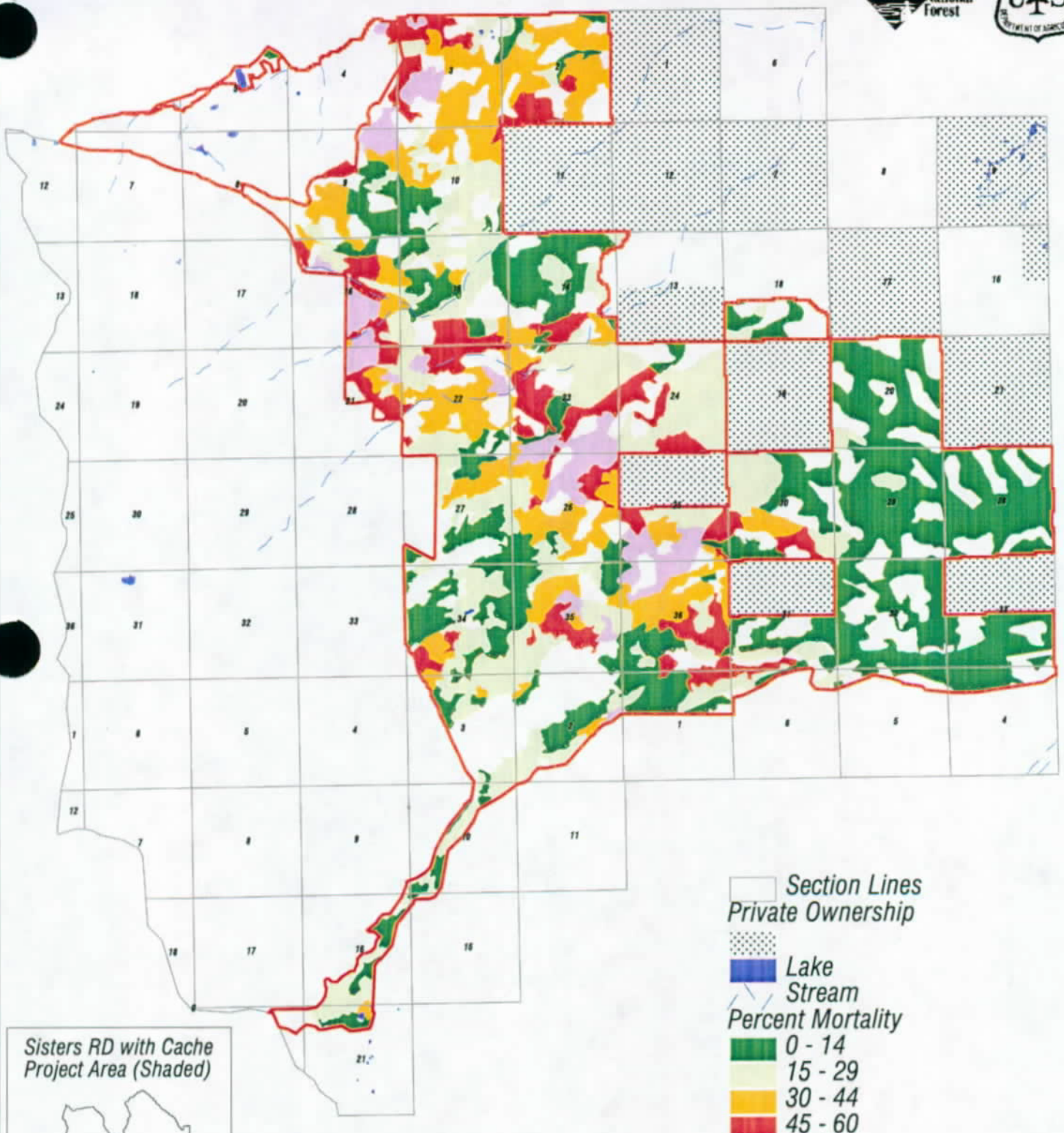
Even with the high mortality that has occurred in the mixed conifer areas, many acres still exceed sustainable density levels. In summary, approximately 56% of the forested acres in the LSR exceed the upper management zone and 85% of the ponderosa pine acres exceed the UMZ. For the mixed conifer dry and wet PAGs, 56% and 46% of the acres are above UMZ, respectively. Many of the mixed conifer acres are below the UMZ because of the mortality that has occurred over the last 10 years.

A very visible example of the consequences of trying to maintain densities above sustainable levels is the amount of mortality in the mixed conifer areas within previously mapped suitable spotted owl habitat. (Map 8).

Percent Mortality by Stand for Cache LSR

Deschutes National Forest

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE



Section Lines
Private Ownership
Lake
Stream
Percent Mortality
0 - 14
15 - 29
30 - 44
45 - 60
> 60

Sisters RD with Cache Project Area (Shaded)

North

1:82,000
October 1997

0.5 0 0.5 Miles

Mortality

Tree mortality as a result of the spruce budworm outbreak and drought that began in 1985 has been fairly significant across the project area, especially in the mixed conifer PAGs. Table 8 below displays the levels of basal area mortality by PAG.

Table 8. Percent of examined acres in each basal area mortality class for each PAG.

PLANT ASSOCIATION GROUP (PAG)	MORTALITY CLASS (Basal Area)*					
	Very Low <10%	Low 10%-29%	Moderate 30%-49%	High 50%-69%	Very High >69%	Totals
High Elevation, Mountain Hemlock	12%	65%	10%	7%	7%	100
Lodgepole Pine	21%	72%	7%	<1%		100
Mixed Conifer Wet	26%	35%	23%	13%	2%	100
Mixed Conifer Dry	4%	53%	20%	17%	6%	100
Ponderosa Pine	95%	5%				100
Riparian		89%	11%			100
GRAND TOTALS	28%	37%	21%	12%	2%	100
TOTAL ACRES*	3,177	4,238	2,366	1,418	259	11,457

* Acres include all stands with a stand exam but do not include regeneration harvest units, non-forest areas or stands without a stand exam.

Mortality below 10% of the total stand basal area is considered normal and endemic. All of the PAGs within the Cache LSR, with the exception of the ponderosa PAG, have experienced basal area mortality above 10% on 74% or greater of the PAG acreage in the last 10 years. The mixed conifer plant associations have experienced the most significant mortality primarily due to several landscape-wide factors including, the presence of white fir, a species extremely susceptible to defoliating insects and endemic root disease, high stand densities and multi-storied stand structures. The ponderosa pine stands have experienced the least mortality of all the PAGs, well within the normal endemic range of mortality.

CURRENT AND HISTORIC CONDITIONS AND TRENDS BY PAG

The PAG summaries in the following sections include discussion and analysis of current and historic size/structure, species composition, stand density and trends and opportunities. They also include discussion of the current species composition of the overstory and understory components and the current levels of stand mortality.

MIXED CONIFER DRY (MCD) PAG — 72% of Total Acresl

The MCD PAG combines moderate and lower productivity CW Series plant associations and one highly productive CP plant association that has the potential for white fir to become mixed with ponderosa pine. This PAG includes the following plant associations, CR-S1-11, CW-S1-12, CW-C2-11, CW-C2-13, CW-S1-14, CW-S1-15, CW-XX-XX (Unclassified MCD), and CP-G2-12. These 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 LSR. Generally these areas have moderate to high productivity and a mean annual precipitation of 35'' to 75" (most sites are in the lower half of this range). Current tree vegetation consists of true firs, ponderosa pine, Douglas fir, lodgepole pine and small amounts of other species.

Tables 9a and 9b show the distribution of size/structure and species composition in the MCD plant associations. Table 9a compares the distribution of size/structure and species composition between: 1) the estimated historical range of variability (Historic), the known historical reference point (1953) and the present (1998). Table 9b, compares the current distribution of species composition between the understory component (all trees <21" DBH) and the overstory component (all trees in >21" DBH).

In table 9a, size/structure was classified for each stand (acres) based on the size/structure class with the most basal area regardless of the total stand basal area. The only exceptions to this were regeneration harvest units/acres, which were assigned to the seedling/sapling size class regardless of age or residual tree basal area remaining on the unit. In both tables 9a and 9b, stands were classified as primarily pioneer species, climax species or mixed (pioneer and climax) species. 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. Major pioneer species include ponderosa pine and lodgepole pine. Major climax species include white fir, Douglas fir and other true fir.

Table 9a. MCD, Comparison of Size/Structure and Species Composition.

MIXED CONIFER DRY PAG (Total Acres = 12,118)						
Size / Structure	**Species Composition**					
	Year or Time-frame	Percent Acres				
		Not Classified or Non-Forest	Pioneer (P)	Mixed (M)	Climax (C)	Totals
Not Classified or Non-Forest	1953	0	0	0	0	0
	1998	3	0	0	0	3
Grass / Forb / Shrub	Historic		1-7			1-7
	1953	0	3	0	0	3
	1998	0	0	0	0	0
Seed / Sapling (0-4.9")	Historic		2-15	1-10	0-1	3-26
	1953	0	0	0	0	0
	1998	0	18	0	0	18
Pole (5-8.9")	Historic		5-21	2-15	1-4	8-40
	1953	0	0	0	0	0
	1998	0	1	0	0	2
Small (9-20.9")	Historic		12-40	6-30	3-5	21-75
	1953	2	2	3	0	7
	1998	2	6	20	4	31
Medium / Large (21"+)*	Historic		15-42	5-28	3-5	23-75
	1953	0	81	10	0	90
	1998	0	14	29	2	45
TOTALS	Historic		35-100	14-83	7-15	
	1953	2	85	13	0	100
	1998	5	40	49	7	100

* Stands that are classified as the medium/large size class are not necessarily **potential** late-successional old growth (PLSOG). This classification simply means that medium/large trees represent the dominant basal area on those acres. See section VI. Late-Successional and O/G Habitat Conditions, for an estimate of acres of PLSOG.

Table 9b. Distribution of total acres with stand exams by overstory and understory species composition for the MCDry PAG in 1998.

MIXED CONIFER DRY						
UNDERSTORY SPECIES COMPOSITION	OVERSTORY SPECIES COMPOSITION					
	Pioneer	Mixed	Climax	No Overstory	Not Classified	Totals
Pioneer	18%	2%	1%	<1%		21%
Mixed	17%	6%	1%	<1%		25%
Climax	25%	19%	3%			47%
No Understory		<1%				<1%
Not Classified					8%	8%
GRAND TOTALS	59%	27%	6%	1%	8%	100%
TOTAL ACRES	5,474	2,525	514	60	703	9,276

Trends:

- General:
  - Historically, mature stands were primarily composed of early seral species. Ponderosa pine was the major species present, with minor amounts of lodgepole pine, Douglas fir, and white fir. On a landscape scale, stands currently exist outside this range, being partially or totally composed of white fir, Douglas fir, or lodgepole pine with varying levels of mortality.
  - Surveyor's notes from the late 1800's describe heavy yellow pine (ponderosa pine) and fir overstories. Hardly any of the understories in the lower elevations were described as dense. In some areas laurel, manzanita, bunchgrass and/or pinegrass were common. The entire area appeared to have been forested with contiguous stands. One of the surveyors noted sizes and species of many of the largest trees that were on his survey lines. In the western part of this PAG, he mentioned pines up to 40" and 50" DBH and firs 40"-70" DBH, although most trees noted were 10"-30".
  - The current vegetation types have shifted from open, park-like stands of ponderosa pine and in some cases Douglas fir to dense stands of white fir. Many of the largest ponderosa pine and Douglas fir have been removed.
- Size/Structure: (Table 9a):
  - There has been a significant shift in overall size/structure from large to smaller trees.

- The medium/large class has decreased by 45%.
- The small class has increased by 24%
- The seedling/sapling class has increased 18%

- Species Composition: (Table 9b)
  - In 1953 pioneer species, primarily ponderosa pine, were the dominant species on 85% of the acres and climax species were dominant on 0 acres. In 1998 climax species are a significant component on 56% of the acres.
  - There are significant differences in the species composition of stand overstories compared to stand understories.
    - On a majority of the acres, ponderosa pine, a long-lived, very stable component of the MCD plant association is being replaced by white fir, a short-lived, very unstable component.
    - After nearly 100 years of fire suppression, ponderosa pine is still the dominant overstory species on 59% of the acres and mixed with climax species on another 27% of the acres.
    - On 72% of the acres, climax species, primarily white fir, are a significant component of the understory. Climax species are the dominant species in the understories on 47% of the acres and mixed with pioneer species on another 25% of the acres.
    - Pioneer species, both ponderosa pine and lodgepole pine, dominate the understories on only 21% of the acres.
- Stand Densities:
  - Table 7 shows that 56% of the mixed conifer dry acres are currently above the upper management zone (UMZ) and thus at unstable densities.
  - Of the 39% of the MCD acres that are currently below the UMZ, approximately 72% of those acres have sustained >30% basal area mortality in the last 10-15 years. Thus, the number of acres at unstable densities was much higher prior to the recent mortality in this PAG.
- Mortality:
  - Table 8 shows that the MCD plant associations have experienced the second highest levels of mortality of any PAG other than the MCW PAG.
  - The mortality in this PAG is relatively high with 74 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 38% of the acres having basal area mortality greater than 30%.

MIXED CONIFER WETTER (MCW) PAG — 12% of Total Acres

The MCW PAG includes the CD Series and the most productive sites in the CW series. The CD Series plant associations in the PAG include CD-S6-12, CD-S6-13, and CD-S6-14. The CD associations are climax to Douglas fir and white fir. The major early seral species is ponderosa pine. The most productive CW plant associations in this PAG include CW-C2-12, and CW-S1-13. The MCW plant associations occur on the upper slopes of the Cascades with a mean annual precipitation of 35 to 75 inches. The productivity is generally higher than in the MCD PAG. Current vegetation consists of true firs, ponderosa pine, Douglas-fir, and lodgepole pine. Spruce can be found in the wetter uplands and riparian areas.

Tables 10a and 10b were developed the same way and describe the same information for the mixed conifer wet (MCW) PAG as tables 9a and 9b do for the MCD PAG.

Table 10a. MCW, Comparison of Size/Structure and Species Composition.

MIXED CONIFER WET PAG (Total Acres = 1,949)						
Size / Structure	**Species Composition**					
	Year or Time-frame	Percent Acres				
		Not Classified or Non-Forest	Pioneer (P)	Mixed (M)	Climax (C)	Totals
Not Classified or Non-Forest	1953	0	0	0	0	0
	1998	46	0	0	0	46
Grass / Forb / Shrub	Historic		0-20			0-20
	1953	0	1	0	0	1
	1998	0	0	0	0	0
Seed / Sapling (0-4.9")	Historic		3-20	0-25	0-9	3-54
	1953	0	0	0	0	0
	1998	0	9	0	0	9 (17)
Pole (5-8.9")	Historic		1-11	5-30	1-10	7-51
	1953	0	0	0	0	0
	1998	0	0	0	0	0
Small (9-20.9")	Historic		1-11	10-32	2-14	13-57
	1953	28	0	1	0	29
	1998	4	0	17	2	23 (43)
Medium / Large (21"+)*	Historic		1-11	8-28	2-14	11-53
	1953	0	29	22	19	70
	1998	1	2	18	1	22 (41)
TOTALS	Historic		6-73	23-100	5-47	
	1953	28	30 (42)**	23 (32)	19 (26)	100
	1998	51	11 (22)	35 (71)	3 (6)	100

* Stands that are classified as the medium/large size class are not necessarily **potential** late-successional old growth (PLSOG). This classification simply means that medium/large trees represent the dominant basal area on those acres. See section VI. Late-Successional and O/G Habitat Conditions, for an estimate of acres of PLSOG.

** A significant number (48%) of the acres of the MCW PAG are located in the Cache RNA and were not classified for this table, therefore, for comparison, figures in parenthesis are percentages when only the classified acres are considered.

Table 10b. Percent distribution of total acres with stand exams by overstory and understory species composition for the mixed conifer wet plant associations.

MIXED CONIFER WET						
UNDERSTORY SPECIES COMPOSITION	OVERSTORY SPECIES COMPOSITION					
	Pioneer	Mixed	Climax	No Overstory	Not Classified	Totals
Pioneer	4%	<1%		<1%		4%
Mixed	6%	9%	<1%			16%
Climax	47%	16%	5%			67%
No Understory		1%				1%
Not Classified					12%	12%
TOTALS	57%	26%	5%	<1%	12%	100%
TOTAL ACRES	489	225	44	1	103	862

Trends:

- General:
  - Historically, mature stands in this series were primarily composed of early seral species mixed with climax species. Ponderosa pine was the major species present, with some lodgepole pine, Douglas fir, western white pine, white fir, and western larch. Species composition included young white fir, with mature trees usually making up 30% or less of stocking. On a landscape scale, stands currently exist outside this range, being largely composed of mature and immature white fir or Douglas fir.
  - Surveyor's notes from 1870 describe heavy yellow pine (ponderosa pine) and fir overstories, as well as heavy western larch and spruce overstories. They described dense understories of pine, fir, willow, and chinquapin in some areas. The entire area appeared to have been forested with contiguous stands.
  - Historically these associations contained small amounts of Engelmann spruce and pacific silver fir. White fir and Douglas-fir were present, but made up less than 30% of the stands. On a landscape scale, stands currently exist outside this range, being partially or largely composed of mature white fir or Douglas-fir.
- Size/Structure: (Table 10a):
  - There has been a significant shift in overall size/structure from larger to smaller trees.
  - The medium/large class has decreased by 29%.

- The small class has increased by 14%
- The seedling/sapling class has increased 17%

- Species Composition: (Table 10b)
  - In 1953 pioneer species, primarily ponderosa pine, were the dominant species on 42% of the acres and climax species were dominant on 19% of the acres. In 1998 climax species are a significant component on 76% of the acres.
  - There are significant differences in the species composition of stand overstories compared to stand understories.
    - On a majority of the acres, ponderosa pine is being replaced by white fir.
    - Even after nearly 100 years of fire suppression, ponderosa pine is still the dominant overstory species on 57% of the acres and mixed with climax species on another 26% of the acres.
    - On 83% of the acres, climax species, primarily white fir, are a significant component of the understory. Climax species are the dominant species in the understories on 67% of the acres and mixed with pioneer species on another 16% of the acres.
    - Pioneer species, both ponderosa pine and lodgepole pine, dominate the understories on only 4% of the acres.
- Stand Densities:
  - Table 7 shows that 46% of the mixed conifer dry acres are currently above the upper management zone (UMZ) and thus at unstable densities.
  - Of the 50% of the MCW acres that are currently below the UMZ, approximately 67% of those acres have sustained >30% basal area mortality in the last 10-15 years. Thus, the number of acres at unstable densities was much higher prior to the recent mortality in this PAG.
- Mortality:
  - Table 8 shows that the MCW plant associations have experienced the highest levels of mortality of any PAG. These figures do not include the Cache RNA. The Cache RNA is also known to have a significant number of acres of moderate to very high levels of mortality; it is estimated that more than half the RNA exceeds 50% mortality.
  - The mortality in this PAG is relatively high with 96 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 43% of the acres having basal area mortality greater than 30%.

PONDEROSA PINE (PP) Wet and Dry PAG **5% of Total Acres**

The PP PAG includes the High, Moderate, and Lower Productivity Sites in the CP Series. In the CP-S2-12, CP-S2-11, and CP-S3-12 associations, ponderosa pine and lodgepole pine are early seral, lodgepole with disturbance and on colder sites. In the CP-S2-17, CP-S2-13, CP-S2-16, CP-S1-11, and CP-S1-12 associations, ponderosa pine was and 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.

This PAG has some slopes, but the pure ponderosa pine areas are mostly fairly flat. It is located along the eastern fringe of the LSR, and includes fairly productive ponderosa pine sites. Annual precipitation ranges from 15" to 40".

Table 11. PP PAG Size/Structure.

PONDEROSA PINE PAG (Total Acres = 849)		
Size / Structure	**Species Composition**	
	Year or Time-frame	Percent Acres Pioneer, Mixed and Climax
Not Classified or Non-Forest	1953	0
	1998	3
Grass / Forb / Shrub	Historic	5-30
	1953	0
	1998	0
Seed / Sapling (0-4.9")	Historic	3-21
	1953	0
	1998	25
Pole (5-8.9")	Historic	3-21
	1953	0
	1998	4
Small (9-20.9")	Historic	20-50
	1953	0
	1998	26
Medium / Large (21"+)	Historic	30-70
	1953	100
	1998	41
TOTALS	1953	100
	1998	100

Trends:

- General:
    - Historically, stands are composed of mature ponderosa pine and ponderosa pine regeneration, in relatively even-age groups, with minor amounts of white fir and Douglas-fir present in the ecotones with the mixed conifer plant associations.
    - Historic surveyor's information describes the stands in this area as large even-aged stands of pure ponderosa pine, many with grass understories. Some fir, probably Douglas-fir, is mentioned, and there are many references to "best bunchgrass." Most of the understories, if present, are not "dense", and include "sweet laurel" or "Greasewood."
- Size/Structure (Table 11):
    - There has been a significant shift in overall size/structure. However, the current distribution of size/structure is still within the estimated range of historical variability (HRV).
    - The medium/large class has decreased by 59%.
    - The small class has increased by 26%
    - The seedling/sapling class has increased 25%
    - The pole class has increased 4%
- Species Composition:
    - In the ponderosa pine plant associations ponderosa pine is both early and late seral, consequently, no shift in species composition was expected or observed.
- Stand Densities:
    - Table 7 shows that 85% of the mixed conifer dry acres are currently above the upper management zone (UMZ) and thus at unstable densities. This is a significant percentage of the acres above UMZ.
- Mortality:
    - Table 8 shows that mortality in the PP plant associations to be the lowest of any PAG with only 5% of the acres having 10% or more basal area mortality.

LODGEPOLE PINE (LP) PAG

3% of Total Acres

This vegetation type is found mostly at higher elevations. 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 CL High Productivity Sites in this LSR include CL-M4-11 and CL-G4-12 plant associations. The CL Moderately Productive sites include the CL-S9-11 plant association.

Table 12. LPP PAG Size/Structure.

LODGEPOLE PINE PAG (Total Acres = 476)		
Size / Structure	**Species Composition**	
	Year or Time-frame	Pioneer, Mixed and Climax Percent Acres
Not Classified or Non-Forest	1953	0
	1998	?
Grass / Forb / Shrub	Historic	0-60
	1953	15
	1998	2
Seed / Sapling (0-4.9")	Historic	0-60
	1953	0
	1998	1
Pole (5-8.9")	Historic	10-80
	1953	20
	1998	34
Small (9-20.9")	Historic	0-80
	1953	13
	1998	59
Medium / Large (21"+)	Historic	0-2
	1953	52
	1998	3
TOTALS	1953	100
	1998	100

Trends:

- General:
    - There is a wide range of historical conditions because of the boom and bust cycles of fire and insects in these plant associations. Because of this, none of the size classes are shown as outside HRV.
    - Historically, for the high productivity sites, mature stands were composed mainly of lodgepole pine, with minor amounts of sub-alpine fir, mountain hemlock, or white pine present at higher elevations. Lodgepole pine associations are simple in structure. Most are relatively even-age, even-sized stands.
    - Historically, for the moderately productive sites, mature stands were mainly composed of lodgepole pine, with minor amounts of ponderosa pine and white fir present. The moderately productive lodgepole plant associations also are composed of relatively even-sized, even-age lodgepole pine. Scattered mature ponderosa pine is often present near edges adjacent to mixed conifer and ponderosa pine associations.
- Size/Structure (Table 12):
    - There has been a significant shift in overall size/structure.
    - The medium/large class has decreased by 49%. This is probably not an accurate representation of the true condition from 1953 to the present. The classification of 52% of this PAG as medium/large size class is probably a misclassification due to the small number of acres of lodgepole pine PAG in the LSR and the large scale of mapping done in 1953. It is most likely that in 1953, most stands were dominated by pole-sized stands, although one area, a recent burn, was open/grass/forb/shrub. Since 1953 these stands have increase in size and density and one would expect a movement of pole size acres into the small size class.
    - The small class has increased by 46%
    - The pole class has increased by 14%
    - The grass/forb/shrub class has decreased by 13%.
    - The seedling/sapling class has increased 1%
- Species Composition:
    - In 1953, most of the medium/large size class was classified as being dominated by ponderosa pine. This was probably a misclassification for the same reason as listed under size structure above. Generally, in the lodgepole pine plant associations, lodgepole pine is the early and late seral species replacing itself through a boom and bust cycle of insects and fire. Currently, lodgepole pine is the dominant species on most acres; however, there are some stands that have a fairly large component of true fir and Mt. Hemlock. True fir and Mt. Hemlock are also reproducing fairly heavily in most stands.
- Stand Densities:

- Table 7 shows that 65% of the LP acres are currently above the upper management zone (UMZ) and thus at unstable densities.

- Mortality:
  - The mortality in this PAG is relatively low with only 7 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 30%. In addition, 72% of the acres have basal area mortality between 10% and 30% and 21% of the acres have mortality < 10%. These levels of mortality are probably fairly typical of lodgepole pine before it reaches the upper limits of size (8"-12" DBH) and age (80-120 years), at which point the mountain pine beetle has the capability of creating very high levels of mortality.

HIGH ELEVATION MT HEMLOCK (MH) PAG 4% of Total Acres

Only one plant association, CM-S1-11 is included in this PAG. Generally these sites are of low to moderate productivity. This plant association is found at the higher elevations along the boundaries of the Mt. Washington Wilderness area and within the Cache RNA (42%of the PAG). 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 that may be found in these stands. The portions of this PAG within the Cache RNA were not classified as to size structure.

Table 13. HIGH ELEVATION MT. HEMLOCK PAG Size/Structure.

HIGH ELEVATION / MT. HEMLOCK PAG (Total Acres = 696)		
	Species Composition	
Size / Structure	Year or Time-frame	Percent Acres Pioneer, Mixed and Climax
Not Classified or Non-Forest	1953	0
	1998	57
Grass / Forb / Shrub	Historic	0-5
	1953	0
	1998	0
Seed / Sapling (0-4.9")	Historic	0-8
	1953	0
	1998	2 (5)
Pole (5-8.9")	Historic	5-30
	1953	29
	1998	1 (2)
Small (9-20.9")	Historic	5-55
	1953	68
	1998	33 (77)
Medium / Large (21"+)	Historic	5-20
	1953	3
	1998	7 (16)
TOTALS	1953	100
	1998	100

** A significant number (57%) of the acres of the MH PAG have not been classified (42% are in the Cache LSR) for this table, therefore, for comparison, figures in parenthesis are percentages when only the classified acres are considered.

Trends:

- General:
  - There is a wide range of historical conditions because of the boom and bust cycles of disturbance in this PAG.
  - Historically, mature stands were composed mainly of mountain hemlock, with minor amounts of lodgepole pine, sub-alpine fir, western white pine and whitebark pine.
- Size/Structure (Table 13):
  - There has not been a significant shift in overall size/structure. The biggest change appears to be that many of the stands have moved up a size class in the last 45 years.
  - The small class has increased by 11%
  - The pole class has decreased by 27%
  - The seedling/sapling class has increased 5%
- Species Composition:
  - The amount of mountain hemlock has increased in most stands.
- Stand Densities:
  - Table 7 shows that for a majority of the stands, an estimate of stand density was not available. It can be assumed that a majority of the stands have high densities due to the lack of either human or natural disturbance in last 50 to 100 years.
- Mortality:
  - The mortality in this PAG is relatively low with only 24 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 30%.

RIPARIAN PAG <1% of Total Acres

RIP species composition and density

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 LSR.

Riparian vegetation can be very diverse. The successional classes of riparian vegetation in the LSR for 1953 show a dominance (98%) of riparian acres in medium/large sized pioneer species. In 1998 the dominant successional class was still medium/large size classes (68%), but small mixed and climax species have increased from 0% to 22%. 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.

IV. DISTURBANCE EVENTS THAT INFLUENCE VEGETATION

OVERVIEW

Disturbance to natural vegetation has occurred in many forms: insects and disease, tree harvesting, roads and fires have all played a role in shaping the current LSR.

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.

Tree harvest and silvicultural treatments have had a large impact in the LSR. 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.

HARVEST, REGENERATION, AND TSI RELATED DISTURBANCES

In the Mixed Conifer PAGs regeneration harvest has been a significant disturbance in the last 40 years. 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 and recent spruce budworm and tussock moth outbreaks.

In the Ponderosa Pine and Mixed Conifer PAGs 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 2644 acres. There are still large trees in about 20% of the units. The known timber stand improvement activities cover approximately 465 acres, mostly in pole size or small size structure. There were previous entries in some of these same areas, many of them partial cuts, covering approximately 407 acres.

INSECTS AND DISEASE

The primary insects and diseases include various bark beetles, defoliators, mistletoes, and root diseases. All of the conifer species are affected by one or more of these agents. 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.

Western spruce budworm was very active in the late 1980's and early 1990's. Noticeable defoliation occurred on true and Douglas fir between 1986 and 1992. In those cases where defoliation was light, the affected trees recovered and now show minimal effects of the prolonged budworm outbreak. In the Mixed Conifer associations, the effects of defoliation were more profound. Many trees sustained moderate to severe top-kill while many others

were killed, either by the budworm defoliation, or in combination with the high levels of Armillaria root disease, which is pervasive throughout the Mixed Conifer PAGs.

In addition, the budworm outbreak set the stage for secondary bark beetles such as the Douglas fir beetle and fir engraver which attacked and killed trees weakened by defoliation and by the complex of other factors which are operating in that area.

The combined effects of western spruce budworm, Armillaria root disease, and other agents such as bark beetles have produced substantial tree mortality in the Mixed Conifer PAGs.

In the Mixed Conifer PAGs there has been a large 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 PAG the occurrence of insects is relatively low. There are endemic levels of western pine beetle and mountain pine beetle. Due to fire exclusion, dwarf mistletoe has had a significant influence in the area. It has influenced the vegetation and motivated much of the harvesting that has occurred. Windthrow occurs occasionally but has produced no significant changes in vegetation.

In the Lodgepole Pine PAG the mountain pine beetle is the major disturbance factor.

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 important 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 those fire regimes can be difficult.

See Cache LSR Fire Management Plan (Appendix 1) for detailed discussion of the fire regimes, effects of fire exclusion, risk and hazard analysis.

V. LATE-SUCCESSIONAL AND O/G ASSOCIATED SPECIES

The following is a summary of the status and habitat conditions of focal species that are known or suspected to occur in the LSR. The focal species represent a variety of other species with similar habitat needs. Surveys for plants, birds, mammals, reptiles, and amphibians conducted in Cache RNA provide an estimation of species that are expected to occur in other areas of the LSR (Appendix 2)

TERRESTRIAL ANIMAL SPECIES

Proposed, Threatened, Endangered and Sensitive Focal Species

Bald Eagle *(Ponderosa Pine and Mixed Conifer PAGs)*

The bald eagle is a federally threatened species.

Cache LSR is within the High Cascades Bald Eagle Recovery Zone 11. There are no known bald eagle nest trees or territories in the LSR and no potential territories were identified in the "Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington" (Bald Eagle Working Team, 1990).

Although not presently occupied by nesting eagles, there is potential habitat for eagles within the LSR, and use of the area by foraging eagles is probable. Three lakes in the northern portion of the LSR (PeeWee, Four O'clock, and Torso Lakes) are stocked with fish and currently provide a potential prey base for eagles. Large diameter Douglas fir and ponderosa pine trees suitable for nest trees and roosting and foraging perches exist in proximity to the lakes. A known eagle nest site exists approximately 3.5 miles outside the LSR and it is suspected that these eagles may forage and roost within the LSR.

Special Considerations

Management for bald eagle habitat is not a priority objective for Cache LSR. However, because potential habitat for this species is limited in the LSR, management for current and future bald eagle habitat should be considered in the Four Lakes area of Cache RNA as long as no conflict exists with other LSOG related species warranting greater consideration. Management for bald eagle habitat should occur in selected areas within 150' of lakes to minimize conflicts with other LSOG species needs. Look for opportunities to develop and maintain ponderosa pine and Douglas fir trees that are dominant or codominant trees >35" dbh with limb structure that will support a nest and provide a view of the foraging area.

Canada Lynx *(Mt. Hemlock, Lodgepole Pine, and Mixed Conifer PAGs)*

The Canada lynx is proposed for listing under the Endangered Species Act. The decision is due Fall 1999.

The Suttle Lake lynx management unit (LMU) lies partially within the Cache LSR. There has been one probable sighting approximately 4 miles northeast of the LSR in 1986 and one probable sighting south of the LSR in 1996. However, no occurrences of lynx have been documented within this area. A regional survey effort was conducted in 1998 to determine presence/absence of lynx within the Cascades of Oregon. Two survey blocks were located

on the Sisters Ranger District but none were located within the Cache LSR. It was determined through these surveys that lynx do occur within the Oregon Cascades.

No known occurrences exist in the LSR currently, but potential habitat exists, especially within the lodgepole pine PAG. The lynx requires a mix of habitats to support its primary prey species, the snowshoe hare. This species requires dense, young stands of lodgepole primarily but not exclusively, that provide a forage base both in summer and winter months. The lynx also requires old or mature stands with high canopy closure and if possible, large accumulations of down woody material. This provides security sites for denning. Travel cover between denning and forage areas and between other suitable sites is usually located on prominent ridges, through saddles, and along riparian areas.

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

Special Considerations

Management for the protection and enhancement of spotted owl NRF is compatible with denning habitat management objectives for the lynx. Maintain adequate levels of down woody material within or adjacent to suitable denning habitat. Thinning of plantations less than 15' in height should be delayed until after such time as these plantations exceed 15' above 4500'. Maintain travel cover along prominent ridges, riparian areas, and through saddles. Refer to the FY 99 Biological Assessment to determine the mix of habitats needed by PAG for the Suttle Lake LMU. Strive to reduce road densities especially where roads are within 1/4 mile of suitable denning habitat.

Northern Spotted Owl *(Mixed Conifer PAGs)*

The northern spotted owl is a federally threatened species.

Cache LSR 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.

Suitable, Potential, and Sustainable Spotted Owl 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 DNF; identifies potential NRF habitat, (PAGs that have the potential to provide spotted owl habitat at least in the short-term); and discusses sustainable NRF habitat, (PAGs 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 0-50 years and long-term means 50+ years.

Suitable NRF Habitat

Spotted owl NRF 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 DNF vegetative sampling project identified the following characteristics of suitable NRF 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" dbh), second canopy layer with densities of at least 280 trees per acre, at least 12 hard snags per acre (>15" dbh), and 15 or more down logs per acre (>15"dbh) (Austin, 1994).

However, based on the same sampling effort, NRF actually in use by owls on the DNF was described as having the following minimum structural characteristics: Mixed Conifer PAGs, multi-storied stands of at least 40 contiguous acres with at least 60% canopy cover; at least 8 trees per acre >21"dbh; and at least 82 trees per acre in the understory <21" dbh.

Potential and Sustainable NRF Habitat

The MCWet and MCDry PAGs represent potential NRF habitat on the DNF. These are the PAGs that are capable of (and do) provide NRF habitat for the owl. However, many of the forested sites in the MCDry PAG do not have the vegetative site potential to sustain NRF habitat characteristics over the long-term (DNF White Paper, 1995).

Forested stands that have the site-potentials to sustain higher tree densities and basal area are most likely to provide the highest quality NRF for the longest period of time. Generally, MCWet, and MCDry (on north aspects) plant associations have the site potentials and environmental conditions that are expected to sustain NRF habitat (USFS 1996).

Historic and Current Trends

As described earlier, fire exclusion has altered the species composition and structure of many MCDry stands, consequently spotted owl NRF may exist today in sites that did not historically provide habitat. Conversely, many of the stands that historically were NRF habitat have been harvested and no longer provide habitat. Thus, although it is a common assumption that there was less spotted owl habitat available historically, questions of how much less habitat and what corresponding spotted owl densities were associated with the historic habitat levels remain unresolved. Changes in owl densities from current to historic times are unknown.

Over the past 5 to 15 years, many of the overstocked, "out of balance" MCDry 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.

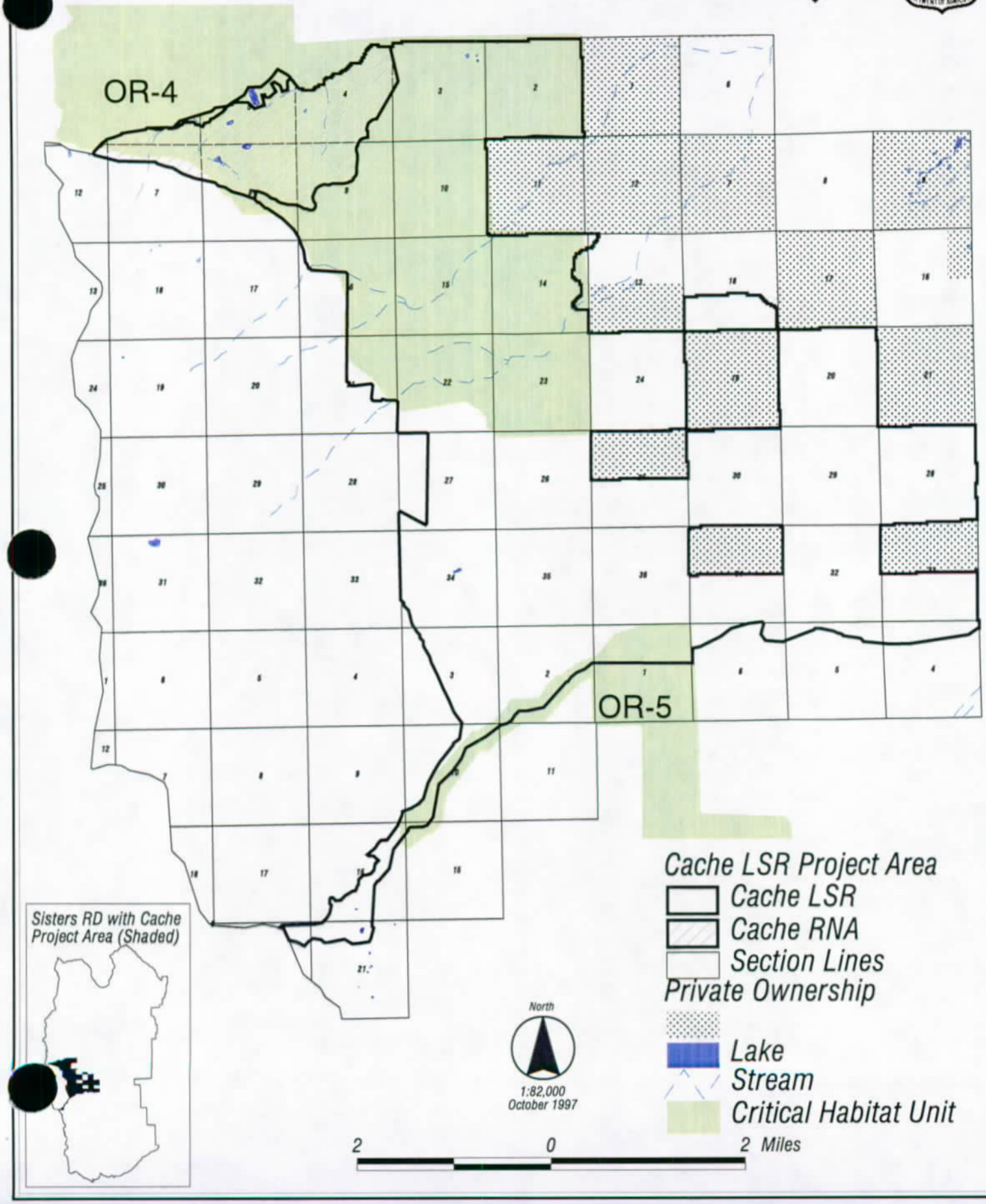
Landscape Overview of the Existing Condition of the Spotted Owl

In order to understand the existing condition of the northern spotted owl and its habitat in Cache LSR it is necessary to examine how this LSR currently functions for the species in the

context of the network of LSRs and to describe quality and quantity of owl habitat in the surrounding landscape.

The Cache LSR is part of a regional network of LSRs designed to maintain habitat and viability for late successional and old growth (LSOG) related species including the northern spotted owl. The LSR 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, designed to provide for the protection and recovery of a listed species.

Cache Late Successional Reserve



CHUs

Cache LSR includes parts of two CHUs: CHU OR-4 & OR-5 (Map 9). 36% of OR-4 and 4% of OR-5 are within the LSR boundaries. The desired function of these CHUs is described below:

"**Critical Habitat Unit OR-4** was designated to provide essential breeding, roosting, and foraging owl habitat and to assist in dispersal of spotted owls along the eastern crest of the Oregon Cascades within the Eastern Cascades province. Unit OR-4 maintains not only an inter-provincial link with the Western Cascades province to Unit OR-15, but also helps maintain the north-south continuum of spotted owl habitat along the eastern slope of the Cascades Mountains" (USDI, 1992).

"**Critical Habitat Unit OR-5** 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. Unit OR-5 helps maintain the north-south continuum of spotted owl habitat and provide for owl dispersal along the eastern slope of the Cascades Mountains" (ibid. 1992).

Table 14 displays the total acres in the CHUs, acres of existing (NRF), and the percentage of the CHU that is currently NRF. NRF habitat within these CHUs is limited in quantity, is fragmented, and has been impacted to some degree by insect and disease infestation. NRF acres are based on the 1992 aerial photo interpretation map generated by the DNF Supervisors Office and are not modified to reflect recent tree mortality, which may be as much as 20% to 30%.

Table 14. Spotted Owl NRF in CHUs OR-4 & OR-5

CHU #	*Acres in CHU*	*Acres NRF*	*% of CHU = NRF*
OR-4	18,697	4,127	22%
OR-5	8,406	2,903	35%

Cache LSR in Context of DNF/LSR Network

The 1995 DNF LSR Overview broadly describes the desired ecological function of the individual LSRs and identifies how the LSRs interrelate and contribute to the overall function of the LSR system.

The DNF Overview identifies the northern spotted owl as one of the LSOG related species associated with Cache LSR and identifies the following deficits in Forest - level habitat connectivity: "Of particular concern are the Matrix land allocation surrounded by the Metolius LSR (the Jack Canyon area) and Matrix land between the Cache/Trout and Three Creeks LSR..." (USDA, 1995). Heavy tree mortality in NRF within and between Cache/Trout and Metolius LSRs has resulted in substantial habitat loss and degradation. In short, habitat connectivity along a north-south continuum has been compromised by current forest conditions.

Existing Condition of Owl Habitat on the Sisters RD

Federal lands on Sisters RD encompass about 316,720 acres. Approximately 57,000 acres or 18% of the district was mapped as spotted owl NRF 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 PAGs capable of sustaining NRF habitat (USFS 1996).

The majority of known spotted owl activity centers on the DNF are located on the Sisters RD. 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. Forty- percent 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 07 consultation with the U.S. Fish and Wildlife Service under the Endangered Species Act.

Spotted owl habitat within Cache LSR is limited in quality as well as quantity. Past harvest activities and insect and disease infestation have removed and fragmented owl NRF habitat in the area. Reduced canopy cover and stand structural diversity, (resulting from spruce budworm defoliation, Armillaria root disease, bark beetles and other agents) have lowered the quality of the remaining owl habitat. Table 15 summarizes relevant owl NRF habitat data in the LSR. NRF acres are based on the 1992 aerial photo interpretation map generated by the DNF and are not modified to reflect recent mortality.

Table 15. Existing and Potential NRF Habitat and Sustainable PAGs in Cache LSR.

Total Acres in LSR	*Acres NRF*	*% LSR = NRF*	*Acres of Potential NRF*	*% LSR = Potential NRF*	*Acres in Sustainable. PAGs*	*% LSR in Sustainable PAGs*
16,938	5,628	33%	14,338	85%	3,684	22%

Three recent projects on the district - Jack Canyon, Santiam Corridor, and Santiam Restoration Vegetation Management Projects, have (or will) remove or degrade 2,585 - 2,841 acres of spotted owl NRF (USFS 1997, USFS 1996). Extensive tree mortality has occurred in much of the NRF habitat in these project areas, and most activity centers were already below the 40% habitat threshold. Management for future, long-term NRF 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 will result in the "incidental take" of ten owl pairs (48% of the known owl activity centers).

There are 5 known spotted owl activity centers associated with the Cache LSR, four are pairs and one is a resident single. All of the owl home ranges contain less than 40% suitable habitat. NRF has been (or will be) removed from the home ranges of three of these owls - MSNO #'s 5008, 5009, and 5020 - by the vegetation management projects described earlier.

All of the home ranges associated with Cache LSR contain enough potential NRF PAG to provide "unsustainable" NRF habitat at high levels. Three of the five owl home ranges have enough of the sustainable PAGs to maintain >40% NRF habitat within the home range radius on a long-term basis; the remaining 2 owl pairs do not. Table 16 and Table 17 summarize

NRF habitat data and owl reproductive success for the known owl activity centers in the LSR. Owl sites have not been monitored annually, so the productivity of these sites is not well established. Mapping and evaluation of NRF condition was completed by district wildlife biologists Ron Archuleta and Jeff Grenier (in most instances acres reflect habitat loss via insect and disease).

Table 16 Habitat Summaries for the Five NSO Pairs/Resident Singles Known To Occur in Cache LSR.

Spotted Owl MSNO	*Acres NRF w/n 1.2 Mile Radius*	*% NRF w/n 1.2 Mile Radius*	*% Potential NRF w/n 1.2 Mile Radius*	*% Sus. PAG w/n 1.2 Mile Radius*
5008	539	18%	80%	77%
5009	521	18%	97%	45%
5010	460	16%	96%	49%
5015	820	28%	82%	21%
5020	152	5%	89%	32%

Table 17 Reproductive Status for Spotted Owls Known to Occur in Cache LSR.

Owl ##	*1996*	*1995*	*1994*	*1993*	*1992*	*First year Located*
5008	R/2	R/2	UK	UK	UK	1972
5009	NA	MP	UK	PO	UK	1987
5010	MP	R/2	UK	NA	MP	1989
5015	UK	NA	UK	FP	UK	1980
5020	PO	R/2				1995

FP = female present; MP= male present; NA = Surveyed, but not active; UK = Not surveyed, status unknown; R/# = Reproductive with # young observed; PO = Pair occupancy, but not reproductive.

Special Considerations

Spotted owl habitat in this LSR and in the surrounding landscape is very limited in quantity, is fragmented, and has been heavily impacted by insect and disease infestation. Not managing NRF may leave the habitat vulnerable to loss of desired structural characteristics in the future. However, given the recent risk-reduction treatments in NRF elsewhere on the district and the minimal levels of existing habitat currently available to this species, further loss/degradation of existing NRF 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 NRF habitat and are not critical dispersal habitat for this species.

California Wolverine and Fisher *(Mt. Hemlock, lodgepole pine and Mixed Conifer PAGs)*

The wolverine is a federal candidate species (Category 2) and is on the Regional Foresters Sensitive species list. The fisher is a federal candidate species (Category 2).

There have been no formal surveys for wolverine; however, there is a recent sighting (1997) inside the LSR. There was also a 1996 wolverine sighting approximately 1 mile from the

southern boundary of the LSR and a historic sighting north of the LSR near Suttle Lake. There is not enough information available to determine whether or not CLSR supports any resident wolverines. However, it is likely that dispersing and migrating individuals moving through the Cascades from northern Washington to northern California pass through this area.

There have been no formal surveys for fisher in the LSR and there are no documented sightings. Potential habitat is extensive in the area and the probability of occurrence is moderate. It is not known whether the LSR currently supports resident individuals or populations.

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

Special Considerations

Maintain unfragmented habitats with few or no roads.

Northern Goshawk *(Mixed Conifer and Ponderosa Pine PAGs)*

The goshawk is listed as a State Sensitive Species due to conversion of mature and late-successional habitats to younger, even-aged stands. This species is also listed as a federal category 2 species (C2) and is proposed for listing on the Region 6 Regional Foresters Sensitive Species list. Goshawks are DNF Management Indicator Species for old-growth ponderosa pine forests.

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 PAGs 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 (450 acres) and foraging areas (5,400 acres) include a mosaic of vegetation structural stages (Reynolds et al. 1992).

Goshawk population densities in the LSR are not known and there are no known nest sites. No surveys have been completed in the LSR.

The amount of suitable goshawk habitat in the LSR 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 LSR 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.

Special Considerations

Management for the protection and enhancement of spotted owl NRF in the LSR is compatible with habitat management objectives for the goshawk. Surveys for existing

goshawk nest territories should be completed in Cache LSR prior to any risk-reduction or habitat enhancement activities.

Selected Focal Species

Flammulated Owl *(Ponderosa Pine and Mixed Conifer PAGs)*

The Flammulated owl is considered a sensitive species in the critical category by ODFW due to the conversion of multi-storied mature and late-successional habitats to even-aged small sized forests, and snag loss.

This species nests in ponderosa pine, western larch or Douglas fir snags having a dbh of 12 - 23 inches. Typical habitat for this species is a mosaic of open forests containing mature or late-successional ponderosa pine mixed with other tree species, patches of dense forest growth and grasslands (McCallum 1994).

Flammulated owls have been heard throughout the mid and lower elevation mixed conifer and ponderosa pine PAGs and there are documented sightings within Cache LSR. Historically, the open forest dominated by large diameter trees provided habitat for this species. More recently, the fragmentation of forests, and selective logging for large diameter ponderosa pine, western larch and Douglas fir has reduced the amount of suitable habitat. Fire exclusion has also reduced the open character of the ponderosa pine stands, creating dense forests that provide high quality roosting habitat but low quality foraging habitat for this species.

Special Considerations

Suitable habitat for the flammulated owl - open, fire-climax forests in the MC Dry and ponderosa pine PAGs, is limited in Cache LSR. Management for flammulated owl habitat is compatible with the habitat needs of the white-headed woodpecker - another LSOG related species of emphasis for this LSR. Consider management for flammulated owls and white-headed woodpeckers in areas that are not spotted owl NRF habitat. (See the habitat needs of white-headed woodpeckers for additional information).

Great Gray Owl *(Ponderosa, Lodgepole pine and Mixed Conifer PAGs)*

The great gray owl is considered a sensitive species in the vulnerable category by ODFW due to the loss of nest and roost sites from logging activities. Great gray owls are a survey and manage species (survey strategies 1 & 2) under the NWFP.

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 PAGs; 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). The vast majority of great gray owl nests are found within .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 are no documented great gray owl sighting in Cache LSR and no formal surveys have been conducted. Potential habitat with the highest likelihood of occupancy exists around Dugout Lake, the Dugout burn area, and in the larger created openings adjacent to Dry Creek swamp. Additional habitat may exist in the more open mixed conifer and ponderosa pine stands in the area and adjacent to the four lakes in the Cache RNA.

The historic and current population and habitat levels for this species within the LSR 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.

Special Considerations

Potential habitat is limited in the LSR, thus protection and enhancement of desired habitat characteristics in proximity to available foraging areas (the meadows/openings identified above) is appropriate.

Vaux's Swift *(Ponderosa Pine and Mixed Conifer PAGs)*

This species was identified as a focal LSOG related species for the Cache LSR.

Vaux's swifts utilize large hollow snags for nesting and roosting. In eastern Oregon, 85% of nests were in late-successional forest habitats. Seventy-five percent of the nesting cavities were accessed through openings created by pileated woodpeckers. Broken off-snags with deep hollow chambers open to the sky are also characteristic roosting and nesting trees. Large diameter snags (>21" dbh) particularly grand fir, were commonly used for nesting and roosting (Bull and Cooper 1991).

There are no documented sightings of this species in the LSR, however potential habitat exists throughout the area and the likelihood of occupancy is high. The historic and current population trends within the LSR are unknown. However, it is likely that the recent fragmentation of late-successional forests and selective logging of large trees probably reduced the amount of large diameter snags and the amount of suitable Vaux's swift habitat.

Special Considerations

Potential habitat for Vaux's swift exists in LOS stands throughout the planning area. Retention of large diameter snags and management for large hollow snags in the future is an appropriate objective for all of the MSAs in the LSR. The habitat needs of this species are compatible with most of the other LSOG related species described. Consider managing for Vaux's swifts across the LSR.

Black-backed Woodpecker *(Lodgepole pine and Mixed Conifer PAGs)*

The black-backed woodpecker is considered a sensitive species in the critical category by ODFW due to loss of snags and the conversion of mature lodgepole pine stands to younger

stands. Black-backs are DNF Management Indicator Species for old-growth lodgepole pine forests.

There are documented sightings of black-backed woodpeckers in Cache LSR. No formal surveys have been completed. Black-backed studies conducted on the DNF showed habitat preference for mature and overmature lodgepole pine and mixed conifer stands (Goggans et al. 1987). 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. (1987) 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. 1987).

The following management recommendations were identified in the DNF black-backed study: management areas for one pair of black-backs should be 956 acres of mature and overmature lodgepole pine or lodgepole pine-dominated mixed conifer forest, at a minimum elevation of 4500' (Goggans et al. 1987). The 100 percent population potential for this species is 0.12 conifer snags per acre in forest habitat; these snags must be at least 17 inches dbh or greater and of a hard decay class (USDA 1994).

The mature lodgepole pine or mixed conifer with lodgepole pine habitats found in the Mixed Conifer, Lodgepole, and High Elevation PAGs are current and potential habitat for this species in the LSR. The historic and current population trends within the LSR are unknown.

Special Considerations

Lodgepole stands above 4500' have the highest potential to provide suitable nesting, roosting, and foraging habitat for this species in the LSR. The Lodgepole PAG occurs primarily in an area around and to the west of Dugout Lake. Additional habitat for this species would be provided in areas of spotted owl NRF and in goshawk nesting habitat.

White-headed Woodpecker *(Ponderosa pine and Mixed Conifer PAGs)*

The white-headed woodpecker is considered a sensitive species in the critical category by ODFW due to loss of snags and the conversion of mature ponderosa pine stands to younger stands. This species is also identified in the NWFP (Appendix J2) as needing special mitigation provisions.

There are no documented sightings of white-headed woodpeckers in the LSR and no formal surveys have been conducted. Potential habitat exists within the mixed conifer and ponderosa pine PAGs of the LSR and the likelihood of occupancy is high.

A study of white-headed woodpecker ecology in central Oregon included 8 study sites on the Sisters RD. In this study white-headed woodpecker habitat was characterized as follows: the majority of nests and roosts were in ponderosa pine forest types with $\leq$57% canopy closure; most nests were in ponderosa pine snags, with a mean diameter of 25" dbh and a mean height of 46'; roost sites were primarily in ponderosa pine snags and live trees, with a mean diameter of 24" dbh and a mean height of 66'; foraging sites were live ponderosa pine trees with a mean diameter of 27" dbh (Dixon 1995).

Dixon (1995) also documented these relevant aspects of white-headed woodpecker ecology: this species uses snags in a variety of decay classes; demonstrates selection for trees/snags >21"; and has an average home range size of 257 acres in unfragmented habitats, and 793 acres in fragmented habitats; the highest woodpecker density recorded was approximately 1 pair/100acres of habitat.

The NWFP notes that a snag level of 0.6 conifer snags per acre is required to maintain 100 percent population levels for the white-headed woodpecker in forested habitats. These snags must be at least 15 inches dbh or greater and in soft decay stages.

Historic and existing population densities are not known. However, this species was probably more abundant historically than it is today. The selective harvest of mature ponderosa pine within the ponderosa pine and mixed conifer PAGs has reduced the amount of suitable habitat for this species. The role that low to moderate intensity fires played in maintaining snag densities within the ponderosa pine and mixed conifer PAGs is unclear. When compared to current conditions, it is likely that snag levels were much higher under natural fire regimes.

Special Considerations

Potential habitat for the white-headed woodpecker is abundant in the LSR. Habitat needs for this species are generally compatible with management toward a fire-climax, ponderosa/mixed conifer forest type, provided adequate snag levels are retained.

Pileated Woodpecker *(Mixed Conifer PAGs)*

The pileated woodpecker is considered a sensitive species in the critical category by ODFW due to loss of snags and the fragmentation of late-successional mixed conifer habitats.

There are documented sighting of pileated woodpeckers in the LSR and abundant potential habitat exists in the in the mixed conifer PAGs of the LSR. This species has probably benefited from the recent tree mortality associated with the spruce budworm epidemic. There are large tracts of mixed conifer forest that support high levels of snags and down logs. This species forages mainly by excavating into wood and scaling or chipping bark. A preference for large diameter logs and trees is related to insect abundance. Nest tree dbh was found to range from 16" to 30" or greater. For this species a snag level of 0.6 per acre is required to maintain 100 percent population levels in forested habitats. These snags must be at least 25 inches dbh or greater and of a hard decay class (Bull and Holthausen 1985 & 1992).

Current and historic pileated woodpecker population densities in the LSR are unknown. Though populations may be benefiting from the recent insect and disease tree mortality, timber harvest activities and late-successional forest fragmentation have probably reduced population levels in recent decades.

Special Considerations

The habitat needs of the pileated woodpecker are compatible with the habitat needs of several of the other LOS species including the spotted owl, goshawk, and Vaux's swifts. Consider management for this species in MSAs designed to provide spotted owl habitat.

Ensure that current and future snag and down wood habitat exists in adequate levels and distribution to meet pileated woodpecker needs at the 100% potential population level.

American Marten *(Mixed Conifer, Lodgepole, and Mt. Hemlock PAGs)*

The marten is considered a sensitive species in the critical category by ODFW due to loss and fragmentation of late successional mixed conifer habitats. Marten are DNF Management Indicator Species for old-growth mixed conifer forests.

There have been no formal surveys for martens in Cache LSR, but individuals have been observed in several locations within and adjacent to the LSR. It is likely that this species can be found throughout the LSR in mature and late successional mixed conifer, lodgepole pine and mountain hemlock PAGs.

Marten demonstrate preference for large late-successional stands of coniferous forests with complex physical structure near the ground (Buskirk and Powell 1994). Complex near-ground structure provides martens with protection from predators, access to subnivean space where most prey are captured in winter, and protective thermal cover.

The following summarizes some of the important habitat characteristics for this species:

- prefer forest with ≥40-60% canopy closure (Thompson and Harestad 1994);
- demonstrate a near-universal avoidance of large openings (Buskirk and Powel 1994);
- for rest and maternal/natal den sites 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, in press, Buskirk and Powel 1994, Buskirk and Ruggiero, 1994);
- need adequate down wood to provide subnivian access points for energy efficient foraging in winter. (Buskirk and Ruggiero 1994).

The insect and disease conditions in the LSR have resulted in snag and down log levels that create optimal resting, denning and foraging habitat for marten in many areas. Historic and current population densities for this species are not known. However, it is believed that marten populations have declined in Oregon over the past four to five decades as a result of habitat loss/fragmentation (pers. comm. Chris Carey, ODFW, 04-22-97).

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. Consider management for this species in MSAs designed to provide spotted owl habitat. Ensure that the structural characteristics described above are protected and enhanced.

Neotropical Birds *(All PAGs)*

The LSR provides potential habitat for a number of Neotropical Migratory Birds (NMB) that are associated with late-successional habitats. However, only limited surveys for NMBs have been conducted in the area and thus little is known about which species may currently occupy the LSR. In general, riparian vegetation in Cache LSR is believed to provide important habitat for NMB species.

A 1994 breeding bird survey conducted in the Cache RNA portion of this LSR documented the following NMB species: common nighthawk, northern flicker, western wood peewee, Townsend's warbler, Hermit warbler, flammulated owl, MacGillivray's warbler, common yellowthroat, willow flycatcher, olive-sided flycatcher, dusky flycatcher, rufous hummingbird, Lazuli bunting, orange-crowned warbler, warbling vireo, house wren, western tanager, and chipping sparrow. Some but not all of these bird species are associated with LOS habitat.

There are three Breeding Bird Survey Routes on the Sisters RD; results from these surveys may indicate which species are likely to occur in the LSR. A Breeding Bird Survey Route (1966-1995) in the Metolius Basin reported that 87 species of birds, including 44 NMB, have been observed since 1966. Some of the LOS associated NMB present include: olive-sided flycatcher, hermit thrush, western wood peewee, western tanager, and Vaux's swift.

The cowbird is found in many habitats throughout the LSR. This species parasitizes the nests of many other bird species; the result is lowered reproductive success for many neotropical birds. The extent of this threat is not known. Of special concern is the impact of fragmentation on native species that are associated with late-successional habitats. Studies have shown that fragmentation of forested habitats, and the creation of edge habitat has contributed to the expanding range of the cowbird **(Literature)**. In addition, fragmented habitat increases cowbird parasitism of bird species associated with late-successional habitats.

The changes in NMB populations within the LSR are unknown. The impacts of forest fragmentation and selective logging have probably reduced available habitats and increased cowbird predation in the past 50 years.

Special Considerations

It is expected that several NMB species are associated with most of the various LOS habitat conditions that can be provided in each PAG represented in this LSR. Management for the habitat needs of other LOS species are likely to provide habitat for the LOS associated NMBs. Consider special management emphasis for NMBs in riparian areas within the LSR.

Bats *(All PAGs)*

The Townsend's big eared bat is a federal candidate species Category 2 (C2) and a Regional Foresters Sensitive species. The following bats were identified as survey and manage species (strategies 1 &2) in the Northwest Forest Plan: fringed myotis, silver-haired bats, long-legged myotis, long-eared myotis, and pallid bats.

There is a known hibernaculum for Townsend's big-eared bats within the LSR (however; the entrance of the hibernaculum is located on private land). Although presence of the survey and manage bat species has not been confirmed inside LSR boundaries the following species were documented on Sisters RD during 1995 & 1996 surveys and are likely occur in the LSR: silver-haired bat, long-legged myotis, big brown bat, little brown myotis, and hoary bat.

Bats are known to utilize the following structures for roost sites, winter hibernaculum, and/or maternity colonies: mines, caves, wooden bridges and buildings, lava ridges/tubes, large diameter snags, and live trees with sloughing bark and/or cavities. Although bats are known to roost under loose bark, recent studies have shown that a high percentage of bat roosts are

in woodpecker cavities. Steeger and Machmer (1996) found that 54% of bat roosts were in vacated woodpecker cavities, 32% in natural cavities, 11% in cracks, and the remainder under loose bark. Water bodies are used for both foraging and drinking (Marcot 1995).

Potential bat habitat is abundant in the LSR. Lava flows, caves, riparian areas, and suitable large diameter snags all occur in this area. Changes in bat population densities from historic to current times within the LSR are unknown.

Special Considerations

The habitat needs of bats are compatible with the habitat needs of several of the other LOS species including spotted owls, pileated woodpeckers, goshawks, and Vaux's swifts. Consider management for this species in MSAs designed to provide spotted owl habitat. Ensure that the structural characteristics described above are protected and enhanced within appropriate MSAs in the LSR. Consider pursuing a cooperative partnership with private landowners to protect known hibernaculum.

***LOS Species that Use Snags, Down Logs, and Diseased/Deformed Live Trees** (All PAGs)*

Bull et al. (1997) note that 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. Some of the species not previously discussed that use these structures and are known or suspected to occur in Cache LSR 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 LOS forests.

Snag and Down Log Densities in CLSR:

Snag densities vary on a stand by stand basis. Overall, snag densities in the CLSR are highest in the mixed conifer and lodgepole pine/mt hemlock PAGs and lowest in the ponderosa pine PAG. 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 impacted snag densities in some areas.

The following information was generated from 1996/1997 stand exam data (Table 18). 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 18 Average Snag densities (per acre) by PAG

Diameter Class	Ponderosa Pine PAG	Mixed Conifer Wet PAG	Mixed Conifer Dry PAG	LP/Mt Hem PAG
9.0 – 14.9	.4	19.6	21.6	28.1
15.0 – 20.9	4.6	6.2	8.2	5.7
21.0 – 31.9	2.0	2.6	3.3	1.6
32.0+	.2	.3	.5	.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/mt hemlock PAGS and lowest in the ponderosa PAG. 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 to most managed stands.

In unmanaged and lightly harvested ponderosa pine, dry and wet mixed conifer stands, snag and down log levels are probably higher than in the past because of natural fire frequencies. However, regeneration harvest and selective removal of large trees have lowered snag and down log densities below historic levels in many areas across the landscape. In the lodgepole pine and high elevation mountain hemlock PAGs, snag and down log densities may be similar to historic conditions. The effects of changes in historic and current dead wood levels on dead wood associated species in CLSR 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 LSR over time. See Appendix 5 – Snag and Down Log Recommendations for LSRs.

RIPARIAN/AQUATIC HABITATS

Amphibians

Amphibians are closely associated with riparian habitats. However, different species often have diverse habitat needs with regard to water temperatures and velocity, substrate, and vegetation. The following amphibian species have been documented in Cache LSR: long-toed salamander, northwestern salamander, rough-skinned newt, western toad, pacific treefrog (chorus frog), and cascades frogs. Potential habitat may exist for the tailed frog and spotted frog as well.

Current and historic population densities for amphibians in the LSR are unknown. Several of the lakes in Cache RNA that did not historically bear fish are currently stocked with fish. Recent studies have documented a correlation between amphibian declines and fish stocking. Thus, amphibian densities may be lower than historic conditions. Past harvest activities in

and near riparian habitats may have reduced habitat quality for some amphibian species in the LSR. High road densities may limit effective amphibian dispersal.

The following focal species are known or suspected to occur in the LSR.

Cascades Frog *(Mixed Conifer and Ponderosa Pine PAGs)*

This species is an Oregon State Sensitive Species in the critical category because populations appear to be declining.

Cascades frogs have been observed in Dry Creek and around the lake/marsh habitat in the RNA within Cache LSR. 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).

Special Considerations

Habitat for the Cascades frog is limited in the LSR. Consider designation of one or more MSAs designed to address the needs of this species and its habitat

Tailed Frog *(Mixed Conifer and Ponderosa Pine PAGs)*

This species is an Oregon State Sensitive Species in the critical category because populations appear to be declining.

There have been no formal surveys for this species, and there are no documented sightings in the LSR. Potential habitat exists primarily in Dry Creek. Tailed frogs inhabit cold fast-flowing permanent streams in heavily forested areas. Adults spend the days under rocks or debris and emerge at night to feed on insects and other invertebrates (Leonard et al 1993). This species has the lowest known temperature requirements and one of the narrowest temperature tolerances of the world's frogs: ranging between 41 and 61 F°. These cold temperature requirements are primarily associated with high levels of canopy cover and cool micro-climates found in mature and late-successional habitats (Brown 1975, Welsh 1990).

Recent studies indicate that the tailed frog may be severely reduced or eliminated in some areas as a result of timber harvest and road building. These habitat alterations may cause stream siltation, increased water temperatures, and lower humidity - all conditions that adversely impact this species (Leonard et al 1993). Changes in current and historic population densities in the LSR are unknown.

Special Considerations

Habitat needs of the tailed frog are generally compatible with the habitat needs of the Cascades frog.

Spotted Frog *(Mixed Conifer and Ponderosa Pine PAGs)*

This species is a federally listed category 2 species.

No formal surveys have been conducted for this species, and there are no known current or historic sightings in the LSR. Spotted frogs generally inhabit warm (>20 C°) perennial

marshes, lakes, ponds, or slow moving streams (Corkran and Thoms 1996). The species is most often associated with nonwoody wetland plant communities with species such as sedges, rushes, and grasses (Leonard et al 1993).

Potential habitat exists only around the marsh complex associated with some of the lakes in the RNA portion of the LSR. Lack of appropriate suitable water temperatures during the breeding season for spotted frogs makes the likelihood of occurrence for this species low.

Special Considerations

Conduct field reconnaissance to assess habitat suitability for the spotted frog. Conduct presence/absence surveys.

Fish Distribution

Fish are present in three lakes, Four O'clock, Peewee and Torso, inside the Cache RNA. In the past brook trout or rainbow trout fingerlings have been stocked in these lakes for anglers. Torso Lake has road access and receives the greatest angling pressure. Four O'clock and Peewee require off trail hiking for access and get fewer visits.

No fish were found during an electrofishing survey of Dry Creek. Cascades frogs and pacific tree frogs were found along the stream. The stream temperature was 7.0 C°, and may be habitat for the caddisfly Apatania tavala, an aquatic insect that is found in low densities in several drainages in the Cascades. The caddisfly is on the Regional Foresters Region 6 list as Sensitive. Habitat for this caddisfly is associated with shaded streams with instream wood, swift current and gravel/cobble substrates.

Issues Related to Managing Aquatic Habitats

The main issues in this LSR are primitive lake management and downstream risks of sedimentation. Management of the small lakes in the RNA should be directed toward a primitive setting and maintain the natural process of wood recruitment. The connection of Cache Creek to the Metolius River is infrequent but occurs during flood periods when sediment is moved. Roads and streambank disturbance can lead to increased sediment routed to trout spawning habitat in the Metolius River and Lake Creek.

Restoration should be focused on reestablishing large trees along stream banks that have been logged in the past. Roads that erode and are connected to the stream channels of Dry and Cache Creek should be repaired and/or obliterated. Future management of riparian reserves and stream channels should be consistent with the Aquatic Conservation Strategy Objectives in the Northwest Forest Plan and the Metolius Watershed Analysis.

PLANT SPECIES KNOWN OR SUSPECTED TO OCCUR IN CACHE LSR

One sensitive plant species is known to occur within the CLSR. Sensitive plant species are those listed in the Regional Foresters Sensitive Plant List. Two lichens and two fungi classified as "Survey and Manage" species in the Northwest Forest Plan are known to occur within the CLSR. One species listed as a "Taxa of Concern - List 4 " by the Oregon Natural Heritage Program is also known to occur. Plant species of concern known to occur in the Cache LSR are listed in Table A of Appendix 3.

Species with potential to occur in the LSR include 17 TES plant species and 14 Survey and manage species that are known primarily from elsewhere on the District or the Deschutes National Forest. Many other Survey and Manage species have potential to occur but are not listed. Species suspected to occur in the LSR are listed in Table B of Appendix 3.

Focal LS/OG Plant Species

The following is a summary of the status and habitat conditions of the focal plant species that are known or suspected to occur within the CLSR. These species represent a variety of other species with similar habitat needs.

Table 19 – Focal Plant Species – Terrestrial and Aquatic

Species	Status	Occurrence	Habitat
Peck's penstemon *Penstemon peckii* **Vascular Plant**	Sensitive	Known Terrestrial	Open pine forests and meadows maintained by fire. High water table areas and channels.
Candy Stick *Allotropa virgata* **Vascular Plant**	Survey and Manage 1,2	Known Terrestrial	Mixed conifer forests with areas of deep humus, some fire, down wood. Fungi/mycorrhizal associates.
Larsen's Collomia *Collomia debilis var larsenii* **Vascular Plant**	Oregon Natural Heritage Program, List 4- Taxa of Concern	Known Terrestrial	Lava, talus slopes
Elaphomyces anthracinus **Fungi/Rare truffle**	Survey and Manage 1,3	High probability Terrestrial	Fungi/mycorrhizal associates with mature pine Forests. Dispersal may involve rodents.
Nitrogen fixing Lichens *Lobaria hallii* *Lobaria pulmonaria* **Rare Lichens**	Survey and Manage 1,2	Known Riparian	Riparian areas, drainages, high water table areas, or floodplains, especially associated with large old Black Cottonwoods, other hardwoods, or Pacific Yew

Peck's penstemon (Penstemon peckii)

Focal Species representing habitat requirements for open canopied pine and dry mixed conifer forests and meadows, fire maintained habitats, patch patterns, seasonally moist areas with high water table or channels. May represent other fire-adapted species such as fungi (morels), other sensitive vascular plants (Tall Agoseris).

Rarity/Status: This rare endemic wildflower is found only on approximately 325 square miles centered around Black Butte on the Sisters Ranger District. Field (1985) found the center of the range of PEPE overlies a disjunct quaternary alluvium, or an area of glacier deposit formed at the end of the Pleistocene. Most known populations are on National Forest Lands. Only one small population is known from federal lands in the CLSR, however additional unsurveyed high probability habitat exists associated with channels of Dry and Cache Creek and the Trout Creek floodplain. A large population of 2000 plants was described in 1989 on private lands near Little Butte. The plant is classified as "sensitive" on the Regional Foresters Sensitive Plant List.

Habitat Peck's penstemon is a good indicator for a 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 often occurs in high water table 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. 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.

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. PEPE is found primarily on sandy loams, loamy sands, and occasionally pumiceous loamy sands that formed from tills deposited in valley bottoms. These soils are finer textured and retain higher moisture contents through the season. Larsen Soil Types 8 or 10 may often indicate potential habitat.

The PEPE Conservation Strategy (O'Neil, 1992) identifies the five most important abiotic and biotic variables involved in the plant's viability:

- abundant moisture,
- light (required for flowering),
- abundant pollinators,
- periodic fire,
- flooding (seed dispersal).

Changes to Habitat

The 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, including timber harvest activities that uproot plants, can destroy populations. Pogson (1979) observed populations in otherwise contiguous habitat ending at private land boundaries where the soil was severely disturbed. If the seed bank is depressed from canopy closure before harvest, or conditions are too dry for successful germination, the population is in particular danger of being lost.

Timber Harvest: In the Lake Creek Monitoring Study, the effects of timber harvest on Peck's penstemon were studied. Plots established in 1980 were read in 1993, (Because harvest was delayed in some units by over a decade, some sites were sampled only 3-4 years after harvest). Ingersoll (1993) found the abundance of PEPE declined significantly between 1980 and 1992 at all harvest sites. The study had no control areas. 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."

Land exchanges/ Development Permanent habitat loss is of concern because of the finite amount of habitat for this endemic species. Several populations outside the watershed have lost federal protection through land exchanges or have been altered by adjacent gravel mining. All populations near the town of Sisters have been proposed for land exchanges in the recent past and will most likely to exchanged at some point in the future. These populations are on the southern and eastern edges of the plants' range and may contain important ecotypic variation. 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. Opportunities to share stewardship of the plant with private landowners should be pursued.

Candy Stick (Allotropa virgata)

Focal Species representing habitat requirements for mixed conifer forests with areas of deep humus and woody debris. These forests experienced a complex sequence of periodic fire. The plant is mycorrhizal with soil fungi, one of its fungal partners is believed to be the matsutake mushroom. May represent other species of complex mixed conifer forests with abundant woody debris, and mycorrhizal fungi

Rarity/ Status: The plant has highly isolated populations and is rare throughout its range. Surveys in 1998 on a portion of the LSR have located over 50 clumps of plants. Additional unsurveyed high probability habitat exists throughout the watershed, however the plants'

episodic flowering habitats make it difficult to detect. The plant is a "Survey and Manage" category 1 and 2.

Habitat: Candy Stick is believed to benefit from some level of periodic fire and occurs in primarily old growth forests with well-drained soils and abundant woody debris. Under historic fire regimes a complicated interaction of low, moderate, and high severity fires in these forest types created a variable patchwork of vegetation types and seral stages that is believed to have been the most diverse of all eastside landscapes.

Changes to Habitat: The exclusion of fire, fragmentation of older stands, and effects to the plant's obligate mychorrhizal fungi through soil compaction and disturbance have affected suitable habitat. Excluding fire from these forests has been cited as the single greatest detriment to landscape and habitat diversity on the eastside (Hessburg et al. 1994).

Larsen's Collomia-(Collomia debilis var. larsenii)

Focal Species representing habitat requirements for vascular plant species associated with harsh non-forest habitats such as talus slopes and lava flows. These habitats are generally unaffected by most management activities, but may be vulnerable to recreation or indirect effects from adjacent road construction.

Rarity/ Status: Larsen's collomia is considered rare throughout its range from Washington to California.

Habitat: It grows on talus slopes on the high peaks of the Cascades from Washington to California on extremely harsh unstable sites that are low in nutrients and subject to extreme environmental fluctuations. High probability habitat exists within the CSLR.

Changes to Habitat: Generally, little change has occurred in the recent past to this habitat type. A road was built through the known site on Cache Mountain before the plant was discovered. Improvements to the Cache Mountain road could affect plants and habitat. Plants may also be vulnerable to impacts from hikers or other disturbance of loose talus slopes.

Fungi/Rare Truffle-(Elaphomyces anthracinus)

Focal Species representing habitat requirements for fungi species that are ectomycorrhizal associates in mature pine forests. This truffle may be an indicator for old growth pine habitats. Its fire ecology is unknown but it may be assumed the truffle evolved with periodic fire regimes. This fungus may represent other mycorrhizal fungi species, such as chanterelles, and ties to other species such as mycophagus rodents that are an important part of the forest food base for owls and other wildlife. Rodents also play an important role in the dispersal of truffle spores and colonization of new habitats.

Rarity/ Status: Elaphomyces anthracinus has been reported as widely distributed but rare since its discovery in Italy in 1832. Only 50 collections are known. No sites are known from the CLSR, however potential habitat is present. A population existing in the adjacent Metolius watershed within a streamside mature pine forest is the only known site within the range of the Spotted Owl. The truffle is classified as "Survey and Manage category 1 and 3.

Habitat: This truffle is known from only one site that contains numerous old growth pine trees, a high water table and a early to mid seral understory, managed as a walk-in

campground. Fire scars in the area point to a history of periodic fire. Additional high probability habitat exists within the CSLR.

Changes to Habitat: The harvest of mature ponderosa pine is believed to have reduced available habitat. The known site is in a campground along the Metolius River, which in past years was impacted by unrestricted traffic flow and recreational vehicles. The site has since been closed to vehicles and is managed for walk-in camping only.

Nitrogen fixing Lichen Group

- Lobaria hallii (KNOWN)
- Lobaria pulmonaria (KNOWN)
- Nephroma helveticum
- Nephroma resupinatum
- Pseudocyphellaria anomala
- Pseudocyphellaria anthrapsis

Focal Species representing habitat requirements for lichen and other species found in moist areas. The known populations are associated with large old Black Cottonwood swamp areas. Lichen species may disperse only over small distances (i.e. 6 ft). These lichens may represent other lichen species, such as the riparian Lichen, Collema, the Pin Lichen, Calicium, as well as invertebrates associated with similar riparian habitat.

Rarity/Status: This group of lichens is generally found associated with trees at least 140 - 200 years old. *Lobaria hallii* and *Lobaria pulmonaria* have been found at one site in the CSLR. *Lobaria hallii* is a Category 1 and 3 species requiring protection of the known site. The others are classified as "Survey and Manage" category 4.

Habitat: This group has been found in association with late-successional and old growth forests and requires sheltered microsites with complex canopy structure, leaning tree boles, increased humidity and the presence of hardwoods or coastal disjunct species such as pacific yew. *Lobaria hallii* and *Lobaria pulmonaria* appear to have a strong association with black cottonwood trees although the lichens also occur on other tree species growing near the canopy of black cottonwoods. In eastside watersheds black cottonwood, pacific yew, and hardwoods are restricted mainly to riparian areas, drainages, high watertable areas, or floodplains. Therefore, in this watershed this lichen group has a strong riparian association.

Changes to Habitat: Many moist forest habitats have been altered by harvest. Harvest within and next to riparian areas has reduced shading and warmed and dried microclimates. Fragmentation within riparian habitats has probably affected lichen dispersal to suitable adjacent habitats, since they are known to be dispersal limited. Some cottonwood sites are maintained by beavers, so reduced numbers of beaver may be limiting the establishment of new potential habitats. Nitrogen fixing lichens may also be sensitive to air pollution.

VI. LATE-SUCCESSIONAL and O/G HABITAT CONDITIONS

INTRODUCTION

The amount of habitat within the LSR 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 LSR, and many stands, while not possessing all the characteristics of "late-successional" habitat, do possess a number of late-successional habitat components or characteristics.

There are a variety of seral stages and forest structures associated with each PAG group in the LSR as described in the Historic and Current Vegetation Condition portion (Chapter III) of this assessment. In general, The CLSR 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 349 terrestrial wildlife species, 10 aquatic and 41 plant species associated with late-successional habitat conditions present in the LSR (Appendix 2). There are approximately 282 wildlife species that are known or suspected to occur in riparian habitats in the LSR. These riparian habitats are a relatively small portion of the LSR but may contribute significantly to habitat and wildlife species diversity.

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 Cache LSR.

The identification and delineation of late-successional habitats for this LSR Assessment is an 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 LSR possessed all the characteristics necessary to meet the definitions of "late-successional habitats" described below. 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.

The successional pathways that lead to climatic climax forests can be considered "directional" where an accumulation of changes leads to community-wide changes (Barbour, et al, 1987). The resulting climax community takes a long time to develop, perhaps several hundred years, primarily because combinations of weather, elevation, aspects, productivity and disturbance agents don't provide conditions for frequent community-level disturbance and change.

Another type of succession is "cyclic" where a community is perpetuated by the reoccurrence of a disturbance event (ibid, 1987). Certain elements of the community are resistant to the

effects of the reoccurring disturbance and so survive the events time after time. In the Cache LSR, frequent low intensity fire was the reoccurring event that developed and favored open "park-like" stands of fire resistant ponderosa pine and Douglas fir.

In this LSR 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 PAGs than they are now. Fire exclusion has resulted in the conversion of much of the fire-climax forest into climatic climax habitat.

Fire Climax Ponderosa Pine

The "fire climax" definition for ponderosa pine is based on personal communications between Bill Hopkins, Area 4 Ecologist, and Rod Bonacker, Sisters Ranger District Watershed Analysis Team Leader as an eastside expression of the climatic climax definition for ponderosa pine from the Region 6 Intern Old Growth Definitions (1993)

In general, ponderosa pine "fire climax" conditions would consist of:

- 1 - 2 storied, open (<40% canopy closure) canopy
- 10 - 30 large trees (17"dbh or greater) per acre
- 0 - 2 snags per acre
- 0 - 6 large down trees per acre, in various stages of decay
- understory tree and shrub cover limited and composed of shade intolerant species.

Fire Climax Mixed Conifer

The "fire climax" definition for mixed conifer is not well defined, but has been described by Agee (1990) and Oliver, et. al (1991).

- 1-2 storied, open (but less open than ponderosa pine) forests
- dominated by large trees (21"dbh or greater) ponderosa pine, Douglas fir, western larch.
- understory tree and shrub cover limited and primarily shade tolerant species (except Douglas fir, which may be early seral on some sites).

Snags and down wood are not included in Agee's and Oliver's definitions, but we can assume that they are higher than in ponderosa pine stands because of the higher sites and greater number of available trees.

Lodgepole Pine and Mountain Hemlock

The lodgepole pine and high elevation mountain hemlock cover 7% of the LSR. These forests generally develop under long fire intervals (100-300 years) and are generally replaced by early seral conditions due to catastrophic fires. They are generally climatic climax in nature and are not considered fire climax plant associations.

Climatic Climax Ponderosa Pine

A "climatic climax" ponderosa pine forest would be dominated by large diameter ponderosa pine, provided they were able to develop under earlier fire climax conditions, but there would also be significant amounts of seedling, saplings and pole size ponderosa pine trees, and some shade tolerant species (i.e. white-fir) in the understory. There might also be lodgepole pine. There would be high understory cover levels from shrubs such as bitterbrush and manzanita.

Hopkins' definition of eastside "climatic climax" condition in ponderosa pine includes:

- at least 2 storied, open (<40% canopy closure) canopy
- 15-40 large trees (17"dbh or greater) per acre
- 3 or more snags per acre > 14"dbh and/or 10% stand with spiral tops
- 3-6 down logs per acre at least 12 inch diameter on the large end.

Climatic Climax Mixed Conifer

The "climatic climax" mixed conifer condition would consist of multi-storied (3 canopy layers), high-canopied (60% or greater) forests dominated by Douglas fir, ponderosa pine, white fir, and western larch. There would be a variety of tree age classes present in the understory composed primarily of shade-tolerant species such as white and Douglas fir, and the shrub cover would be nearly continuous.

The "climatic climax definition for mixed conifer in the Region 6 Interim Old Growth Definitions (1993) for the Grand Fir/White Fir Series is:

- multi-storied (3 canopy layers), high canopy cover (60% or greater) forests dominated by Douglas fir, ponderosa pine, white fir, western larch and incense cedar.
- 2-12 snags greater than 14" dbh per acre
- 20-50 down logs at least 12 inches diameter on the large end per acre
- 15-50 trees per acre greater than 21" dbh

Lodgepole Pine and Mountain Hemlock Climatic Climax

Lodgepole pine and mountain hemlock climatic climax conditions would consist of mountain hemlock and lodgepole pine dominated overstories. Generally the understory would be dominated by shade tolerant species, including other true firs and mountain hemlock. The shrub cover would be sparse and composed of manzanita, currant, snowbrush and bitterbrush.

CURRENT AND HISTORIC LATE-SUCCESSIONAL HABITAT CONDITIONS

Historic Conditions

For this Assessment, we have used the 1870 Surveyor notes and 1953 Aerial Photo Interpretation data to describe historic late-successional conditions.

1870 Surveyor Notes

Fire played a significant role in creating open, park-like, fire climax forests from the eastern boundary of the LSR to the upper elevation mixed conifer forests. The surveyor notes described the Ponderosa Pine PAGs as large even-aged stands of pure, large diameter ponderosa pine with grass understories. The surveyor's notes describe mid elevation mixed conifer stands as heavy yellow pine (ponderosa pine) and fir (Douglas fir) overstories (primarily in he northern portion). The understories are described as open (not dense). The higher elevation mixed conifer (Wet Mixed Conifer PAG) was described as being similar to the dry mixed conifer, except that 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 and Douglas fir (in the northern portion).

1953 Aerial Photo Interpretation

Similar to the 1870 notes, a large contiguous forest of medium/large diameter ponderosa pine and Douglas fir dominated the overstory in the LSR. Fire climax conditions were common in the lower elevations, while denser, multi-storied stands were common in the middle and upper elevations. The presence of climatic climax conditions was increasing due largely to the suppression of fire. The Ponderosa Pine forest was dominated by large open, large diameter ponderosa pine with grass. The presence of a ponderosa pine understory with some white-fir is more common due to the suppression of fires. The Dry and Wet Mixed Conifer forests are dominated by open, medium/large diameter tree forests. Dense, mixed species understories are more common due to the suppression of fires.

Current Conditions

Two different analyses, based on 1996/1997 stand exam data, were conducted to determine the amount of "late-successional" habitats in the Cache LSR. The first data query identified stands with the appropriate tree species mix and overstory to be considered potential late-successional habitat. The second data query added a canopy cover parameter to determine the approximate amount and location of open, parklike ponderosa pine stands and multi-storied, high-canopied mixed conifer and ponderosa pine stands. The amount and percentage of early successional habitat by PAG is also included below with the objective of demonstrating the extent of fragmentation of late successional habitat.

Based on the initial query by plant association and large tree abundance, the following acres of potential late-successional habitat occur in each PAG:

Ponderosa Pine PAG

An estimated 44% of this 849 acre PAG is considered late-successional habitat. These acres include open, park-like and denser two-storied stands that contain 13 or more live trees per acre that are ≥21" dbh.

Approximately 26% of the PAG is of the small tree size class (9.0 - 20.9" dbh), and 29% of the PAG is grass/forb/shrub, seed/sapling or pole size/structure.

Dry Mixed Conifer PAG

An estimated 31% of this 12,118 acre PAG is considered potential late-successional habitat. This includes open park-like stands and multi-storied stands. These stands contain 15 or more live trees per acre that are ≥21" dbh and possess most, if not all of the structural characteristics described in the definitions above. Approximately 57% of the PAG contains 10 or more live trees per acre that are ≥21" dbh

A majority of the PAG is in grass/forb harvest units (18%), and small tree size classes (31%) of varying densities.

Wet Mixed Conifer PAG

An estimated 9% of the 1949 acre PAG is considered potential late-successional habitat. This includes acres of open low-canopied and multi-storied stands and contain 15 or more live trees per acre that are ≥21" dbh. Approximately 24% of the PAG contains 10 or more live trees per acre that are ≥21" dbh.

A smaller portion of the PAG is in grass/forb harvest units (9%), and small tree size classes (23%) of varying tree densities. If the unclassified acres in Cache RNA are not counted, over 50% of the PAG is in the small tree class.

Lodgepole Pine and Mountain Hemlock PAGs

An estimated 37% of this 1172 acre PAG is considered potential late successional habitat. These forests are believed to be in a "climatic climax" condition and contain the majority of their basal areas in trees > 12 "dbh.

Summarizing across all PAGs from the above data, an estimated 31% of the forested acres are considered to be ***potential*** late successional habitat.

The second data query added a canopy closure parameter to the previous criteria for identifying late successional habitats as follows:

- Ponderosa Pine PAG: Ponderosa Pine/Ponderosa Pine Mix species composition with 10 or more live trees per acre that are ≥21" dbh and average >4% canopy closure.
- Mixed Conifer PAGs: Mixed and climax species composition with 15 or more live trees per acre that are ≥21" dbh and average 40-60% canopy closure (for fire-climax conditions) and 61-100% canopy closure (for climatic-climax conditions).

Based on this query, the following acres of potential late-successional habitat occurred in each PAG:

Ponderosa Pine PAG

An estimated 37% of this PAG is considered to be in the "fire-climax" condition. This includes open, park-like and denser two-storied and multi-storied late-successional habitats.

Mixed Conifer PAG (Dry and Wet)

An estimated 16% of this PAG is considered to be in the "fire- climax late-successional habitat condition. These stands have between 40-60% canopy closure.

An estimated 6% of this PAG is considered to be in the "climatic-climax" late-successional habitat condition. These stands have 60% or more canopy closure.

Summarizing across all PAGs from the above data, an estimated 28% of the forested acres are considered to be ***potential*** late successional habitat.

Loss of Potential Late-Successional Old Growth (PLSOG)

An analysis was conducted to estimate the amount of potential late-successional old growth that was lost as a result of the spruce budworm outbreak and drought that occurred between 1985 and 1992. The analysis considered only trees per acre (TPA) greater than 20.9" dbh as the indicator of PLSOG. Live plus dead TPA >20.9" was used to estimate PLSOG for 1985. The assumption is that all the large trees that are dead now and still standing at the time of the 1997-8 stand exams were alive in 1985. From this analysis it is estimated that PLSOG decreased from approximately 48% of the total forested acres to the current 31% of the forested acres. This represents a loss of about 35% of the PLSOG from one disturbance event lasting less than 10 years. The conditions that led to this dramatic loss are still very much in place across the landscape as this LSRA shows.

Fragmentation of Late-Successional Habitats

Past timber harvest and natural disturbance agents such as wildfire and insect and disease mortality have fragmented LOS habitat within the LSR. Habitat fragmentation limits the amount of suitable habitat available to LOS associated species and hinders successful dispersal for some plant and wildlife species.

Habitat connectivity must be considered from both a temporal and spatial perspective and at a scale that is relevant for each LOS associated species (Mellen 1997). Habitat connectivity accomplishes the following five functions: (1) wide-ranging animals are able to travel, migrate, and meet mates; (2) Plants can propagate; (3) Genetic exchange can occur; (4) Populations can move in response to environmental changes and natural disasters; and (5) Individuals can recolonize habitats from which populations have been locally extirpated (Beier and Loe 1992).

Early Successional Habitats

It is recognized that some early successional habitat should exist within LSRs so that LSOG habitat can be maintained in these areas over time. Desired amounts of habitat in early successional conditions were identified by PAG in the DNF Overview (USDA 1995). The mean percentages of desired early successional habitats for the PAGs ranged from 15-40%. Currently, about 19% of the LSR is in stands that are dominated by grasses, forbs, and seedling, sapling, and pole sized trees. About 30% of the LSR is in stands that are dominated by small trees (9.0-20.9" dbh). Thus, younger forests currently occupy approximately 49% of Cache LSR.

Roads

Roads may negatively impact LSOG 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 LSOG. 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.

It is important to note that roads also provide some benefits to LSRs:

- Decreased response time for initial attack forces to suppress fires before they become large high intensity stand replacement fires,
- Increased access and safety routes for fire fighters allows more direct attack and thus smaller fires,
- Road access makes both fire suppression and LSR rehab and enhancement activities more cost effective.
- Roads provide recreation access and opportunities for the public to enjoy and learn to appreciate the benefits of late successional forests.

The DNF LRMP provides road management guidance based on land allocation, but generally towards road densities of 2.5 miles per square mile or lower (USDA 1990). Forman and Hersperger (1996) completed a review of the impacts of road densities on wildlife including elk (Lyon 1979, Thomas et al. 1979, Tost and Bailey 1979, Lyon 1983), black bear (Brocke et al. 1990), and mountain lion (VanDyke et al. 1986) and subsequently recommended managing for 1 mile of road per square mile.

There are currently 154.1 miles of open road in the LSR. The existing road density across the LSR is 5.6 mi/sq mile. Existing road densities by subwatershed are summarized below.

Table 20 Road densities by subwatershed within the Cache LSR (1997).

Subwatershed	*Area (sq. mi.)*	*Miles of roads*	*Road density (mi/sq. mi)*
Cache	11.8	74	6.3
Indian Ford	3.7	22.3	6.1
Suttle	0.5	3.6	7.2
Trout	8.2	51.1	6.2
Suttle (RNA)	2.2	2.8	1.3
Cache (RNA)	0.9	0.3	0.3

Non-native Plants /Noxious Weeds

In order to maintain the composition, structure, and function of late successional ecosystems it is critical to manage and control the spread of aggressive non-native plants and noxious weeds. Weeds replace native plants that support complex relationships with insects, mycorrhizal fungi, and other plants.

Historic Condition

Noxious weeds and other non-native plants were introduced from other countries both intentionally and inadvertently during international trade of goods and livestock. Natural biological controls that existed in the weed's native country were not present and populations could expand unchecked. Once introduced to this country, weeds were spread by animals, vehicles and numerous other vectors.

Current Condition

Noxious weeds and other non-native plants are increasing in the watershed. Of particular concern is the westward movement of Spotted and Diffuse Knapweed along Highway 242 from Sisters. The increasing use of mechanized harvest equipment, subsoiling equipment, reintroduction of contaminated native plants and seed, and prescribed fire have the potential to infect new areas and lower the quality and quantity of native and rare plant habitat and disrupt relationships within the ecosystem. Prevention is considered the most effective and in the long term, least expensive control tactic.

Table 21 Noxious weed and aggressive non-natives species known or suspected to occur in Cache LSR:

Terrestrial Species	Riparian /Moist site Species
Diffuse Knapweed *(Known)*	Scotch Broom
Spotted Knapweed *(Known)*	St Johnswort *(Known)*
Dalmation Toadflax	Bulbous bluegrass and other exotic grasses *(Known)*
Tansy Ragwort	Canada Thistle
Scotch Broom	Ox-eye daisy
St Johnswort *(Known)*	
Canada Thistle	
Bull Thistle *(Known)*	
Cheatgrass *(Known)*	
Ox-eye daisy	
Bulbous bluegrass and other exotic grasses *(Known)*	

Terrestrial Noxious weeds and Non-natives

Most of these species are colonizing disturbed habitats, especially roadsides and areas of severe ground disturbance such as old timber sale landings and informal parking areas. An aggressive group of plants, the Knapweeds, are spreading rapidly along roads and in some areas invading some undisturbed habitats. Tansy ragwort has a high probability of occurrence in old timber sale areas or near horse use areas where it may have been introduced by contaminated logging equipment or hay from the westside where the plant is prevalent. **Hay and vehicle tires** remain top concerns as vectors of new weed infestations. Most of the LSR remains unsurveyed for noxious weeds.

Non-native grasses Cheatgrass is widespread in areas that have had soil disturbance, particularly old timber sale units, landings and skidtrails. Cheatgrass is of particular concern because when dried and cured in the late summer and fall it is a highly flammable fine fuel that increases fire hazard. Other non-native grasses such as crested wheatgrass were widely applied to timber sale landings as wildlife forage and persist, displacing native grasses. Bulbous bluegrass (Poa bulbosa) is a non-native grass that appears to be rapidly increasing in disturbed areas of the watershed. It is reproductively aggressive and non-palatable.

Risks with Rx Fire: Fire has not been shown to be effective in control of most weed species and often leads to increases in populations because of new disturbed ground and enhanced nutrient and water availability. Vehicles use for fire operations support may carry weed seeds from roadsides into new areas. Weed risks need special consideration in prescribed fire planning.

Control An Integrated Weed Management Strategy for the Deschutes National Forest is in progress. Manual and biological control methods are currently being used to control weed populations. Preventing weed introduction is addressed by considering the risk during project planning and with recommendations for mitigation.

Riparian Noxious weeds and Non-natives

Because of their moist microclimate, riparian areas in this eastside watershed harbor weed species that are more typically found on the westside. These non-native plants can displace native riparian plants and their mycorrhizal and invertebrate counterparts, as well as more palatable or nutritious wildlife forage species. Most riparian areas in this watershed remain unsurveyed.

Control An Integrated Weed Management Strategy for the Deschutes National Forest is in progress. Manual and biological control methods are currently being used to control weed populations. Preventing weed introduction is addressed by the considering risk during project planning and with recommendations for mitigation.

HABITAT CONDITIONS FOR TEN SELECTED INDICATOR SPECIES

The Deschutes National Forest Science Team developed a process to determine desired future habitat conditions in LSRs. Ten indicator species were selected to reflect suitable late-successional old growth habitats for each PAG. Selected species are American martin, boreal owl, pileated woodpecker, northern spotted owl, bald eagle, flammulated owl, whiteheaded woodpecker, blackbacked woodpecker, great grey owl, and northern goshawk. These species all depend on LS/OG structural components for nesting, denning, roosting, hunting, and foraging. The Science team quantified needs for several critical components including snags, down logs, canopy cover, canopy layers, trees per acre, and other special features.

Habitat characteristics were identified for each indicator species by PAG (Appendix 4, Table 1), based on characteristics identified in a broad range of current published research. Although developed for the Cultus/Sheridan LSR on the Bend Ranger District, the information is a close reflection of optimal habitat requirements for species found in the Cache LSR.

SUITABLE WILDLIFE HABITAT COMPARED TO SUSTAINABLE VEGETATION

Table 22 compares suitable wildlife habitat with sustainable vegetation conditions. Suitable habitat is displayed using trees per acre (tpa), Stand Density Index (SDI), and fuel loading of snags and down logs as tons per acre. Sustainable vegetative conditions are also described for each PAG, as measured by the upper management zone of SDI (UMZ-SDI) which is the density level at which sufficient competition and stress begin to suppress tree growth and vigor. Fuel loading for low to medium hazard is also indicated in tons per acre. See also Appendix 5 – Snag and Down Log Recommendations for LSRs.

Table 22 - Comparison of Suitable Habitat and Sustainable Vegetation Conditions for Cache LSR Plant Associations

PAG	SUITABLE HABITAT (1) DENSITY		FUELS	SUSTAINABLE (2) DENSITY	FUELS
	TPA	(UMZ) SDI	TONS/AC	UMZ (SDI)	TONS/AC
MH	220-330	411-620	25-40 tons	256	< 40 tons
climatic MCW	430	365-581	284-25-35 tons	195-265	< 35 tons
climatic MCD	175-261	279-405	12-24tons	150-177	<24 tons
fire MCD	23-294	141-373	LOW	150-177	LOW
climatic PPW	150-224	347-535	12-24 tons	145 < 24 tons	
fire PPW	294	141-373	23-LOW	145	LOW
climatic PPD	144-216	313-472	10-15 tons	92-124	15 tons
fire PPD	8-273	27-216	LOW	92-124	LOW
LPW	296-444	222-353	12-24 tons	170	< 24 tons
LPD	288-432	132-198	8-12 tons	80	< 12 tons
mid - low elev LPD	282-424	172-259	8-12 tons	161 < 12 tons	

(1)Within the PAG, identify the plant association that is predominant in the LSRs. If there are several major plant associations, a range of UMZs could be used here. For subsequent site specific project analysis, use the best site specific data available 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 is 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. (See Appendix 4)

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, 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, 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 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.

Results of the comparison show little or no overlap between sustainable vegetative conditions and those conditions considered optimal habitat for the 10 indicator species described above and in Appendix 4, Table 1. For example, in Mixed Conifer Dry PAG, the required stand densities would result in an SDI almost double of what is indicated for the upper management zone of the representative plant association. As described in Appendix 4, vegetation management to achieve LSR objectives will need to follow a process of cycling suitable (but not sustainable) habitat with sustainable (but less than optimal habitat) stand conditions across the landscape over time.

CYCLING AND SUSTAINING DESIRED LS/OG CONDITIONS IN CACHE LSR

As described in Appendix 4, the cycling model uses four stages:

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 SDI
3. **transitional vegetation stage** where stands become less stable as densities increase, but are not yet optimal habitat.
4. **climatic climax suitable habitat stage** where structural features provide optimal habitat for species like the spotted owl. This stage is unstable and only sustainable for short periods.

Using rotation cycles for each PAG, different structural stages are maintained and managed through time so there will be habitat developing to replace habitat that is lost or becomes nonfunctional due to disturbance. Suitable wildlife habitat loss or decline will occur as a result of a combination of excessive densities, drought, insect, disease, and fire.

Table 23 describes three ways of distributing stands in different size classes across the landscape. The first column describes distribution from the standpoint of thresholds for suitable NSO habitat. The second column describes, for different rotation lengths depending on the PAG, the distribution of early size classes necessary to result in the largest size classes at the culmination of the rotation. The third column describes the historic range of variability for the Metolius watershed, which includes the northern portion of Cache LSR. Finally, Table 24 describes the desired distribution of vegetative stages by PAG.

Table 23 Evaluation Criteria for Size Class Distribution in Cache LSR

Size Class	Suit. Habitat Thresholds % acres per size class				Cycling (1) % acres per size class				HRV (4) % acres per size class				
	MCW	MCD	PP	LP/ HE	MCW	MCD	PP	LP/ HE	MCW	MCD	PP	LPP	HE
S/Sap (2) 0" - 5"		*	*	25	6	7	5	25	3-54	3-25	3-21	0-60	0-8
Pole (2) 5"–9"		*	*	25	7	7	5	25	7-50	8-40	3-21	10-80	0-35
Small (2) "9–21"	40	30*	40*	50*	12	15	10	50	13-57	20-75	20-50	0-80	5-50
Med (3) 21" 32"	60	70	60		25	38	20		11-53	23-75	30-70	0-2	5-20
LOS (3) 32" +	*	*	*		50	33	60		*	*	*	*	*

(1) Different rotation lengths were used for each plant association group. These rotation lengths (until 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 may be 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) This size/structure class represents 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.

(4) Historic ranges of variability are for the Metolius and Cache LSRs based on plant associations described in the Metolius Watershed Analysis (10/95).

Table 24 Desired Amounts of 4 Stages of Vegetative Conditions for Cache LSR

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)	10 (5-20)	10 (0-20)	50 (40-60)
MCD	25 (20-30)	60 (45-75)	10 (5-20)	5 (0-10)
PPW/D	20 (10-30)	65 (50-80)	10 (5-20)	5 (0-10)
LPW/D	40 (20-60)	NA	10 (0-20)	50 (30-70)

(1) Plant Association Groups (PAGs) are the combinations of plant associations, described by Volland (1988), and grouped according to productivity and growth potential. While PAGs work well as guidelines for landscape analysis, specific plant associations or individual stand measurements where available, should be used for site specific prescriptions to best meet long term habitat objectives

(2) Preliminary vegetation: Stands in this group do not satisfy the habitat 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 emphasize 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 prescribed burn to remove hazardous levels of fuels. In frequent fire adapted ecosystems, lack of management will result in cycling from other categories back to this category as a result of insect, disease, and wildfire.

(3) Stable fire climax suitable habitat: Stands in this group satisfy the requirements for suitable fire climax habitat and stand densities are below upper management zones. Without natural or human-induced density management, 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.

(4) Transitional (unstable fire climax) vegetation: This condition exists when stable fire climax vegetation 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 and/or lacks species composition and size/structural characteristics required for achieving optimal climatic climax suitable habitat. Management in these stands should focus on developing large trees, developing the understory conditions needed for climatic climax, when large trees are already present, or density reduction to return the stand to suitable fire climax conditions.

(5) 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 to both retain these essential characteristics and be below the upper management zone. It could be thinned, prior to some natural endemic event, to a fire climax condition which is stable and could, in a relatively short time once again be suitable climatic climax. This however, assumes the reaction time and resources available to the land manager are enough to affect an area of sufficient scope. This action would 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 climatic climax 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 the no management scenario it would not be retained.

In previous vegetation management projects in the Metolius LSR (Santiam Corridor, 1996 and Santiam LSR Restoration, 1998), we analyzed the potential shift between stages that could result from different treatment alternatives. We determined the current acres within each PAG/stage and what stage would result after treatment. We then predicted what stage would develop in 50 to 100 years. We found that the primary changes occurred where the oldest stands with very high mortality were converted to preliminary stands, either immediately as a result of treatment (removing dead and imminently dying and thinning) or in 50 to 100 years under the "no action" alternative. Other substantial changes resulted where thinning was used in plantations, promoting the development of future transition stands; and where transition and climax stands were thinned, which promoted large tree development and reduced stand risk, even though it may have removed or slowed the development of some climatic climax

VII. CRITERIA FOR APPROPRIATE TREATMENTS

The ROD lists two principal objectives for silvicultural activities in LSRs. The primary objective is the development of late-successional and old growth forest habitats (enhancement). The second is the prevention of large-scale high intensity disturbance that would affect habitat to the extent that the LSR would no longer be able to sustain viable populations of LS/OG-dependent species (risk reduction). Additional treatments can be used in LSRs to reduce risks of large-scale disturbance to Riparian Reserves, and to meet Aquatic Conservation Strategy objectives.

Treatments are determined to be appropriate when they move stand or landscape conditions from what exists to what is desired to meet LSR objectives. A list of management goals and objectives that address the intent of the Northwest Forest Plan, Forest-wide LSR Overview, the Deschutes National Forest Land Management Plan, the Final Draft Recovery Plan, and sustainable ecosystems are provided. The following section provides criteria for the landscape and the various structural stages for stands in specific PAGs.

HABITAT RISK IN THE EAST CASCADES PROVINCE

Both the Northwest Forest Plan and the Spotted Owl Recovery Plan recognized the increased risk of fire, insect and disease associated with the Cache LSR. The following summary of these two plans provides the basis for treatment criteria and management recommendations.

Northwest Forest Plan

The Northwest Forest Plan acknowledges the ecological principles important in the east Cascade provinces:

"in the warmer, drier Physiographic provinces,...fire is more frequent, less intense, and is an integral part of the internal dynamics of a typical stand (tens to thousands of acres). In the drier provinces, fire control and timber harvest have decreased the abundance of some types of OG, such as ponderosa pine, that are dependent on frequent low intensity fires. Other types of late-successional forest that are less fire resistant or are less desirable for harvest have become more widely distributed. In these areas, the potential for stand-replacing wildfires has increased, resulting in a higher risk to the stability of current stands reserved for LS species" (B-4).

It is recognized that in the East Cascade province, management that goes beyond these guidelines may be considered: "silviculture aimed at reducing the risk of stand-replacing fires may be appropriate. Density reduction in mid-level canopy layers by thinning may reduce the probability of crown fires"(B-7). and "In some LSRs in these provinces, management that goes beyond these guidelines may be considered. Levels of risk in those LSRs are particularly high and may require additional measures. Consequently, management activities designed to reduce risk levels are encouraged in those LSRs 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 LSRs from playing an effective role in the objectives for which they were established." (C-13)

Final Draft Recovery Plan For The Northern Spotted Owl (Dec, 1992)

The 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. The Plan clearly recognizes the threats in the Eastern Cascades province:

- "Declining Habitat - a moderate threat. Habitat levels probably increased in historic times, as fire suppression allowed pine-dominated stands to develop a second canopy of mixed conifer." (page 148)
- "Vulnerability to Natural Disturbance - 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 DCAs in the province will avoid a stand replacing fire over a significant portion of the landscape during the next century. Loss of habitat is currently occurring as drought is creating forest health conditions which are expected to decrease the acreage of suitable habitat in the province." (page 149)

Biological Goals and Implementation on Federal lands -

- "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." (page 149)

Forest protection Guidelines for the NSO - Appendix E (Agee and Edmunds, 1992)

- "Fire - HIGH RISK - will need fuelbreak system plus substantial underburning particularly in lower elevation habitat, to break up fuel continuity. South aspects a high priority.... Subsequent wildfire severity and extent reduced at some cost to existing owl habitat.
- "Wind - LOW RISK
- "Insects - HIGH RISK - stand density control is imperative on most sites to reduce stocking and stress on existing stands. Extensive thinning could increase root rot problems. Mortality already occurring in pine.
- "Diseases - HIGH RISK - likely to increase in absence of fire. Underburning may help to control some disease by burning out stumps harboring disease organisms." (page 185 - Disturbance Agents and Risk)
- "FIRE - A total fire suppression strategy has created the multilayered yet unstable forest structure present on the landscape today. There is a very low probability that any DCA created in the East Cascades sub-region will avoid catastrophic wildfires over a significant portion of its landscape during the next century
- "INSECTS - Fire exclusion, coupled with natural mortality factors, gradually reduce the pine and larch components of mixed conifer stands. ....the resulting multistoried stands of Douglas fir and true fir create conditions for the buildup of defoliators. Douglas fir

tussock moth and western spruce budworm populations will increase with frequent outbreaks. Accumulations of heavy fuels within stands will make total fire protection very difficult." (Likely Outcome of a Total Protection Strategy During the Next Century, page 232-233)

- "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, page 233)
- "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, page 234)

The Designated Conservation Areas (DCAs) on the Deschutes National Forest were recognized as being vulnerable to large-scale loss of owl habitat from severe threat of fire (page 149). The Plan indicates that DCAs on the DNF may require forest management activities beyond those recommended in Section III.c (pages 63-93) of the Plan. The plan recommends focusing on unsuitable habitat, but activities may occur in suitable habitat. The Recovery Plan recommends that Matrix Prescription C (Managed Pair Areas) be established around all currently known and future-discovered owl activity centers in the matrix outside of DCAs.

The Deschutes NF met with Dave Johnson and Kay Ogden for the Recovery Plan Team on October 2, 1992 and October 16, 1992, respectively, to discuss the severe risk of habitat catastrophic habitat loss. A letter to Richard S. Holthausen, Northern Spotted Owl Recovery Team, from Jose Cruz, Forest Supervisor, (October 26, 1992) documents the Forest recommendations for the Recovery Plan.

The Deschutes NF Science Team has recommended (January, 1996) an approach for consistently defining and determining spotted owl dispersal habitat for east side ecosystems on the Deschutes. Two solutions are proposed for evaluating dispersal habitat:

1) For those plant associations with the site capability to meet and sustain the 11-40 standard, continue to do so.

2) For those plant associations that cannot meet or sustain the 11-40 standard, we will use local forest conditions and local biological knowledge of what is likely to be dispersal habitat.

In areas that cannot meet or sustain the 11-40 standard, local biological conditions will be described using peer reviewed literature, practical field experience, and radio telemetry data pertinent to East Cascade ecosystems. Site-specific requirements include the physical

elements that provide overhead cover, roosting structure, prey habitat, and dispersal habitat amounts.

Project-level assessments will evaluate dispersal habitat conditions and forward site-specific descriptions, together with the rationale for the descriptions, to the Deschutes Science Team for peer review.

GOALS OF THE CACHE LSR

For the purposes of this assessment, ***GOALS*** are long term desired future conditions. ***OBJECTIVES*** are recommended management paths that are likely to result in the goals being reached. And, ***ACTIONS*** are specific activities that are recommended as consistent with the objectives.

(1). Provide sustainable vegetative conditions within the natural range of variability typical of the Eastern Oregon Cascade Province where succession of vegetation occurred under natural fire regimes. The presence of specific vegetative conditions on the landscape is not static, and will constantly change over time.

The sustainability of habitats across the landscape is most successful when the distribution is similar to that of the historic range of variability. Historically Dry Mixed Conifer med/large tree stands were dominated by early seral (pioneer) species, especially ponderosa pine. These kinds of stands are estimated to have covered between 23% and 75% of the PAG (Table 9b). Actively managing for stand conditions that provide habitat over the low end of the range will increase the likelihood of sustainability, but could reduce the amount of currently available habitat for species dependent on dense multi-layered stands. Managing at the high end of the range increases the risks of large-scale disturbance, but provides more habitat for species like the spotted owl at least for the short term.

In the Wet Mixed Conifer PAG, the mix of species in med/large tree stands was much broader, depending primarily on the site and length of time since the last disturbance. Approximately 11% to 53% of the PAG was covered by stands dominated by med/large trees (Table 10b). Currently, about 22% of the PAG is in stands of this structure and another 23% is in stands dominated by small-sized trees. While the existing amount of med/large tree habitat is within HRV, more can be provided by developing small tree stands into larger tree stands in the sites and plant communities that are able to sustain higher densities of large trees (especially the CD-S6 series which cover 8-10% of the LSR in the mid-elevations).

The best chances to provide climatic-climax conditions will be on lands capable of sustaining them over the long-term. Potential areas include: moderate to steep north-facing slopes, high vegetative site potentials, known terrestrial and avian reproductive core areas, interior and dispersal habitat, existing suitable spotted owl habitat, survey and manage species habitats, and other late-successional refugia areas.

The historic range of stand conditions generally included 15% to 40% (depending on PAG) of stands in early seral stages from grass/forb to young forests, but ensuring that this is present in the landscape should not be considered an objective. Some amount of young regenerating forest is necessary to ensure the perpetuation of late-successional stands, but currently Cache LSR is comprised of almost 50% early seral and young stands. Future stand management and disturbance activities will continue to result in a

preponderance of young stands for a long time. It will be several hundred years at least before managers will have to take action with the specific objective of providing early seral stands as future LSOG replacements.

(2). Maintain vegetation conditions in mixed conifer PAGs that support at least five spotted owl pairs. This desired spotted owl pair number is based on the Designated Conservation Area Future Expected Pair numbers described in the USFWS Final Draft Recovery Plan for the Northern Spotted Owl (December 1992). **Providing enough habitat to avoid a "Take" situation would require a minimum of 1182 acres per home range, or a total of 5910 acres of NRF which is 42% of the Mixed conifer acres or 35% of the LSR. Since only 23% of the LSR consists of plant associations capable of sustaining climatic climax habitat, it will be necessary to manage some stands at densities and composition that are outside the range of historic variability and sustainability, with the attendant risk.**

Table 25 Management Strategy Area Goals for Climatic Climax Habitat

MSA	TOTAL ACRES	SUSTAINABLE PAG	REGEN	GOAL FOR CLIM.CLIMAX HABITAT	OWL HOME RANGES/ NESTS
A	1543	73%	6%	70+%	1/1
B	2577	6%	25%	40%	3/1
C	6022	24%	12%	20 - 25%	2/1
D	3600	15%	28%	15 - 20%	1/0
E	698	40%	0%	15 - 25%	0/0
F	2500	14%	8%	20 - 25%	1/1
TOTALS	**16940**	**23%**	**15.6%**	**25 - 30%****	**5/4**

**This percentage is less than the goal described above to avoid Take because portions of 4 out 5 home ranges are outside the LSR.

(3). Meet the Aquatic Conservation Strategy (ACS) objectives as defined by the Northwest Forest Plan (ROD B-9 thru 17) and the Metolius Watershed Analysis ACS (pages 145 - 149), by restoring and/or maintaining the riparian ecosystem and natural disturbance regimes commensurate with the type of vegetation in the associated uplands (ROD B-9 thru 17, B-20, B-32, B-35). Riparian Reserves constitute a small percentage of the Cache LSR. Many of these areas are also at risk from fire and insect and disease. Emphasize activities that are needed to protect Riparian Reserves from these high-risk disturbance factors.

OVERALL OBJECTIVES FOR THE CACHE LSR

(1). Move the Ponderosa Pine PAG and the lower elevation (<4000 ft), eastern-most MCDry PAG towards fire-climax late-successional habitat conditions, and the balance of the Mixed Conifer PAGs to a mosaic of fire-climax and climatic climax late-successional habitats. In

fire climax stands, manage for late-successional habitat conditions that allow for low-intensity/severity prescribed or natural fires.

(2). Promote late-successional habitat by managing stand densities that restore and maintain med/large tree (21" dbh and greater) character. Since medium and large trees are limited, activities that restore the overall abundance and/or reduce the loss of these trees due to overstocked conditions should be emphasized. The recent western spruce budworm outbreak has reduced live tree densities in some areas, however, stress-induced root rots and other insects and disease are still likely to occur.

(3). To keep species within a healthy range of variability, white fir should compose less than 20% of tree stocking on dry sites, and less than 30% on wetter sites (personal communication, H. Maffei). However, some stands are composed of little but white fir, and higher levels of stocking may need to be risked to provide short-term dispersal or NRF habitat in critical areas such as home ranges and heavily fragmented dispersal corridors. Age is a consideration, too. Fillip and Schmitt (1990) cite Aho (1977) stated that white/grand fir has little defect when less than 100 years old, and has considerable decay after age 150. "Second generation" true fir may experience insect and disease problems at earlier ages, due to the increased level of pathogens introduced from first generation firs." (personal communication, H. Maffei). Minor amounts of true fir can help meet various resource objectives, such as presence of soft snags for cavity excavators, hiding cover, NRF habitat, etc. while minimizing potential for stand-level and landscape-level forest health problems. However, large landscape blocks with white fir stocking outside the range of historical variability pose considerable risk of total loss to fire, insects, and disease, and cannot be sustained over time.

(4). Remove dead material necessary to reduce the potential for catastrophic habitat loss from wildfire. High understory stand densities (ladder fuels) and large amounts of dead fuels increase the risk of catastrophic fires in some areas. Reducing down fuel loads in the large size classes represented by the current mortality could reduce predicted fire sizes by 50-80%. Reducing stand densities in mid-level canopy layers will also reduce ladder fuels and the probability of crown fires.

(5). An estimated 55%, 78% and 59% of the dry mixed conifer, wet mixed conifer and ponderosa pine, respectively, are dominated (basal area) by trees less than 21" dbh. Use treatments such as commercial thinning, precommercial thinning, salvage, pruning, release and/or prescribed fire to develop late-successional habitats and large tree characteristics.

(6). Where landscape-scale fuels modification is not possible, design, develop and maintain fuels reduction zones, defensible space zones or "fuel-breaks" in the LSR. Fuelbreaks should be used to protect known terrestrial and avian reproductive core areas and activity centers; Riparian Reserves and associated uplands identified to meet connectivity concerns; interior and other connectivity habitats; existing suitable spotted owl habitat, survey and manage species habitats, and other late-successional refugia areas.

(7). Design treatments to reduce forest fragmentation and provide well-connected late-successional habitats. The LSR is highly fragmented and existing late-successional habitats are poorly connected.

(8). Retain enough down log and snag habitat components necessary to provide sustainable late-successional habitat conditions. In the long term, snags retained should have the diversity of tree species and sizes representative of the site. Maintain a variety of down wood sizes. Numbers of snags and amounts of coarse woody material necessary to provide at least 100% MPP will be determined at the project analysis level and should be consistent with the current peer reviewed literature discussed in Appendix 2 and summarized in the tables in Appendix 5.

(9). Identify reproductive sites and/or activity centers when possible, and protect the integrity of these sites. In addition, implement activity restrictions as need to avoid disturbing reproducing species.

MANAGEMENT STRATEGIES & CRITERIA COMMON TO ALL MSAS

Large Trees, Snags, and Down Wood

Protection of medium/large trees, snags, and down wood (>21" dbh) is of primary importance in Cache LSR. These structural components are the constituent elements of suitable LS/OG habitat, are generally most limited in the existing landscape and which require the longest time period to replace once they have been removed. The following summarizes the team's recommendations for management of large wood.

Harvest of large trees will be avoided if possible. Suitable conditions for removal of large trees are anticipated to be rare. The following situations have arisen during our current risk reduction activities in the Metolius LSR:

- Removing large fast growing white fir in order to meet a maximum basal area objective that is otherwise fulfilled by large Douglas fir and/or pine. 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 white fir to favor growth of smaller Douglas fir and/or pine in the understory.
- Removing large white fir to create openings for Douglas fir and/or pine regeneration.
- Removing large white fir to give other species a chance to seed in and recolonize the site.
- Removing large declining (likely to die in 5 to 20 years) trees of any species in order to reduce the contribution to future down fuel loads. This should only be done after all snag, GTR, down wood, and canopy cover objectives are met.
- **Removing large declining (likely to die in 5 to 20 years) trees of any species in order to recover economic value that can be applied to other restoration and risk reduction activities that meet the LSR objectives. This should only be done after all snag, GTR, down wood, and canopy cover objectives are met.**
- Large trees of any species that are determined (through the use of the R6 Hazard Tree Rating Guide) to be hazards to restoration or risk reduction activities, developed recreation sites, or public access roads.

Removal of large snags and down wood (>21") is generally not consistent with the overall goals and objectives of LSRs. In MSAs that have objectives to reduce risk of catastrophic wildfires, risk reduction efforts should be focused on reduction of ladder fuels and smaller ground fuels, establishment of defensible space, and limitation of human access to the area. Consider the following options:

- Topping large hard snags to reduce downwind spotting distance
- Removing fuel concentrations downwind of snags
- Risk rating snags for ignition potential, and removing only the highest potential snags
- Maintaining high numbers of declining trees (those likely to die in 5 to 20 years) as substitutes for more volatile snags.

General Guidelines for Management of Mortality

Given that the majority of Cache LSR will remain at some risk from wildfire, fires are expected to occur. Patches of burned area, both those areas that are burned clean, and those that have high levels of snags and down wood remaining, are very valuable components of late successional landscapes. The NWFP generally limits salvage to patches larger than 10 acres. Consider not salvaging patches that are consistent in size with the low end of the range for historic landscape patterns. For Ponderosa Pine and MC PAGs, this would be 150 acres. For Lodgepole and High Elevation PAGS, it would be 100 acres (see Appendix 1 – Fire Management Plan, Historic Conditions). Snag and down wood retention should meet the requirements identified in individual MSAs.

Mortality, for this discussion, describes forested stands where 30% to 100% of the basal area is dead (moderate to very high mortality, commensurate with the existing categories used in the LSRA). It was determined that some earlier stages of mortality in stands (e.g. those that are mostly dead, but with some green) could 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 (<40% closure), and undisturbed forest floors and soils. Patch sizes should be based on HRV, and range from less than one acre in pine and dry mixed conifer stands up to more than 100 acres in wet mixed conifer, lodgepole and some areas of dry mixed conifer. Patches do not need to be connected, but should be well distributed across the LSR. Values at risk from disturbance spreading away from mortality patches should be a major consideration when locating these habitats, i.e., don't try to manage a 100 acre patch of dead forest adjacent to private lands or critical spotted owl NRF.

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 26. Desired Amount of Mortality to Retain by Plant Association Group

PLANT ASSOCIATION GROUP	PERCENT MORTALITY BY PLANT ASSOCIATION	RATIONALE
Ponderosa pine dry	<1	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	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	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

In addition, when considering where to leave mortality patches, consider:

1. Needs to minimize risk to adjacent resources (e.g. if adjacent to nesting, roosting, and foraging habitat, or to private property)
2. Access to the mortality patch (leave mortality where access for treatment is difficult, and treat mortality where access is more feasible)
3. Opportunity to provide habitat for species that are associated with mortality (e.g. black-backed woodpecker, Vaux's swift, lynx, marten)
4. Need to protect snags or down wood in areas that may be deficient.

Habitat Connectivity

Various management activities such as salvage, thinning and prescribed fire are recommended by the LSR team as appropriate tools to accomplish protection and/or enhancement goals. However, maintaining connectivity between LS/OG habitats throughout the LSR is also essential and must be a primary consideration in the application of these tools. Spotted owl habitat is of particular concern in the existing Cache LSR landscape, thus species-specific mitigation was developed to address owl habitat needs. This mitigation is also expected to enhance habitat for a variety of other LS/OG associated species.

Management activities as indicated above 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. The following

are some of the mitigation actions that the team has recommended to facilitate retention of habitat connectivity for many species:

Spotted owl dispersal habitat: Where available prior to management activities, maintain stands so that on average the following conditions still exist after treatment:

- MCWet and MCDry PAGs managed as climatic climax - 40% canopy cover in trees that average at least 11" dbh,
- Ponderosa Pine and MCDry PAGs managed for fire climax - 30% canopy cover in trees that average at least 11" dbh;
- Lodgepole & Mt Hemlock - 30% canopy cover in trees at least 7"dbh.

Leave 10 to 30% of any treatment unit in an untreated condition. Consider using the protocol developed (1998) for the 15% reserve requirement on Matrix lands. Implementation of this mitigation for all management activities, commercial thinning, salvage, burning, firewood cutting, etc., 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.

In salvage and firewood activities, retention of recommended levels of snags and down woody debris; limited or no treatment in riparian areas; no treatment in unique habitats such as lava flows and aspen groves (except to restore decadent or declining aspen stands); no treatment around sensitive plant locations; and maintenance of the healthy overstory should allow treated stands to maintain at least some of their habitat connectivity functions.

In areas that are currently fragmented with young plantations and thus present a "barrier" to LS/OG habitat connectivity, adopt an aggressive precommercial thinning program to accelerate development of LS/OG stands and meet long-term habitat connectivity objectives.

Purpose of Retention Areas

Both the Deschutes LRMP and the NW Forest Plan contain direction for the provision of retention areas. The NWFP is very specific for allocations other than LSR, the assumption being that treatments in LSRs would be very limited in scope and size, so there would be little need for specific retention. This is not the situation we generally face on the eastside of the Cascades, where decades of stress and mortality drive the need for large-scale disturbance, both human and natural. Retention is not forever, but scarce late-successional elements and cover should be protected until adjacent areas are again providing the missing components and processes. Retention must be considered at both the landscape scale and at the smaller treatment unit scale.

At the landscape scale, large untreated areas (100+ acres) provide connectivity between foraging and breeding territories (dispersal habitat) and allow species to move easily between isolated pockets of better habitat. Large untreated areas, especially without roads, provide hiding areas for big game. Large untreated patches can be located to buffer smaller patches of optimum habitat. Finally, large untreated areas can retain options for future management in case conditions change or our management assumptions turn out to be ineffective.

There are two primary objectives for retaining untreated areas at the stand or treatment unit scale (10 to 50 acres):

1) Providing late-successional refugia and inoculation sites for low motility and small home range species, thus preserving ecological diversity and function that could otherwise be lost to treatment disturbance. Especially important are elements of late-successional forest that are only developed over long periods of time - large trees and snags, large down logs, pockets of habitat and forest that have been missed by natural disturbance regimes. This includes unique and special habitats such as large cottonwood clumps for lichens, rock outcrops, and small wet seeps or intermittent wet spots. Clumps also provide a manageable method of protecting snags, down logs, and GTRs.

2) Providing hiding cover for foraging and resting animals. This includes: hiding cover to avoid disturbance by humans and other predators; thermal cover for insulation from temperature extremes; and minimizing the size of created openings that reduce habitat connectivity and may limit the territory sizes of some cavity nesters and the foraging effectiveness of small predators such as martin.

Although generally not a primary objective in LSRs, retention can also be used to provide the visual diversity common to natural forests and to reduce the visual effect of large openings and severe edges that can result from major alterations of landscape structure and texture.

Retention Strategy

1) There is no need for retention areas when the existing stand structure is not substantially altered by treatment as described in the following:

Where canopy closure can be maintained as at least 30% in PP and MCD PAGs and 40% in other PAGS and:

a. where treatment openings (not units) are smaller than 10 acres, or

b. where openings can be kept narrow and linear - less than 400 feet wide,

Protection of unique or special habitats including undisturbed and intact areas of the forest floor (organic soil layers, duff, litter, coarse woody debris) is still important. Openings can be defined as in Thomas, 1979, for big game hiding cover; or as areas that lack late-successional elements such as large trees, coarse woody debris, snags, moderate to high canopy closure.

2) In units where treatment will result in one or more openings larger than 10 acres, leave a minimum of 10% of the unit as untreated retention area. Leave 10 to 20% when the unit is located on a slope within fore or background views. Leave up to 30% when treatment will alter forest structure (canopy closure and the presence of multiple canopy layers) and connect existing openings, such as leave strips between plantations.

3) In all treatment units snags, GTRs and coarse woody debris should be distributed between retention areas and the rest of the unit. Even in units where retention areas are not necessary, it may be beneficial to group most of the snags, GTRs and down logs in clumps.

4) Riparian Reserves are defined in the NWFP as an integral part of the connectivity strategy and the Aquatic Conservation Strategy. They should not be counted as a portion of required retention. They may, however, reduce the size of created openings so that additional retention may not be necessary.

5) To maintain biological and visual connectivity, retention areas should be located and distributed within treatment units rather than outside on the edges, so that the effects of created and existing openings are reduced.

6) Fuels breaks and fuels management zones should contain retention areas, as long as the fuel break continues to provide a discontinuity in the fuels.

Examples

1) Any size treatment area, treated by any method so that there are no openings or areas lacking late-successional elements that are larger than 10 acres; and average canopy closure remains at least 30% in PP or MCD and at least 40% in other PAGs:

No retention is necessary, although special habitats may need protection. Also, required snags, GTRs and coarse woody debris may best be managed within retention clumps.

2) Any size treatment area, where an >10 acre opening is created or where existing openings are connected to be larger than 10 acres, or where late-successional elements are lacking on areas greater than 10 acres, or where canopy closure objectives cannot be met:

Retain at least 10% in untreated areas in clumps of 1/4 to 5 acres. Retain 10 to 20 % when the treatment area is on a slope within fore or background views. Retain 20 to 30% when connecting existing openings, depending on the size of the resulting opening.

3) Any size treatment area containing a portion of untreated Riparian Reserve, treated so that an opening or area lacking late-successional elements larger than 10 acres is created:

Retain 10 to 30% of the area untreated, in addition to the Riparian Reserve. Depending on the size, shape and location of the created opening, it may be more beneficial and efficient to expand or buffer the Riparian Reserve, rather than to distribute additional retention areas across the treatment area.

4) Any size treatment area, containing a portion of Riparian Reserve, treated so that an opening greater than 10 acres is created, but it is bisected by the Riparian Reserve, so that the resulting open portions are smaller than 10 acres:

No retention is necessary.

LS/OG Species Surveys

Limited surveys have been completed in Cache LSR for LS/OG associated species. Prior to management activities, surveys should be completed for northern goshawks and great gray owls in proposed management activity areas. Implement Survey and Manage species protocols as developed for activities in the LSR implemented in FY1999 and beyond.

Plant Species of Concern

(a) Peck's penstemon - Continue monitoring Management Treatment Studies for long-term effects. Reintroduce fire in populations especially where coincident with other resource needs.

(b) Candy Stick - Continue to inventory potential habitat with plant surveys. If opportunities arise try prescribed fire on a portion of potential habitat as a management treatment study. Develop specific protection and mitigation during project planning.

(c) Rare truffle - *Elaphomyces anthracinus* - Survey for additional populations in potential habitat - large old pine tree stands.

(d) Larsen's Collomia - Continue to inventory potential habitat with plant surveys.

(e) Rare Nitrogen fixing Lichens - Map the extent of the known populations. Continue to inventory potential habitat. Provide for Black Cottonwood regeneration where little exists. Consider planting Black Cottonwood in high water table regeneration units that have failed to grow conifer trees.

Special Forest Products

The following recommendations address specific concerns related to the most popular Special Forest Products programs:

Matsutake Mushrooms: There is limited habitat for this species, and there is no known commercial harvest. The Deschutes and Winema National Forests completed a Matsutake Mushroom EA that states, "Commercial harvest of matsutake mushrooms shall not be authorized within LSRs unless an LSR evaluation has determined that the activity will not have a significant effect on late-successional habitat. Restriction may be appropriate in some cases".

There is no information on the status of this mushroom in the LSR, therefore this assessment does not determine the effect of commercial harvest on late-successional species. The LSR IDT recommends that no commercial harvest of matsutake mushrooms be permitted without a specific monitoring program that includes surveys for the associate species, *Allotropa Virgata.*

Rare Fungi, Lichen and Moss Species: No harvest of these species is recommended within Riparian Reserves to protect rare moss and lichen species associated with riparian areas. No harvest of rare (Survey and Manage) fungi (truffles), lichens and mosses is recommended.

Boletes and Morel Mushrooms: There is very little information on the amount and location of mushroom picking in the LSR. In addition, very little is known about the impacts of mushroom picking on late-successional species. The LSR is currently open to commercial and free use harvest of all species except matsutakes. An informal monitoring effort to gain information about where mushrooms are being gathered, and the potential impacts of this activity would help determine impacts to LS/OG habitat and species. The monitoring thresholds that would initiate more intensive monitoring or restrictions on gathering activities would include: (1) unacceptable resource damage and (2) perceived decline in fruiting body abundance over a specified period of time.

Fuel-wood Gathering: The ROD (C-16) provides specific guidance for fuelwood gathering in LSRs. There are areas in the LSR where tree mortality has resulted in high levels of standing dead trees and down logs. These same areas are the highest priority for salvage activities. Acceptable fuelwood gathering opportunities arise from several activities (green trees identified for thinning, existing cull decks, blow-down blocking roads, recently

harvested timber sale units) identified in the ROD (C-16). Fuelwood gathering in specifically designated areas 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 LSR. Generally, firewood gathering should be targeted towards white fir and smaller (<15" dbh) Douglas-fir and pine.

Access

Highway Safety Act Roads: There are less than 10 miles of Highway Safety Act Roads (HSA) within the LSR, all of Hwy 242. The ROD (C-16) states, "Road maintenance 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. The HSA roads in the LSR encompass about 365 acres (10 miles x 300 feet wide) or 2% of the LSR. Hazard tree removal of this magnitude for safety purposes is not considered a significant impact on the LSR, especially if coarse woody debris is retained on site. Highway 242 in the LSR is in a scenic view allocation that has high quality scenery objectives. HSA roads also offer some of the best locations for safe and effective fuelbreaks. LSR habitat, reduction of fuels, and scenery objectives must all be considered when managing vegetation adjacent to HSA roads.

Apply the Forest and District Transportation Management Plan to determine which secondary and unimproved roads are necessary for management and recreation, and which roads are in excess and available for closure.

Stocking with Non-native fish

If it is determined through research that fish have or are having a negative effect on native amphibian populations, consider suspending fish stocking in the Cache RNA lakes.

STAND-LEVEL CRITERIA FOR DEVELOPING APPROPRIATE TREATMENTS

Ponderosa Pine PAG (849 acres)

Landscape Desired Condition

Range of Seral Classes:

- grass/shrub/forb - 5-30%
- seed/sapling - 3-21%
- pole - 3-21%
- small - 20-50%
- medium/large - 30-70%
- mortality patches - <1%

Generally homogenous landscape of scattered or clumped large trees, reproduction in even-aged clumps up to several acres in size, scattered grass/shrub/forb openings, 1/10 to 1/4 acre in size with a few larger. Stands are denser in riparian bottomlands and other moist ecotones, sparser on steep south facing slopes. Other species present include Douglas fir and western larch in moist ecotones, juniper and incense cedar on drier ecotones. Understories are primarily shrub and grass. Large snags and down logs are evenly distributed, and only rarely concentrated where openings result from root disease, bark beetle mortality, or localized high intensity fire or insect attack. Low intensity fire is the primary disturbance agent, with fire return intervals ranging from 8 to 20 years. Windthrow is locally a factor.

New Regeneration, grass/shrub/forb (<1% of PAG)

Existing Stand Condition:

The amount of this seral class is currently lower than the historic and desired range of conditions. Even-aged plantations, generally exclusively planted to pine, occasionally containing volunteer or natural regeneration of other species from adjacent areas. Generally high shrub, grass and forb component. Usually few if any large down logs, snags, or remnant large green trees are present, unless it is a recent (since about 1985) shelterwood.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees. Allow high stand densities to encourage the development of a dominant size class.

Threshold - usually none. Monitor for insect, disease, or predation that would remove enough young trees that an adequate stand could not develop without additional planting.

Treatment Strategies:

Base density prescriptions on adjacent stand health and the previous survival history of similar plantations.

Resulting Stand:

No significant changes prior to stands reaching seedling/sapling size class. New plantations in this PAG should include some species diversity where possible. Consider other seral species as appropriate for the plant association. Also consider varying planting densities and patterns where past history indicates good survival success.

Meeting LSR Objectives:

Plantations provide conditions conducive to development of future LS/OG stands. New plantations can be designed to enhance LS conditions by retaining or adding species diversity, variable spacing, and retaining large green trees, snags, and down logs.

SEEDLING, SAPLING, AND POLE STANDS (29% of PAG)

Existing Stand Condition:

The amount of this seral class is within the range of historic or desired conditions. High density of young trees, (400+ per acre) usually single species between 1" and 9" dbh, but often with some variety in species from residual stand or natural regeneration; high variety of early seral shrubs, grass, and forbs. In many of these stands, few or no overstory trees remain because of prior harvest or recent mortality.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees.

Threshold - The timing for precommercial-sized thinning is difficult to quantify. These stands are usually growing at rates that discourage insect and disease problems, and only develop basal areas that approach the upper management zones of the appropriate plant association when they reach sizes of approximately 4"- 6" dbh. Desired stocking levels are generally between the upper and low management zone boundaries for the appropriate plant association. Generally, plantations are thinned after stand densities have forced some individual trees to begin to express dominance, but before growth begins to slow down. The timing must be balanced 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.

Treatment Strategies:

Thin plantations to favor and develop the larger dominant and co-dominant trees. Favor seral species such as ponderosa pine, Douglas fir, and larch. Climax species such as white fir can be left for diversity, but should not comprise more than 5% of the resulting stand, and should be left in clumps rather than as individual trees. Spacing should be as random as possible

given the limitations of marking and contracting feasibility. Specify several spacing regimes or variable spacing within a plantation, e.g. untreated clumps, 16x16 average and 18x18 average.

Where plantations are surrounded by existing mortality, consider felling dead trees into the plantation to increase coarse woody debris. Balance the increased fuel load with the decreased risk of fire in the surrounding stands.

To the extent practical, thinning should be done to a stocking level that precludes the need for future entries. Generally, this would require a spacing of 35 to 50 feet. Higher stand densities may be maintained to provide short-term cover and require further thinning. Or stand densities may be lowered too much to the extent that future insect, disease, or fire mortality require interplanting to maintain desired stand structure.

Fuel treatment depends on the location of the plantation and the size and number of trees removed. Where they do not contribute significantly to the fuel profile, protect and retain shrubs, grasses, forbs, snags and large (>16" dbh x 16' long) CWD. Resulting fuel profile should not increase the overall risk to the LSR. Consider the following fuel treatments in descending order of preference for enhancing LSR characteristics, but ascending order of risk reduction:

- no fuel treatment.
- partial treatment - treat patches sufficient to reduce overall risk; pull fuel back along road to create defensible fuelbreaks; pull fuel away from leave trees and clumps; lop or lop and scatter limbs.
- prescribed underburn all or part of plantation.
- hand pile all or part of plantation; burn all or part of the piles (piles can be left for wildlife cover).
- machine pile and burn all or part of plantation.

Resulting Stand:

Thinned plantations in pine should contain the best dominant and co-dominant pine, Douglas fir and larch. Other species are present but make up less than 5% of the total stand. Trees are randomly scattered, in small groups, or in clumps up to several acres in size. Shrubs, grasses, and forbs are present, as are remnant large trees from the pre-regeneration stand. Snags and down wood, especially large pieces, are present, but overall fuel loads do not increase the risk of fire that would preclude the eventual development of late-successional stands.

Meeting LSR Objectives:

Thinning plantations as described above enhances Late-Successional conditions by: 1) accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands, and 2) by retaining other elements of LS/OG forests -- species diversity, soil and undergrowth productivity, untreated refugia, snags and CWD, and other remnants of the original forest.

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 LS/OG resources.

SMALL SIZE CLASS STANDS (59% of PAG)

Existing Stand Condition:

The amount of this seral class is greater than the range of historic or desired conditions. These stands are typically dominated by 31 to 176 ponderosa pine 9"-21" dbh in the representative plant association (CP-S2-11). Understory is usually in high density clumps or continuous stands of pine poles and saplings. Some managed stands of high density pole to small sized trees with no overstory.

Objectives and Thresholds for Action:

Objective - Protect remaining large trees by reducing stress and fire risk from fuel loading and arrangement. Protect private property and rural lands from fire as well as LS/OG stands next to rural development. Reduce risk of high intensity fire damaging core habitat areas for focal species or special and unique habitats. Reduce fuel loads and continuity. Promote the most desirable 9" to 21" individuals into the medium and large size class.

Threshold - Stand basal areas at or exceeding the upper management zones of GBA. Understories may exhibit increasing levels of pine beetle. Understory thickets may form ladder fuels that threaten large trees even in low intensity fires. In stands that have not been thinned or prescription burned, the combination of dense understory, decadent shrubs covering more than 50% of the area, and duff layers more than 2" to 4" deep, will lead to fires of moderate to high intensity. These fires can only be attacked by indirect methods that limit the amount of protection that can be provided to adjacent lands and resources.

Objective - Enhance habitat for PEPE and other fire-dependent flora associated with LS/OG stands.

Threshold - Less than 10% of the area has bare mineral soil and /or canopy closure greater than 60%. Grass and forb communities consist of only a few species or individuals, and species known to occur in this plant community under a low intensity fire regime are missing.

Treatment Strategies:

Stand density reduction -- thin clumps that are above UMZ and remove trees in the 9" to 21" range, especially in areas that contain or surround large trees. Reduce competition for light, water, and nutrients; remove ladder fuels; promote development of future large trees.

Tree culturing -- Thin understory thickets and/or remove sub-dominant trees larger than 9" dbh around large dominant and co-dominant pine, Douglas fir and larch. This reduces stress on specific large trees desired for nesting, perching or roosting habitat, or can also be used where stand level treatments are not appropriate or unfeasible.

Fuel breaks -- combinations of understory thinning, reduction of ladder fuels, break up of fuel continuity, reducing amounts of fine and heavy ground fuels. Reduce fire intensity and

increase likelihood of successful suppression. Maintain LS/OG stand conditions at the lower boundary of the management zone, with most of the basal area in the largest available trees.

Prescribed fire -- Use low intensity fire for stand density reduction, fuel profile modification, and to provide conditions conducive to regeneration of grasses, shrubs and forbs. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts.

Resulting Stand:

FOR FIRE CLIMAX STANDS - CP-S2-xx and CPS3-12 plant associations. Stands exhibit most of the characteristics of LS/OG stands described under Moderate to Large size class stands below. Generally one or two storied stands, less than 40% canopy closure, dominated by 10-30 trees larger than 17-inch dbh. Densities in these stands are usually at or about 90% of the upper management boundary for the appropriate plant association. Initially, there may be few individuals over 21" dbh, but the reduced stand densities and selection of the most vigorous large leave trees will allow for growth. Understories are almost entirely ponderosa pine in scattered individuals or thinned even-aged clumps. Some (10-25% of the area) is bare soil conducive to regeneration of the associated shrubs and grasses. Snags are present, but some stands may not have sufficient numbers to meet 100% MPP for focal species (usually about 4 snags/acre). Down logs are scattered throughout the stand (3 to 6 pieces per acre, 16-25" dbh by 16' in size), associated with windthrow or fallen snags. As with snags, some stands may not have the desired levels. Stands managed with prescribed fire or for fuelbreaks may have less than desired numbers of snags and down logs. Some of the large live trees may have spike tops.

FOR CLIMATIC CLIMAX STANDS - CP- S3-11, CP-S3-14, and CP-G2-12 plant associations. In moister ecotones such as riparian bottoms or north slopes, or other areas with longer than usual fire return intervals, stands may be denser (>40% canopy cover), clumps may be larger; more shade tolerant trees and shrubs may be present. There may be higher numbers of large pine in the overstory and more snags and down logs.

Meeting LSR Objectives:

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

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.

MEDIUM TO LARGE SIZE CLASS STANDS (41% of PAG)

Existing Stand Condition:

The amount of this seral class is slightly greater than the low end of the historic or desired range of conditions. Existing stands have 14 to 32 large trees per acre (21+ dbh), with understories in even-aged high-density clumps. Some shade tolerant tree species are present, but comprise less than 5% of the total canopy cover.

Objectives and Thresholds for Action:

Objective - Maintain and protect existing LS/OG habitats.

Threshold - Densities exceed the upper management zone of GBA. Stands are imminently susceptible to stand replacing insect, disease or fire mortality over areas larger than 10 acres.

Treatment Strategies:

Stand density reduction -- thin areas that are above UMZ and remove trees in the 9" to 21" range, especially in areas that contain or surround larger trees. Reduce competition for light, water, and nutrients; remove ladder fuels; promote development of future large trees.

Prescribed fire -- Use low intensity fire for stand density reduction, fuel profile modification, and to provide conditions conducive to regeneration of grasses, shrubs and forbs. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts.

Resulting Stand:

FOR FIRE CLIMAX STANDS - CP-S2-xx and CPS3-12 plant associations Generally one or two storied stands, less than 40% canopy closure, dominated by 10-30 trees larger than 17 inch dbh. Understories are almost entirely ponderosa pine in scattered even-aged clumps. Shrubs and grasses are young and vigorous, reflecting the influence of frequent low intensity fire. Snags are present, but some stands may not have sufficient numbers to meet 100% MPP for focal species (usually about 4 snags/acre). Down logs are scattered throughout the stand (3 to 6 pieces per acre, 16-25" dbh by 16' in size), associated with windthrow or fallen snags. As with snags, some stands may not have the desired levels. Stands managed with prescribed fire or for fuelbreaks may have less than desired numbers of snags and down logs. As many as 10% of the large live trees may have spike tops.

FOR CLIMATIC CLIMAX STANDS - CP- S3-11, CP-S3-14, plant associations. In moister ecotones such as riparian bottoms or north slopes, or other areas with longer than usual fire return intervals, stands may be denser and multi-storied, with more seedlings, saplings or poles in the understory; clumps may be larger; shade tolerant trees and shrubs may be present; there may be higher numbers of large pine in the overstory and more snags and down logs.

Meeting LSR Objectives:

Reducing imminent susceptibility protects and maintains existing LS/OG habitat over the long term.

Mortality Patches (<1% of PAG)

Existing Stand Condition:

The amount of this class is currently consistent with the historic and desired range of conditions. Large snags and down logs are unevenly distributed depending on frequency and type of disturbance, and only rarely concentrated where openings result from root disease,

bark beetle mortality, or localized high intensity fire or insect attack. Mortality areas are small, usually ½ to 2 acres in size. Remaining snags and coarse woody debris is usually in the larger size classes, unless the disturbance has been recent.

Objectives and Thresholds for Action:

Objective – Maintain mortality patches distributed across the PAG unless the amount or location poses a risk to adjacent late-successional habitats or improvements such as roads, powerlines, recreation sites or buildings.

Threshold - usually none. Fuel loads in the smaller size classes that exceed hazard objectives or individual trees that have been evaluated via the Hazard Tree Guide (Long Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management, PNW 1992), and determined to be a risk to improvements.

Treatment Strategies:

For excess fuel loads, remove dead trees and coarse woody debris less than 12" dbh. Isolate larger snags and logs, especially those greater than 20" dbh, from ladder fuels and fuel concentrations. Treat individual hazard trees according the Hazard Tree Guide. As an alternative to removal of large snags that provide significant habitat, consider topping or relocating the improvement. Unless fuel loads are already in excess, leave large felled snags on site.

Resulting Stand:

Mortality patches should be dominated by at least 4 to 8 large pine snags per acre, with 20 to 30 smaller snags present. Live trees of all sizes may be present too. The presence of smaller <12" snags and coarse woody debris will be dependent on how recently the patch has been created or disturbed by treatment.

Meeting LSR Objectives:

Mortality patches provide habitat components critical to the survival of many species, both mobile and non-mobile, as well as sources for future dispersal of these species into developing future LS/OG stands.

Mixed Conifer Dry PAG (12,118 acres)

Desired Landscape Condition:

- Range of seral conditions:
- Grass/Forb/Shrub -- 1 to 7 %
- Seed/Sapling -- 3 to 25 %
- Pole -- 8 to 40%
- Small -- 20 to 75%
- Med/Large -- 23 to 75%
- mortality patches – 5-15%

Landscape is a mosaic of varying textures and seral stages, but predominately containing stands of small and med/large trees. Patch sizes are quite large -- 100 to 1000 acres. Ponderosa pine and Douglas fir are the dominant overstory species with sparse understories of shade tolerant species. Low intensity fire return intervals are longer, 15-30 years, than in the Pine PAGs. Low intensity fire serves a role similar to that in pine, maintaining primarily 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. Scattered stands exist where disturbance intervals are longer and allow the development of climatic climax conditions. 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. Up to 30% of the dry MC PAG could be in this condition and still be consistent with the historical range of variability for wet cycles. 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.

NEW REGENERATION (<1% of PAG)

Existing Stand Condition:

The amount of this seral class is lower than the historic or desired range of conditions. Even-aged plantations of ponderosa pine and/or Douglas-fir, occasionally containing volunteer or natural regeneration of other species from adjacent areas. Generally high shrub, grass and forb component. Usually few if any large down logs, snags, or remnant large green trees are present, unless it is a recent (since about 1985) shelterwood.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees. Allow high stand densities to encourage the development of a dominant size class.

Threshold -- usually none. Monitor for insect, disease, or predation that would remove enough young trees that an adequate stand could not develop without additional planting.

Treatment Strategies:

Base density prescriptions on adjacent stand health and the previous survival history of similar plantations.

Resulting Stand:

No significant changes prior to stands reaching seedling/sapling size class. New plantations in this PAG should include some species diversity where possible. Consider other seral species as appropriate for the plant association. Also consider varying planting densities and patterns where past history indicates good survival success.

Reforestation of ponderosa pine on most of the acres that have experienced moderate to very high levels of mortality will be difficult at best and has the potential to be extremely expensive. This is due to the length of time since the mortality occurred. In most cases the majority of the mortality occurred 4-5 or more years from the present. High levels of competing vegetation, both grass and brush, have become established. To be successful, reforestation efforts will need to include lots of financing for the control of competing vegetation and animal damage control.

Meeting LSR Objectives:

Plantations provide conditions conducive to development of future LS/OG stands. New plantations can be designed to enhance LS conditions by retaining or adding species diversity, variable spacing, and retaining large green trees, snags, and down logs.

SEEDLING, SAPLING, AND POLE STANDS (20% of PAG)

Existing Stand Condition:

The amount of this seral class is within the historic or desired range of conditions. High density of young trees, (400+ per acre) usually single species between 1" and 9" dbh, but often some variety in species from residual stand or natural regeneration. High variety of early seral shrubs, grass, and forbs. Few or no overstory trees remaining on about 84% of the acres. The rest have some overstory remaining.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees.

Threshold - The timing for precommercial-sized thinning is difficult to quantify. These stands are usually growing at rates that discourage insect and disease problems, and only develop basal areas that approach the upper management zones of the appropriate plant association when they reach sizes of approximately 5" to 7" dbh. Desired stocking levels are generally between the lower and upper management zone for the appropriate plant association. Generally, plantations are thinned after stand densities have forced some

individual trees to begin to express dominance, but before growth begins to slow. The timing must be balanced 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.

Treatment Strategies:

Thin plantations to favor and develop the larger dominant and co-dominant trees. Favor seral species such as ponderosa pine, Douglas fir, and larch. Climax species such as white fir can be left for diversity, but should not comprise more than 20% of the resulting stand, and should be left in clumps rather than as individual trees. Spacing should be as random as possible given the limitations of marking and contracting feasibility. Specify several spacing regimes within a plantation or variable spacing, e.g., untreated clumps, 16x16 average and 18x18 average.

Thinning of stands that are dominated by white fir is a questionable practice and is not recommended at this time. Except under the best scenarios, white fir should not be thinned until the results of the District white fir study are known. In most cases it is best to treat these types of stands by regeneration harvests to accomplish species conversion to ponderosa pine.

While there appears to be a direct correlation between stand density and tree mortality from insect (defoliators and engravers) attack, recent monitoring in central Oregon indicate that other factors may also be at work. Drought or the presence of fir-dominated stands on dry sites (20 to 30 inches precipitation per year) seems also to be significant. In the last century, weather patterns have resulted in drought periods of at least 6 years duration about every 30 years. If significant portions of the landscape are dominated by white fir, even if thinned, that portion of the landscape is at considerable risk during drought periods from defoliation and mortality of the intensity already seen in much of this LSR and neighboring LSRs. While thinning may provide a short term benefit as a compromise between managing for stand health and providing dense, multi-story habitat, there is little chance of successfully providing or maintaining optimal LSOG habitat in these stands over the long term beyond the next drought cycle. This is especially true on drier MCD sites. When only small areas of the landscape are at that high level of short term risk, or when LSOG habitat is particularly scarce, thinning or even no treatment may be an appropriate response. When large portions of the landscape are dominated by stands that are judged imminently susceptible, regenerating new stands with less susceptible species such as ponderosa pine may be a better investment both in terms of resources expended and in providing future LSOG habitat.

Plantations in Dry Mixed Conifer afford the best opportunities to make long-term adjustments in the types of habitat to be provided in the LSR. Generally, plantations on sites with low productivity and drier ecotones such as south and west slopes, the tops of ridges and other flat areas in the eastern part of the PAGs should be managed to provide fire climax stands maintained by low to medium fire regimes, and characterized by low density, open stands of seral species. Conversely, plantations in areas with higher productivity, on north

aspects, midslopes and drainage bottoms, can be aimed towards climatic climax stands with longer disturbance intervals, and characterized by denser, more diverse stands.

Where plantations are surrounded by existing mortality, consider felling dead trees into the plantation to increase coarse woody debris. Balance the increased fuel load with the decreased risk of fire in the surrounding stands.

To the extent practical, thinning should be done to a stocking level that precludes the need for future entries. Generally, this would require a spacing of 30 to 50 feet. Higher stand densities may be maintained to provide short-term cover and require further thinning. Conversely, stand densities may be lowered too much to the extent that future insect, disease, or fire mortality require interplanting to maintain desired stand structure.

Fuel treatment depends on the location of the plantation and the size and number of trees removed. Where they do not contribute significantly to the fuel profile, protect and retain shrubs, grasses, forbs, snags and large (>16" dbh x 16' long) CWD. Resulting fuel profile should not increase the overall risk to the LSR. Consider the same fuel treatment strategies as discussed under the Ponderosa Pine PAG

Resulting Stand:

Thinned plantations should contain the best dominant and co-dominant pine, Douglas fir and larch. Other species are present but make up less than 20% of the total stand. Trees are randomly scattered, in small groups, or in clumps up to several acres in size. Shrubs, grasses, and forbs are present as are remnant large trees from the pre-regeneration stand. Snags and down wood, especially large pieces, are present, but overall fuel loads do not increase the risk of fire that would preclude the eventual development of late-successional stands.

Meeting LSR Objectives:

Thinning plantations as described above enhances Late-Successional conditions by: 1) accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands, and 2) by retaining other elements of LS/OG forests -- species diversity, soil and undergrowth productivity, untreated refugia, snags and CWD, and other remnants of the original forest.

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 LS/OG resources.

SMALL SIZE CLASS STANDS (31% of PAG)

Existing Stand Condition:

The amount of this seral class is at the low end of the historic or desired range of conditions. Primarily pine and Douglas fir 9-21 inch dbh, averaging 30 to 250 trees per acre in the representative plant association (CW-C2- 11). Understory is uniformly dense and continuous stands of white fir, pine, or Douglas-fir poles and saplings. Some managed stands of high density pole to small sized trees with little to no overstory.

Many of these stands have significant mortality from defoliators, over stocking and root diseases, averaging 20%, but locally up to 80%. Many of the remaining live trees have substantial top kill and poor vigor, and will never grow to larger sizes. Standing fuel loads are extremely high.

Objectives and Thresholds for Action:

Objective - Protect remaining large trees, especially ponderosa pine and Douglas fir, by reducing stress caused by high stand densities and fire risk from fuel loading and arrangement. Protect private property and rural lands from fire as well as LS/OG stands next to rural development. Reduce risk of high intensity fire damaging core habitat areas for focal species or special and unique habitats. Reduce fuel loads and continuity. Develop and maintain stands that are predominately influenced by low intensity fire.

Threshold - Stand basal areas in or exceeding the upper management zones of GBA. More than 20% of the understory contains shade-tolerant species such as white fir. Increasing levels of pine beetle, fir engraver, spruce budworm or other defoliators, especially in the understory, will result in significant change to or loss of late-successional characteristics, i.e., canopy cover, large trees or stand co-dominants. Root rot pockets are increasing in size and removing the few remaining large overstory trees. Mortality from insects and disease is more than 10 to 15% of the stand. Understory thickets may form ladder fuels that threaten large trees even in low intensity fires. In stands that have not been thinned or prescription burned, the combination of dense understory and standing and down dead fuels (especially those less than 12" dbh), will lead to fires of moderate to high intensity. These fires can only be attacked by indirect methods that limit the amount of protection that can be provided to adjacent lands and resources.

Objective - Enhance habitat for PEPE and other fire-dependent flora associated with LS/OG stands.

Threshold - Less than 10% of the area has bare mineral soil and /or canopy closure greater than 60%. Grass and forb communities consist of only a few species or individuals, and species known to occur in this plant community under a low intensity fire regime are missing.

Treatment Strategies:

Stand density reduction -- thin understories to reduce competition and ladder fuels, and promote development of additional and future large trees, especially ponderosa pine and Douglas-fir. Desired canopy closure is between 30% and 40% on drier sites, more than 40% on moister ecotones and higher site potentials. Thinning should favor seral species, with no more than 20% of the site stocked with white fir. Remove most or all dead and dying trees less than 21" dbh, but maintain larger snags and green trees of low vigor. Stands without much mortality will still benefit from understory thinning, but may not need removal of dead material to reduce fire risk.

Understory removal could be use in stands in which the understories are dominated by white fir and the overstories are dominated by ponderosa pine and the stands would be adequately stocked by trees >20.9" DBH.

Fuel breaks -- in areas where stand manipulation is not desirable (riparian reserves, owl activity circles, sensitive soils or remnants of climatic climax habitat), or to isolate areas that won't be entered, combinations of understory thinning, pruning, interruption of dead and down fuel continuity may be used to reduce fire intensity and rate of spread, and increase the likelihood of successful suppression. Link existing openings where feasible. Fuelbreaks should continue to exhibit some LS/OG components at the low end of the stocking range -- open stands of predominately medium to large trees, 20-40% canopy closure, and isolated clumps of younger trees. Widely distributed snags and large down logs will be present, but in limited numbers.

Tree culturing -- Thin understory thickets and/or remove sub-dominant trees larger than 9" dbh around large dominant and co-dominant pine, Douglas-fir and larch. This reduces stress on specific large trees desired for nesting, perching or roosting habitat, or can also be used where stand level treatments are not appropriate or unfeasible.

Small Group Shelterwood -- designed to reduce the spread of root rots by removing susceptible tree species from small (2 to 9 acre) root rot pockets, and to convert portions of stands to early seral species. If present, leave 10 to 15 trees per acre of the largest trees of resistant species, i.e., pine and larch. Small regeneration cuts like this can also be used to reestablish seral species where no seed source exists because of mortality or because of the dominance in the stand of climax species. Leave the largest seral species extant, or leave the healthiest climax individuals and interplant with seral species.

In stands where mortality exceeds 10 to 15% and excessive standing and down fuels pose a risk of fire at intensities that will threaten LS/OG habitat or other resources, remove most of the standing dead especially those less than 12" dbh.

Stands with greater than 10% mortality, especially those with greater than 30% mortality will require special consideration for several reasons. First, most of the trees that have died during the last mortality event are white fir and have been dead so long that the majority are past merchantability for sawlogs and under the best scenarios will be salvagable only as fiber/chip. Second, fire hazard is very high in the majority of these stands. Third, given that there is little merchantable product still available on most acres, treatment/restoration of these areas will require financing through some means other than a timber sale.

Consider safety and feasibility when leaving larger snags, averaging up to 7 per acre. Large snags can be left for future down wood where less than desired amounts exist. Where no adequate seed sources exist or the remaining stand is not fully stocked with healthy seral species, consider interplanting.

Prescribed fire - Use low intensity fire for stand density reduction, fuel profile modification, and to provide conditions conducive to regeneration of grasses, shrubs, forbs and early seral tree species. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts.

Resulting Stand:

FOR FIRE CLIMAX STANDS (All MCD plant associations) - Stands exhibit most of the characteristics of LS/OG stands described under Moderate to Large size class stands below. Generally one or two storied stands, 20 to 40% canopy closure, dominated by 15-40

ponderosa pine, Douglas fir, and larch larger than 17 inch dbh. Initially, there may be few individuals over 21" dbh, but the reduced stand densities and selection of the most vigorous large leave trees will allow for growth. Understories are relatively sparse containing individuals or small clumps of ponderosa pine, Douglas fir, or other seral species. Some dense clumps of climax understory remain, but on less than 20% of the area. Some (10-25% of the area) is bare soil conducive to regeneration of the associated shrubs and grasses. Small openings exist, generally less than 10 acres in size, with 10 to 15 trees per acre and some large snags remaining. Snags are present, but some stands may not have sufficient numbers to meet 100% MPP for focal species (usually about 4 snags/acre). Down logs are scattered throughout the stand (2 to 7 pieces per acre, 25" dbh by 16' in size), associated with windthrow or fallen snags. As with snags, some stands may not have the desired levels, especially those stands managed to reduce fuels.

FOR CLIMATIC CLIMAX STANDS - (Portions of CW-C2-11, CP-G2-12 and CW-S1-15). In moister ecotones such as riparian bottoms or north slopes, or other areas with longer than usual fire return intervals, stands may be denser; clumps may be larger; shade tolerant trees and shrubs may be present; there may be higher numbers of large pine, Douglas-fir, and true fir in the overstory and more snags and down logs.

Meeting LSR Objectives:

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

Small shelterwoods develop future LS/OG characteristics by converting or replacing dead, dying or root disease susceptible species with more resistant early seral species.

Removing mortality reduces the risk of high intensity fires that threaten the remaining LS/OG habitats or lengthen the time of development of LS/OG characteristics.

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.

MEDIUM TO LARGE SIZE CLASS STANDS (45% of PAG)

Existing Stand Conditions:

The amount of this seral class is within the historic or desired range of conditions. Existing stands have 4 to 55 large trees per acre (21+ dbh), primarily ponderosa pine, white fir and Douglas-fir. The understory is usually dense white fir.

The understories in these stands have mortality as described above for small-sized stands. In addition, many of the larger overstory trees are dead or dying from combinations of insect, disease, and stress.

Objectives and Thresholds for Action:

Objective - Maintain and protect existing LS/OG habitats.

Threshold - stand densities exceed the upper management zone of GBA. Stands are imminently susceptible to stand replacing insect, disease or fire mortality over areas larger than 10 acres.

Treatment Strategies:

Stand density reduction - thin clumps and remove trees less than 21", especially those that contain or surround large trees, especially ponderosa pine and Douglas fir. Reduce competition for light, water, and nutrients; remove ladder fuels; promote development of future large trees.

Remove Mortality - in stands where mortality exceeds 10 to 15% and excessive standing and down fuels pose a risk of fire at intensities that will threaten LS/OG habitat or other resources, remove most or all of the standing dead especially those less than 12" dbh. Incorporate safety and feasibility when leaving the largest individual snags, averaging up to 7 per acre. Additional large snags can be left for future down wood where less than desired amounts exist. Where no adequate seed sources exist or the remaining stand is not fully stocked with healthy seral species, consider interplanting.

Prescribed fire - Use low intensity fire for stand density reduction, fuel profile modification, and to provide conditions conducive to regeneration of grasses, shrubs and forbs. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts.

Resulting Stand:

FOR FIRE CLIMAX STANDS - (All MCD plant associations). Generally, 1 or 2 storied stands, open canopies, (but denser than in the Pine PAG), stands dominated by large ponderosa pine, Douglas-fir, and larch. Understory trees and shrubs are evenly distributed and a mix of shade-tolerant and intolerant species. White 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 associated with windthrown snags.

FOR CLIMATIC CLIMAX STANDS - (Portions of CW-C2-11, CP-G2-12 and CW-S1-15) On wetter ecotones at higher elevations, north slopes, and other areas with longer fire return intervals, stands are multi-storied, with 40% to 60% canopy closure, dominated by ponderosa pine, white fir, Douglas-fir, western larch and incense cedar. Understory trees are multi-aged, well distributed, but may occur as dense thickets when pioneering a disturbance opening. Snags and large down logs provide a significant amount of the structural complexity.

Meeting LSR Objectives:

Reducing imminent susceptibility protects and maintains existing LS/OG habitat over the long term.

Removing mortality reduces the risk of high intensity fires that threaten the remaining LS/OG habitats or lengthen the time of development of LS/OG characteristics.

Mortality Patches (5-15% of PAG)

Existing Stand Condition:

The amount of this class is currently consistent with the historic and desired range of conditions. Large snags and down logs are unevenly distributed depending on frequency and type of disturbance, and only rarely concentrated where openings result from root disease, bark beetle mortality, or localized high intensity fire or insect attack. Mortality areas are usually small, usually ½ to 2 acres in size. But they may be larger – 25 to 100 acres, up to entire stands or portions of large contiguous stands. Remaining snags and coarse woody debris is usually in the larger size classes, unless the disturbance has been recent.

Objectives and Thresholds for Action:

Objective – Maintain mortality patches distributed across the PAG unless the amount or location poses a risk to adjacent late-successional habitats or improvements such as roads, powerlines, recreation sites or buildings.

Threshold - usually none. Fuel loads in the smaller size classes that exceed hazard objectives or individual trees that have been evaluated via the Hazard Tree Guide (Long Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management, PNW 1992), and determined to be a risk to improvements.

Treatment Strategies:

For excess fuel loads, remove dead trees and coarse woody debris less than 12" dbh. Isolate larger snags and logs, especially those greater than 20" dbh, from ladder fuels and fuel concentrations. Treat individual hazard trees according the Hazard Tree Guide. As an alternative to removal of large snags that provide significant habitat, consider topping or relocating the improvement. Unless fuel loads are already in excess, leave large felled snags on site.

Patches larger than the historical range should be planted, but large snags and coarse woody debris should be retained at the levels described below, even if tree growth and plantation uniformity would be reduced.

Resulting Stand:

Mortality patches should be dominated by at least 5 to 10 large snags per acre in pine, Douglas fir, larch, or rarely, white fir, with 20 to 30 smaller snags present. Live trees of all sizes may be present too. The presence of smaller <12" snags and coarse woody debris will be dependent on how recently the patch has been created or disturbed by treatment.

Meeting LSR Objectives:

Mortality patches provide habitat components critical to the survival of many species, both mobile and non-mobile, as well as sources for future dispersal of these species into developing future LS/OG stands.

Mixed Conifer Wet PAG (1949 acres)

Desired Landscape Condition:

Range of seral conditions:

- Grass/Forb/Shrub - 0 to 20%
- Seed/Sapling - 3 to 54 %
- Pole - 7 to 51%
- Small - 13 to 57%
- Med/Large - 11 to 53%
- mortality patches – 7-10%

Landscape is a mosaic of varying textures and seral stages, but predominately containing stands of small and med/large trees. Patch sizes are quite large - 100 to 1000 acres in size. Ponderosa pine and Douglas fir are the dominant overstory species with sparse understories of shade tolerant species. Moderate to high intensity fire is the primary disturbance agent at varying intervals. Insects and disease also play a role, on a smaller scale.

NEW REGENERATION (<1% of PAG)

Existing Stand Condition:

The amount of this seral class is below the range of historic or desired conditions, primarily because of fire suppression and the resultant elimination of recent stand replacement fires. What little that exists is in even-aged plantations of ponderosa pine and/or Douglas fir, occasionally containing volunteer or natural regeneration of other species from adjacent areas. Generally high shrub, grass and forb component. Usually few if any large down logs, snags, or remnant large green trees are present, unless it is a recent (since about 1985) shelterwood.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees. Allow high stand densities to encourage the development of a dominant size class.

Threshold - usually none. Monitor for insect, disease, or predation that would remove enough young trees that an adequate stand could not develop without additional planting.

Treatment Strategies:

Base density prescriptions on adjacent stand health and the previous survival history of similar plantations.

Reforestation of ponderosa pine on most of the acres that have experienced moderate to very high levels of mortality will be difficult at best and has the potential to be extremely

expensive. This is due to the length of time since the mortality occurred. In most cases the majority of the mortality occurred 4-5 or more years from the present. This length of time has allowed high levels of competing vegetation, both grass and brush, to become established. To be successful, reforestation efforts will need to include lots of financing for the control of competing vegetation and animal damage control.

Resulting Stand:

No significant changes prior to stands reaching seedling/sapling size class. New plantations in this PAG should include some species diversity where possible. Consider other seral species as appropriate for the plant association. Also consider varying planting densities and patterns where past history indicates good survival success.

Meeting LSR Objectives:

Plantations provide conditions conducive to development of future LS/OG stands. New plantations can be designed to enhance LS conditions by retaining or adding species diversity, variable spacing, and retaining large green trees, snags, and down logs.

SEEDLING, SAPLING, AND POLE STANDS - (9% of PAG)

Existing Stand Condition:

The amount of this seral class is near the low end of the range of historic or desired conditions. High density of young trees, (400+ per acre) usually single species between 1" and 9" dbh, but often some variety in species from residual stand or natural regeneration; high variety of early seral shrubs, grass, and forbs. Few or no overstory trees remaining. Only 3% of the acres have some remaining overstory.

Objectives and Thresholds for Action:

Objective - Develop future late successional stands quickly by taking advantage of the potential for regenerated stands to rapidly develop large healthy trees.

Threshold - The timing for precommercial-sized thinning is difficult to quantify. These stands are usually growing at rates that discourage insect and disease problems, and only develop basal areas that approach the upper management zones of the appropriate GBA at approximately 6" to 8" dbh. Desired stocking levels are generally between the upper and lower management zone for the appropriate plant association. Generally, plantations are thinned after stand densities have forced some individual trees to begin to express dominance, but before growth begins to slow down. The timing must be balanced 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.

Treatment Strategies:

Thin plantations to favor and develop the larger dominant and co-dominant trees. Favor seral species such as ponderosa pine, Douglas fir, and larch. Climax species such as white fir can be left for diversity, but should not comprise more than 30% of the resulting stand, and

should be left in clumps rather than as individual trees. Spacing should be as random as possible given the limitations of marking and contracting feasibility. Specify several spacing regimes within a plantation, or variable spacing, e.g. untreated clumps, 16x16 average and 18x18 average.

Where plantations are surrounded by existing mortality, consider felling dead trees into the plantation to increase coarse woody debris. Balance the increased fuel load with the decreased risk of fire in the surrounding stands.

To the extent practical, thinning should be done to a stocking level that precludes the need for future entries. Higher stand densities may need to be maintained to provide short-term cover, but will require further thinning if large trees are desired in the future. Or stand densities may be lowered too much to the extent that future insect, disease, or fire mortality require interplanting to maintain desired stand structure.

Fuel treatment depends on the location of the plantation, the size and number of trees removed. Where they do not contribute significantly to the fuel profile, protect and retain shrubs, grasses, forbs, snags and large (>16" dbh x 16' long) CWD. Resulting fuel profile should not increase the overall risk to the LSR. Consider the same fuel treatment strategies as discussed previously.

Because of the higher site potential of these MCW plant associations compared to the MCD plant associations, the MCW plant associations should be able to carry higher levels of stocking (i.e., higher UMZs).

Thinning of stands that are dominated by white fir is a questionable practice and is not recommended at this time. Except under the best scenarios, white fir should not be thinned until the results of the District white fir study are known. In most cases it is best to treat these types of stands by regeneration harvests to accomplish species conversion to ponderosa pine.

While there appears to be a direct correlation between stand density and tree mortality from insect (defoliators and engravers) attack, recent monitoring in central Oregon indicate that other factors may also be at work. Drought or the presence of fir-dominated stands on dry sites (20 to 30 inches precipitation per year) seems also to be significant. In the last century, weather patterns have resulted in drought periods of at least 6 years duration about every 30 years. If significant portions of the landscape are dominated by white fir, even if thinned, that portion of the landscape is at considerable risk during drought periods from defoliation and mortality of the intensity already seen in much of this LSR and neighboring LSRs. While thinning may provide a short term benefit as a compromise between managing for stand health and providing dense, multi-story habitat, there is little chance of successfully providing or maintaining optimal LSOG habitat in these stands over the long term beyond the next drought cycle. This is especially true on drier MCD sites. When only small areas of the landscape are at that high level of short-term risk, or when LSOG habitat is particularly scarce, thinning or even no treatment may be an appropriate response. When large portions of the landscape are dominated by stands that are judged imminently susceptible, regenerating new stands with less susceptible species such as ponderosa pine may be a better investment both in terms of resources expended and in providing future LSOG habitat.

Resulting Stand:

Thinned plantations should contain the best dominant and co-dominant pine, Douglas fir and larch. Other species should be left where they exist, but should comprise no more than 30% of the total stand. Trees are randomly scattered, in small groups, or in clumps up to several acres in size. Shrubs, grasses, and forbs are present as are remnant large trees from the pre-regeneration stand. Snags and down wood, especially large pieces, are present, but overall fuel loads do not increase the risk of fire that would preclude the eventual development of late-successional stands.

Meeting LSR Objectives:

Thinning plantations as described above enhances Late-Successional conditions by: 1) accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands, and, 2) by retaining other elements of LS/OG forests - species diversity, soil and undergrowth productivity, untreated refugia, snags and CWD, and other remnants of the original forest.

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 LS/OG resources.

SMALL SIZE CLASS STANDS - (23% of PAG)

Existing Stand Condition:

The amount of this seral class is within the range of historic or desired conditions. The overstory is primarily pine, white fir, and Douglas fir 9-21 inch dbh, averaging 30 to 150 per acre for the representative plant associations, some stands could be as much as 20% higher. Understory is uniformly dense white fir, or rarely Douglas fir, in continuous stands of poles and saplings.

Many of these stands have significant mortality from defoliators and root diseases, 42% of the acres have more than 30% mortality and 6% have more than 70% mortality. Many of the remaining live trees have substantial top kill and poor vigor, and will never grow to larger sizes. Standing fuel loads are extremely high.

Objectives and Thresholds for Action:

Objective - Protect remaining healthy large trees, especially ponderosa pine and Douglas fir, by reducing stress and fire risk. Because of the higher elevation where this PAG generally occurs, adjacent private property and rural developments are less common. However, reducing risk of high intensity fire is still an objective because of the potential for wind-driven fires to spread east into the more developed areas. Reduce risk of high intensity fire damaging core habitat areas for focal species or special and unique habitats. Reduce fuel loads and continuity.

Threshold - Stand basal areas at or exceeding the upper management zones of GBA. More than 30% of the understory contains shade-tolerant species such as white fir. Increasing levels of pine beetle, fir engraver, spruce budworm or other defoliators, especially in the understory, will result in significant change to or loss of late-successional characteristics, i.e. canopy cover, large trees or stand co-dominants. Root rot pockets are increasing in size and removing the few remaining large overstory trees. Mortality from insects and disease is more than 20% of the stand. Understory thickets may form ladder fuels that threaten large trees even in low intensity fires. In stands that have not been thinned or prescription burned, the combination of dense understory and standing and down dead fuels (especially those less than 12" dbh), will lead to fires of moderate to high intensity. These fires can only be attacked by indirect methods, which limits the amount of protection that can be provided to adjacent lands and resources.

Treatment Strategies:

Stand density reduction - thin understories to reduce competition and ladder fuels, and promote development of additional and future large trees. Desired canopy closure between 40% and 60% must be balanced with the upper management zone for stocking density for the plant association. Thinning should favor seral species, with no more than 30% of the site stocked with white fir and other climax species (Douglas fir can be climax in these associations). Remove most or all dead and dying trees less than 21" dbh; but maintain larger snags and green trees of low vigor for snag recruitment. Stands without much mortality will still benefit from understory thinning, but may not need removal of dead material to reduce fire risk.

Understory removal could be used in stands in which the understories are dominated by white fir and the overstories are dominated by ponderosa pine and the stands would be adequately stocked by trees >20.9" DBH.

Fuel breaks - in areas where stand manipulation is not desirable (riparian reserves, owl activity circles, sensitive soils or remnants of climatic climax habitat), or to isolate areas that won't be entered, combinations of understory thinning, pruning, interruption of dead and down fuel continuity may be used to reduce fire intensity and rate of spread, and increase the likelihood of successful suppression. Fuelbreaks should continue to exhibit some LS/OG components at the low end of the stocking range - open stands of predominately medium and large trees, 40% canopy closure or less (crowns not touching except in small clumps of 3 to 5 trees), with only scattered or clumpy understory. Large, widely distributed snags and large down logs are present, but usually less than required for 100% MPP.

Tree culturing - Thin understory thickets and/or remove sub-dominant trees larger than 9" dbh around large dominant and co-dominant pine and Douglas fir. This reduces stress on specific large trees desired for nesting, perching or roosting habitat, or can also be used where stand level treatments are not appropriate or unfeasible.

Small Group Shelterwood - designed to reduce the spread of root disease by removing susceptible tree species from small (2 to 9 acre) root rot pockets, and to convert portions of stands to early seral species. If present, leave 10 to 15 trees per acre of the largest trees of resistant species, i.e. pine and larch. Small regeneration cuts like this can also be used to

reestablish stands where no seed source exists because of mortality. Leave the largest and healthiest seral or climax individuals and interplant.

Remove Mortality - in stands where mortality exceeds 15 to 25% and excessive standing and down fuels pose a risk of fire at intensities that will threaten LS/OG habitat or other resources, remove most of the standing dead especially those less than 12" dbh. Incorporate safety and feasibility when leaving the large individual snags averaging 9 to 17 per acre. Large snags can be left for future down wood where less than desired amounts exist. Where inadequate seed sources exist or the remaining stand is not fully stocked with healthy trees, consider interplanting.

Stand (acres) with greater than 10% mortality, especially those with greater than 30% mortality will require special consideration for several reasons. First, most of the trees that have died during the last mortality event are white fir and have been dead so long that the majority are past merchantability for sawlogs and under the best scenarios will be salvagable only as fiber/chip. Second, fire hazard is very high in the majority of these stands. Third, given that there is little merchantable product still available on most acres, treatment/restoration of these areas will require financing through some means other than a timber sale.

Prescribed fire - Use low intensity fire for stand density reduction and fuel profile modification. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts. In small areas (less than 10-15 acres) of high mortality or damage, consider using higher intensity prescribed fire to remove heavy fuels and create small openings for regeneration. This should be approached with the same logistical and contingency considerations as for a broadcast burn in a regeneration unit with high fuel loadings.

Resulting Stand:

Stands exhibit most of the characteristics of climatic climax LS/OG stands described under Moderate to Large size class stands below. Generally multi-storied stands, 40 to 60% canopy closure, dominated by 20-50 trees larger than 17" dbh. Initially, there may be few individuals over 21" dbh, but the reduced stand densities and selection of the most vigorous large leave trees will allow for growth. Understories contain well-distributed individuals or small clumps of several species including ponderosa pine, Douglas fir, or white fir. White fir and other shade tolerant species should not comprise more than 30% of the total stand. Small openings exist, generally less than 10 acres in size, with 10 to 15 trees per acre and some large snags remaining. Large snags are present, but some stands may not have sufficient numbers to meet 100% MPP for focal species (usually about 4 to 7 snags/acre), even if all snags are retained during treatment. Large down logs are scattered throughout the stand (10 to 20 pieces per acre, distributed in size between 16" and 31"+), associated with windthrow or fallen snags.

Some of these plant associations may also have a component that is dependent on moderately frequent, low to moderate intensity fire. Generally, these stands will be located at the lower elevation range for the PAG, where precipitation is less than 30" per year, and/or on drier aspects or ridgetops. The desired condition of these stands is generally as described for Mixed Conifer Dry stands.

Meeting LSR Objectives:

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

Small shelterwoods develop future LS/OG characteristics by converting or replacing dead, dying or root disease susceptible species with more resistant early seral species.

Removing mortality reduces the risk of high intensity fires that threaten the remaining LS/OG habitats or lengthen the time of development of LS/OG characteristics.

Prescribed low intensity fire thins understories to reduce risks as described above. Higher intensity fires could remove heavy fuel loads and allow for regeneration of new stands.

MEDIUM TO LARGE SIZE CLASS STANDS - (22% of PAG)

Existing Stand Condition:

The amount of this seral class is within the range of historic or desired conditions. Stands generally consist of 2 to 25 large trees per acre (21+ dbh), primarily Douglas fir and ponderosa pine, but some large white fir too. The understory is also dense, white fir or Douglas fir. Stand densities in both under and overstories are generally higher than in MCD.

The understories in these stands have mortality as described above, about 38% of the acres have over 30% mortality and 2% are greater than 70% mortality. The effects of pathogens on the large trees, particularly root rots, fir engravers, and pine beetles, is greater here than in MCD, probably because of the greater amounts of larger trees.

Objectives and Thresholds for Action:

Objective - Maintain and protect existing LS/OG habitats.

Threshold - Densities exceed the upper management zone of GBA. Stands are imminently susceptible to stand replacing insect, disease or fire mortality over areas larger than 10 acres.

Treatment Strategies:

Stand density reduction - thin overstocked areas and remove trees less than 21", especially those that contain or surround large ponderosa pine and Douglas fir. Reduce competition for light, water, and nutrients; remove ladder fuels; promote development of future large trees.

Remove Mortality - in stands where mortality exceeds 25% and excessive standing and down fuels pose a risk of fire at intensities that will threaten LS/OG habitat or other resources, remove most or all of the standing dead especially those less than 12" dbh. Incorporate safety and feasibility when leaving large individual snags, averaging 9 to 17 per acre. Large snags can be left for future down wood where less than desired amounts exist. Where no adequate seed sources exist or the remaining stand is not fully stocked with healthy trees, consider interplanting.

Prescribed fire - Use low intensity fire for stand density reduction and fuel profile modification. In stands that are deficit in snags and large down wood, use the prescription or low impact methods to protect the necessary amounts. In small areas (less than 10-15 acres) of high mortality or damage, consider using higher intensity prescribed fire to remove heavy

fuels and create small openings for regeneration. This should be approached with the same logistical and contingency considerations as for a broadcast burn in a regeneration unit with high fuel loadings.

Resulting Stand:

Generally, multi-storied stands, with canopy closure 40-60% or greater. Large ponderosa pine and Douglas fir, western larch, white pine, lodgepole and white fir dominate stands. White fir and other shade tolerant species should not comprise more than 30% of the total stand. Understory trees are multi aged, well distributed, but may occur as dense thickets when pioneering a disturbance opening, and composed primarily of shade tolerant species. True firs are less than 30% of the stocking on any site. Snags and large down logs provide a significant amount of the structural complexity.

Meeting LSR Objectives:

Wet Mixed Conifer stands are generally moister, and on better soils than MCD; allowing for higher site productivity and greater stocking capacity. Reducing imminent susceptibility protects and maintains existing LS/OG habitat over the long term.

Removing mortality reduces the risk of high intensity fires that threaten the remaining LS/OG habitats or lengthen the time of development of LS/OG characteristics.

Mortality Patches (7-10% of PAG)

Existing Stand Condition:

The amount of this class is currently higher than the historic and desired range of conditions. However, as fuel and stand restoration treatments proceed, much of the existing mortality will develop into living stands. Absent another drought/insect/disease epidemic, or large fire, mortality patches in MCW will become less apparent over time. Large snags and down logs are unevenly distributed depending on frequency and type of disturbance, and only rarely concentrated where openings result from root disease, bark beetle mortality, or localized high intensity fire or insect attack. Mortality areas are small, usually 2 to 5 acres in size. Remaining snags and coarse woody debris is comprised of all size classes, unless fire was the disburbance.

Objectives and Thresholds for Action:

Objective – Maintain mortality patches distributed across the PAG unless the amount or location poses a risk to adjacent late-successional habitats or improvements such as roads, powerlines, recreation sites or buildings.

Threshold - usually none. However, large mortality patches adjacent to scarce NRF habitat should be considered carefully against the risk to the NRF. Fuel loads in the smaller size classes that exceed hazard objectives or individual trees that have been evaluated via the Hazard Tree Guide (Long Range Planning for Developed Sites in the Pacific Northwest: The

Context of Hazard Tree Management, PNW 1992), and determined to be a risk to improvements.

Treatment Strategies:

For excess fuel loads, remove dead trees and coarse woody debris less than 12" dbh. Isolate larger snags and logs, especially those greater than 20" dbh, from ladder fuels and fuel concentrations. Treat individual hazard trees according the Hazard Tree Guide. As an alternative to removal of large snags that provide significant habitat, consider topping or relocating the improvement. Unless fuel loads are already in excess, leave large felled snags on site.

Patches larger than the historical range should be planted, but large snags and coarse woody debris should be retained at the levels described below, even if tree growth and plantation uniformity would be reduced.

Resulting Stand:

Mortality patches should be dominated by at least 12 to 20 large snags per acre, usually Douglas fir, white fir, larch spruce, hemlock or lodgepole, with 20 to 30 smaller snags present. Live trees of all sizes may be present too. The presence of smaller <12" snags and coarse woody debris will be dependent on how recently the patch has been created or disturbed by treatment.

Meeting LSR Objectives:

Mortality patches provide habitat components critical to the survival of many species, both mobile and non-mobile, as well as sources for future dispersal of these species into developing future LS/OG stands.

Lodgepole pine PAG (476 acres) and High Elevation Mt Hemlock PAG (696 acres)

Desired Landscape Condition:

- Range of seral conditions:
- Grass/Forb/Shrub - 0 to 60%
- Seed/Sapling - 0 to 60 %
- Pole - 10 to 80%
- Small - 0 to 80%
- Med/Large - 0 to 2%
- mortality patches – no range specified – allow natural cycling within whole stands.

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. Patch sizes in the Cache LSR are small - no more than 100 to 300 acres, and often as small as 10 to 20 acres. 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 in the Cache RNA. 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 PAGS, at relatively regular intervals of around 100 years. Insects and disease also play a role, especially bark beetles in stand replacement.

Existing Stand Condition:

Most of the stands (93%) are pole or small tree-sized. These stands are even-aged, dense, and can have very high fuel loading and standing mortality from age and/or normal bark beetle activity. The other acres are about evenly split between young stands regenerating from the last disturbance and older stands with a medium/large tree component.

Objectives and Thresholds for Action:

Objective - Maintain existing lodgepole LS/OG habitats as long as possible, Develop future late-successional stands quickly by taking advantage of the potential for regenerated and thinned stands to rapidly develop large healthy trees. These habitats are relatively rare in the Cache LSR, and provide an important niche for cavity nesting species dependent on hard snags.

Threshold - The timing for thinning is difficult to quantify. Desired stocking levels are generally between the upper and lower management zone for the appropriate plant association. The timing must be balanced 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.

Treatment Strategies:

Thin to favor and develop the larger dominant and co-dominant trees. Favor lodgepole pine but leave other seral species such as ponderosa pine, Douglas fir, and larch. Climax species such as white fir can be left for diversity, but should not comprise more than 5% of the resulting stand, and should be left in clumps rather than as individual trees. Natural stands are generally rather evenly distributed, so random spacing is not as important as leaving the best trees.

To the extent practical, thinning should be done to a stocking level that precludes the need for future entries. Higher stand densities may need to be maintained to provide short-term cover and require further thinning. Or stand densities may be lowered too much to the extent that future insect, disease, or fire mortality require interplanting to maintain desired stand structure.

Remove Mortality - in stands where mortality exceeds 15 to 25% and excessive standing and down fuels pose a risk of fire at intensities that will threaten LS/OG habitat or other resources, remove most or all of the standing dead especially those less than 9" dbh. Incorporate safety and feasibility when leaving the large (preferably 17"+, but at least >9") individual snags averaging 9 to 17 per acre. Additional large snags can be left for future down wood where less than desired amounts exist. Where inadequate seed sources exist or the remaining stand is not fully stocked with healthy trees, consider interplanting.

Fuel treatment depends on the location, the size and number of trees removed. Where they do not contribute significantly to the fuel profile, protect and retain shrubs, grasses, forbs, snags and large (>12" dbh x 16' long) CWD. Resulting fuel profile should not increase the overall risk to the LSR. Consider the same fuel treatment strategies discussed previously. The small size of the stands can allow for slightly higher fuel loads and risk. Because they are lodgepole stands, free-use or commercial woodcutting can be an attractive method of removing undesirable trees or down wood.

Resulting Stand:

Thinned plantations should contain the best dominant and co-dominant lodgepole pine. Other species should be left where they exist, but should comprise no more than 10% of the total stand. Trees are evenly distributed with small clumps scattered through the stands. Shrubs, grasses, and forbs are present as are remnant large trees from the pre-regeneration stand. Snags and down wood, especially large pieces, are present, but overall fuel loads do not increase the risk of fire that would preclude the eventual development of late-successional stands.

Meeting LSR Objectives:

Thinning lodgepole stands as described above enhances Late-Successional conditions by: 1) accelerating the development of stand size and structure by taking advantage of rapid growing conditions in young stands, and, 2) by retaining other elements of LS/OG forests - species diversity, soil and undergrowth productivity, untreated refugia, snags and CWD, and other remnants of the original forest.

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 LS/OG resources.

Mortality Patches - no range specified

Existing Stand Condition:

The amount of this class is currently lower than the historic and desired range of conditions. However, in the next few decades, older and excessively stocked stands will begin to die, particularly from pine beetles. Also, even light fires in these stands tend to kill all the trees in the burned area regardless of tree size. Large snags and down logs are unevenly distributed depending on frequency and type of disturbance, and only rarely concentrated where openings result from root disease, bark beetle mortality, or localized high intensity fire or insect attack. Mortality areas are usually 25 to 100 acres, comprising entire stands or portions of large contiguous stands. Remaining snags and coarse woody debris is usually in the larger size classes, unless the disturbance has been recent.

Objectives and Thresholds for Action:

Objective – Maintain mortality patches associated with existing live stands of lodgepole, unless the amount or location poses a risk to adjacent late-successional habitats or improvements such as roads, powerlines, recreation sites or buildings.

Threshold - usually none. However, large mortality patches adjacent to scarce NRF habitat should be considered carefully against the risk to the NRF. Fuel loads in the smaller size classes that exceed hazard objectives or individual trees that have been evaluated via the Hazard Tree Guide (Long Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management, PNW 1992), and determined to be a risk to improvements.

Treatment Strategies:

For excess fuel loads, remove dead trees and coarse woody debris less than 12" dbh. Isolate larger snags and logs, especially those greater than 12" dbh, from ladder fuels and fuel concentrations. Treat individual hazard trees according the Hazard Tree Guide. As an alternative to removal of large snags that provide significant habitat, consider topping or relocating the improvement. Unless fuel loads are already in excess, leave large felled snags on site.

Patches larger than the historical range should be planted, but large snags and coarse woody debris should be retained at the levels described below, even if tree growth and plantation uniformity would be reduced. Generally lodgepole stands manage to reseed naturally very efficiently after disturbance.

Resulting Stand:

Mortality patches should be dominated by at least 4 to 12 large snags per acre, usually lodgepole, with 10 to 20 smaller snags present. Live trees of all sizes may be present too. The presence of smaller snags and coarse woody debris will be dependent on how recently the patch has been created or disturbed by treatment.

Meeting LSR Objectives:

Mortality patches provide habitat components critical to the survival of many species, both mobile and non-mobile, as well as sources for future dispersal of these species into developing future LS/OG stands.

VIII. MANAGEMENT STRATEGY AREAS

Seven Management Strategy Areas (Map 10) were delineated based on:

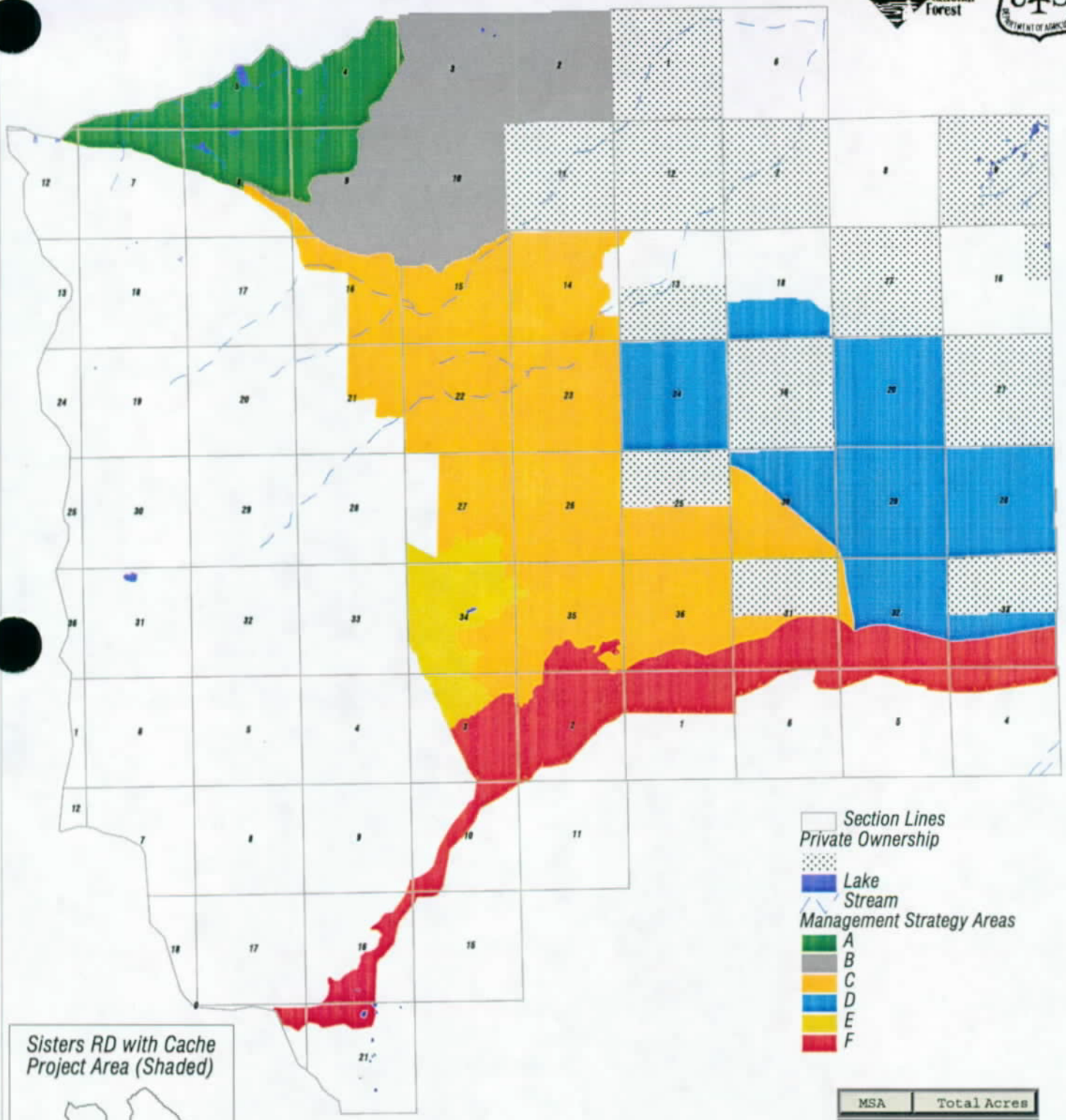
- common plant association groups;
- known spotted owl and other late-successional focal species habitats; and
- common fire management strategies.

While the MSAs have been identified as separate areas, they are strongly linked to each other, and to adjacent habitats outside the LSR, by ecological processes. Activities within these areas should consider the overall impacts to adjacent MSAs and other lands outside the LSR.

Table 25 (redux) Summary of Owl Habitat and MSA Goals

MSA	Total Acres	% MSA in Sustainable PAG	% MSA in Regen	Goal for Clim. Climax Habitat	Owl Home Range/Nests in MSA
A	1535	73%	6%	70+%	1/1
B	2574	6%	25%	40%	3/1
C	6013	24%	12%	20 – 25%	2/1
D	3600	15%	28%	15 – 20%	1/0
E	694	40%	0%	15 – 25%	0/0
F	2466	14%	8%	20 – 25%	1/1
	16882	23%	15.6%	25 – 30%	5/4

Management Strategy Areas for Cache LSR



Sisters RD with Cache Project Area (Shaded)

MSA	Total Acres
A	1543
B	2576
C	6021
D	3600
E	697
F	2496

North

1:82,000
October 1997

0.5 0 0.5 Miles

MANAGEMENT STRATEGY AREA A

This MSA is approximately 1535 acres in size, and includes most of the Cache Research Natural Area (approximately 1400 acres). The MSA is bordered by Matrix lands to the north and Wilderness to the west. Most of the RNA lies on the north and west slopes and summit of Cache Mountain, a dormant cinder cone. Elevations range from the summit 5579 feet down to 4000 feet.

Plant Association Group and Vegetative Condition:

Mostly MC WET (64%) or High Elevation mountain hemlock (24%), with an eastern low elevation fringe of MC Dry. The mixed conifer forests are composed of true fir, Douglas fir, spruce, lodgepole, and white pine. Mortality is very high in this MSA, even in the higher sites and on the north slopes of Cache Mountain. Canopy closure used to be generally over 60%, but has decreased significantly in recent years. Form photo interpretation we estimate that only 22% of the stands have canopy cover greater than 59%, and 41% have less than 40% canopy cover.

Landscape Patterns:

Landscape pattern is homogeneous and relatively unfragmented by timber harvest. There are distinct differences between the MC Wet stands and the hemlock forests, particularly in canopy cover, average tree sizes, and amount of mortality. Small wetlands, bogs and wet meadows are associated with the several small lakes in the MSA.

Stand Structure and Species Composition:

Stands are primarily composed of dense pole or small sized trees with approximately 1/3 of the stands having a medium/large tree component that accounts for more than 5% canopy cover. Older stands contain large Douglas-fir or hemlock. Some large remnant white pine and spruce have survived the ravages of blister rust, bark beetles, and root disease.

Species composition is generally Douglas-fir and true fir with lodgepole pine and mountain hemlock in the mountain hemlock plant associations, along with a variety of other minor species, especially in riparian areas.

Fragmentation:

There are four plantations wholly or partially within this MSA, totaling about 6% of the MSA. A significant portion of the MSA will be dominated by early seral shrub/forb stage as the extensive standing mortality falls over. Natural openings exist around the lakes and on some bare talus or cinder slide areas.

Snags and Coarse Woody Debris:

Snags and down logs are typically numerous in these plant associations. Because of the recent mortality, levels are higher on more acres than what would have occurred under normal disturbance regimes. There is good distribution of species and sizes, although

woodcutters have removed many of the large hard Douglas fir and white pine snags from the lower slopes accessible by roads.

Insect and Disease Condition:

In the MC Wet and MC Dry stands, various combinations of defoliators, bark beetles, and root diseases have resulted in stands with 50% to nearly 100% dead trees. Most of the white pine overstory has died in the last 10 years from blister rust. Most living stands continue to be at risk because of stress caused by high stand densities. The high elevation hemlock stands are relatively healthy, with low endemic levels of insect and disease mortality.

Fire Hazard and Risk:

Moderate risk of fire occurrence because of Cache Mountain's proximity to lightning storm tracks (2 lightning fires in the last 10 years), and because of dispersed recreation use. The risk of fire moving to adjacent lands especially to the east, is moderate to high because of the exposure to mountain pass winds. Fire hazard is high for high intensity fires because of the steep terrain, the location in relation to mountain pass winds, and the increasingly high fuel loads.

Focal LS/OG Terrestrial Wildlife Species

(a) Northern spotted owl - One known nest site in MSA. Owl pair has only 18% of its home range radius comprised of suitable NRF habitat. Approximately 1124 acres or 73% of this MSA is on Sustainable PAGs and is suitable for short and long-term management as NRF habitat

(b) Northern goshawk - Potential habitat and moderate to high probability of occurrence throughout the area.

(c) Northern bald eagle - Probable use of the area by foraging bald eagles. Potential habitat exists adjacent to the lakes.

(d)Great gray owl - Limited habitat adjacent to riparian meadows; probability of occurrence moderate.

(e) Neotropical Migratory Birds (NMB) - Known occurrence of some LS/OG NMB species.

(f) Snag & Dead Wood Associated Species including pileated woodpeckers, black-backed woodpeckers, Vaux's swift's and other cavity excavating/nesting species - high probability of occurrence throughout area.

(g) Bats - High probability of occurrence for S & M bat species and other common bats.

(h) Wolverine, fisher, and marten - High probability of occurrence for marten. Moderate to high for fisher and moderate for wolverine.

(i) Lynx - Potential habitat especially in the western portions and in areas with spotted owl NRF habitat.

Focal Aquatic Species:

(a) Cascades frogs - Known occurrence in lake/wetland areas.

(b) Spotted frogs - Probability of occurrence low to moderate in lake and wetlands.

(c) Salamanders including long-toed and northwestern salamander - Known occurrence in lake/wetland area.

Focal Plant Species:

Larsen's collomia - known population on Cache Mountain. High probability of occurrence on talus and cinder slopes.

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads.

Social Context:

The small lakes get moderate angling and dispersed camping use - most campsites will be full on summer weekends and holidays. OHV riders and equestrians drawn from the Suttle Lake recreation area to the northeast use the area. Many local people rely on this area for firewood, huckleberries, mushrooms, and other forest products. The area gets moderate to high big game hunting pressure. Management objectives for the Cache RNA limit and discourage all but incidental recreation use.

MSA Goals

Management goals need to be consistent with the goals, objectives, and constraints identified in the Cache RNA establishment report (USDA/PNW, December 1996). Generally active large-scale vegetation management is not allowed within RNAs. In some cases, RNA Management Plans have been approved to allow active management when conditions have changed to the extent that the establishment objectives are threatened. If an active management strategy is approved in the future, the following objectives apply:

Develop 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 snags and dead wood. Stands should be managed to obtain or move towards the conditions identified in the NRF description and the mixed conifer climatic-climax suitable habitat descriptions. Manage to provide and maintain a healthy riparian ecosystem in accordance with the Aquatic Conservation strategy to support the diversity of riparian-associated species that utilize this MSA.

Management Objectives

Short-term (0-50 years): Accelerate development of LS/OG conditions within young plantations/regenerated areas.

Long-term (50+ years): Develop and maintain a minimum of 70% of the MSA in suitable LS/OG climatic-climax habitat for focal species.

Rationale: The majority of this MSA (73%) is on Sustainable PAGs. The desired amount of MCW suitable habitat in the climatic-climax condition PAG at a given point in time is between 50-70% of the total (USFS1995). This is the only MSA in the CLSR that has the

site potential to manage for a high percentage of this habitat type long-term. Current forest conditions do not provide quality habitat, and the trend is towards further deterioration and loss of LS/OG habitats. Without active management, this scenario will not change for several hundred years. The likely outcome is a series of high intensity fires, the establishment of shrub fields, periodic loss of shrub and tree regeneration from fire, and the eventual (after a really long time) reestablishment of coniferous forest, provided any seed source remains.

Management of Regenerated Areas:

Manage plantations and naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Consider moving large CWD into plantations from adjacent areas of high mortality.

Management of Forested Areas

Because of constraints on vegetation management activities within RNAs without approved management plans, habitat improvement or protection is not likely in the near future. Eventually, activities could be proposed to restore habitat or to protect the RNA from catastrophic loss of the values for which it was designated. Management to improve or develop habitat would not be appropriate unless it is consistent with meeting RNA objectives, or was designed to restore and protect RNA establishment values.

If treatment is possible and consistent with RNA objectives, the following guidelines should be followed:

In NRF habitat for the northern spotted owl, silvicultural or fuels treatments are not appropriate unless stands are determined to be losing the desired structure at a catastrophic level. Project wildlife biologists, fuels specialists and silviculturists should make this determination.

Rationale: Lack of existing owl NRF habitat within the CLSR and across the landscape make further degradation of this habitat type undesirable in the short-term. Known preventive measures for stand replacement events such as salvage and thinning would decrease the suitability of habitat for the northern spotted owl and other focal species. It is believed that the potential benefits of risk reduction do not justify lowering the quality of existing habitat at this time.

In areas that are not existing owl NRF emphasize thinning from below and precommercial thinning to develop younger stands into climatic-climax LS/OG habitat.

Consider culturing around individual trees to enhance bald eagle habitat in selected areas within 200 feet of one of the stocked lakes. Silvicultural treatments should be designed to promote dominate or codominant ponderosa pine and Douglas fir trees > 25" dbh suitable for roosting/perching which provide a primary view of the foraging area.

Fire Management

Current direction for the Cache RNA specifies that all wildfires within the RNA will be aggressively contained using low impact methods were possible. High impact methods such as dozer line and retardant drops should only be used to prevent a significant loss of the values for which the RNA was established.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	0	148	987	0
Acres of Mortality	0	7-22	49-148	0

The existing mortality patch that takes up most of the Cache RNA exceeds the desirable amount of mortality for the entire MSA as well as the historic range of patches sizes for MC PAGS (10 to 100 acres). The current lack of an RNA Management Plan that would allow stand treatment precludes any activity within the RNA. Accordingly, hazard management must occur on lands to the east of the RNA, primarily in MSA B. Additional mortality patches are not currently necessary in this MSA. As stated above, fires will be aggressively suppressed. Reducing stand densities in younger stands is also a priority so that even small mortality patches are infrequent until the MSA contains a larger percentage of live stands.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability).

MANAGEMENT STRATEGY AREA B

This MSA is approximately 2574 acres in size. The MSA is bordered by Matrix lands to the north, the Cache RNA to the west, and private timberlands to the east. The eastern slopes of Cache Mountain dominate the area. Elevations range from the summit at 5579 feet, down to 3500 feet.

Plant Association Group and Vegetative Condition:

Virtually all (96%) of the MSA is Dry Mixed conifer with some small (less than 100 acre) pockets of Wet Mixed Conifer. The Dry MC forests are dominated by ponderosa pine, Douglas-fir and white fir in the overstory component (>21" DBH), and white fir and Douglas-fir in the understory component, with minor amounts of lodgepole pine, spruce, and white pine in the understories. On 71% of the acres, understories are primarily (>75%) occupied by true firs. This MSA is characterized by moderate to very high mortality from defoliators, bark beetles and root diseases. Canopy cover varies considerably but is generally low with 73% of the forested acres (excluding the regeneration harvest acres) with less than 40% canopy cover and 27% of the acres with >40% canopy cover.

Landscape Patterns:

This MSA is a patchwork island between the unfragmented forests to the west and south, and the heavily logged private and public lands to the north and west. Selective harvest and natural mortality have thinned the forests that have not been clearcut and replanted.

Stand Structure:

Approximately, 43% of the acres in this MSA are dominated by medium/large trees, 29 % are dominated by small trees, 24% are dominated by seedlings and saplings and 1% are dominated by pole sized trees. There are only minor amounts of non-forest acres within this MSA. Of the acres dominated by medium/large trees only 17% of these acres, or 7% of the MSA, are considered **potential** late-successional old growth (PLSOG)

Species Composition:

Considering all size classes, 49% of the mixed conifer acres in this MSA are classified as a mix of pioneer and climax species, 29% are classified as primarily (>75%) pioneer species and 13% as primarily climax species.

When considering the composition of the overstory and understory components of the mixed conifer acres separately, the overstories (>21" DBH) are classified as primarily pioneer species on 25% of the acres, mixed pioneer and climax on 53% of the acres and primarily climax on only 8% of the acres. The understories (<21" DBH) are classified as primarily climax species on 71% of the acres, mixed pioneer and climax on 11% of the acres and primarily pioneer on 5% of the acres.

Stand Densities:

Approximately 53% of the acres were classified as being above the upper management zone (UMZ) and 47% of the acres were classified as being below the UMZ.

Mortality:

The mortality in this MSA is the highest of any MSA with 94 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 61% of the acres having basal area mortality greater than 30%. Of the forested acres (excluding regeneration harvest acres), 4% of the acres have mortality above 70%.

Fragmentation:

This portion of the landscape is uniform, but fragmented by 32 early seral plantations covering about 25% of the MSA. The plantations are well established and relatively productive - some of the older stands will be functioning as dispersal habitat within 30 to 50 years.

Snags and Coarse Woody Debris:

These plant associations typically provide moderate to high amounts of snags and large woody debris. Because of the extensive harvest this area has received, many areas are deficit in snags and down wood, especially in the large size classes. Other stands where mortality is increasing have much more than the desired amount.

Insect and Disease Condition:

Both harvest and natural mortality from defoliators, bark beetles and root diseases have thinned the Dry MC stands. However, densities remain high enough in many areas and species composition is so lopsided, that many acres remain at risk from further high intensity outbreaks.

Fire Hazard and Risk:

Low to moderate risk of fire occurrence because of Cache Mountain's proximity to lightning tracks and low dispersed recreation use. The largest risk is from high intensity fires moving east from the Cache RNA and downslope off of Cache Mountain. Fire hazard is high for high intensity fires because of the steep terrain and the moderate to high fuel loads on an area that is predominately a dry south and east exposure.

Focal LS/OG Terrestrial Wildlife Species

(a) Northern spotted owl - MSA contains portions of two owl home ranges (one nest site in MSA). Both owl pairs are below the 40% NRF threshold with 22% and 18% of their home range radii comprised of suitable NRF habitat. Approximately 146 acres or 6% of this MSA is in Wet MC "Sustainable PAGs" and is suitable for short and long-term management as NRF habitat. All of the "Sustainable PAG" lands are located within owl home ranges.

(b) Northern goshawk - Potential habitat and moderate to high probability of occurrence throughout the area.

(c) Marten - Potential habitat and high probability of occurrence throughout the area.

(f) Snag and Dead Wood Associated Species including pileated woodpeckers, black-backed woodpeckers, Vaux's swift's and other cavity excavating/nesting species; high probability of occurrence throughout area.

g) Bats - High probability of occurrence for Survey and Manage bat species and other common bats.

Focal Aquatic Species

There are no known wetlands or water bodies in this MSA, so the probability of habitat or species occurrence is slim to none.

Focal Plant Species:

Larsen's collomia - known population on Cache Mountain. High probability of occurrence on talus and cinder slopes.

Peck's penstemon - moderate probability of occurrence and habitat in disturbed areas or pockets of open pine forests.

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads.

Social Context:

Road densities are fairly high in this MSA (over 6 miles per square mile), and most recreation is associated with the roads - driving OHV riding, hunting, gathering forest products. There are no recreation destinations or facilities in the MSA.

MSA Goals

Manage to restore and maintain large unfragmented patches of multi-storied, climatic-climax forests within the existing owl home ranges. These stands should be managed to obtain or move towards the conditions identified in the suitable habitat descriptions for NRF and Mixed Conifer climatic-climax. Dry Mixed Conifer stands adjacent to the climatic-climax LS/OG patches should be managed at more sustainable densities. Areas adjacent to private land should be managed in the long-term as fire-climax type LS/OG habitat to reduce risk of high intensity, large-scale wildfire.

Management Objectives

Short-term (0-50 years): Reduce fragmentation as soon as possible and accelerate development of LS/OG conditions within young plantations/regenerated areas.

In existing spotted owl NRF allow natural processes to continue at less than catastrophic levels. Do not utilize risk reduction measures such as salvage and thinning unless it is

determined that the ability of the MSA to function as habitat for the focal species is in jeopardy.

In areas outside existing NRF but not adjacent to private land, manage the Dry MC stands at densities which reduce risk of fire, insect and disease, while maintaining large snags and dead wood. Consider both multi-story & single story treatments.

In areas outside of existing NRF adjacent to private land, manage the Dry MC at lower densities and manage snags at the low end of the acceptable range. If any large snags are felled due to hazard leave them on site.

Long-term (50+ years): Maintain a minimum of 50% of the area within the owl home ranges as suitable LS/OG climatic-climax habitat for focal species. This represents approximately 40% climatic-climax habitat over the entire MSA.

Maintain the rest of the area in a mosaic of transitional climatic-climax...i.e. 90% to 67% UMZ with areas of fire-climax LS/OG strategically located to reduce some of the risk of large scale high intensity fire.

Rationale: The majority of this MSA is on the Mixed Conifer Dry PAG. The desired amount of MCDry suitable habitat in the climatic-climax condition is between 30-50% of the total PAG at a given point in time (USFS, 1995). ***Maintaining a high enough percentage of the area in LS/OG climatic-climax to support the home ranges of the resident three pairs would require taking considerable risk of catastrophic disturbance. Once other more productive portions of the home ranges can be restored as functioning habitat, we can manage a larger portion of the MSA at more sustainable stand densities, species composition, and structure.***

Alternatively, managing a larger percentage of the MSA as open fire climax stands would greatly reduce the risk of high intensity fire moving from the high-risk Cache RNA area into the private lands to the east of the LSR. The downside is that the loss of NRF structure and dispersal cover would have a direct impact on the three owl home ranges, as well as an indirect impact on owls attempting to disperse north and south through the MSA.

Management of Regenerated Areas:

Manage plantations and naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Consider moving large CWD into plantations from adjacent areas of high mortality.

Use a combination of mowing, thinning, and pruning to modify fuel profiles in plantations so that they will survive low intensity fires and can be used as part of the landscape-level fire management strategy.

Management of Forested Areas

In NRF habitat for the northern spotted owl, silvicultural or fuels treatments are not appropriate unless stands are determined to be losing the desired structure at a catastrophic

level. Project wildlife biologists, fuels specialists and silviculturists should make this determination.

Rationale: Lack of existing owl NRF habitat within the CLSR and across the landscape make further degradation of this habitat type undesirable in the short-term. Preventive measures for stand replacement events such as salvage and thinning would decrease the suitability of habitat for the northern spotted owl and other focal species. The potential benefits of risk reduction do not justify lowering the quality of existing habitat at this time.

In areas that are not existing owl NRF emphasize thinning from below and precommercial thinning to develop younger stands into climatic-climax LS/OG habitat, and to develop and maintain stands as fire climax LS/OG.

Fire Management

Suppression should be aggressive to avoid additional loss of NRF or developing NRF, but minimize high impact tactics such as dozer line and retardant. Aggressive suppression should also be used to prevent fires entering the RNA or the private lands to the east of the MSA. Consider a fuel break strategy along Roads 2068-800, 1028 and 1028-600, combined with additional fuel reduction in the numerous plantations. Long-term strategy should include an overall reduction in high intensity fire risk as a result of maintaining up to 50% of the area as fire climax LS/OG with frequent low intensity fire return intervals.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	0	2470	101	0
Acres of Mortality	0	124-370	<10	0

The existing mortality in this MSA exceeds the desirable amount for the entire MSA as well as the historic range of patches sizes for MC PAGS (10 to 100 acres). Additional mortality patches are not currently necessary in this MSA. As stated above, fires will be aggressively suppressed. Reducing stand densities in younger stands is also a priority so that even small mortality patches are infrequent until the MSA contains a larger percentage of live stands.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability).

Areas adjacent to private lands should be managed at the low end of the range; areas within and adjacent to NRF should be managed at the high end.

MANAGEMENT STRATEGY AREA C

This MSA is approximately 6013 acres in size. It includes two intermittent streams and associated wetlands, several small, but prominent cinder cones, and most of the spotted owl habitat that remains in the northern half of the LSR. The MSA is bordered by the Wilderness to the west, and an intermingling of private lands to the east. Elevations range from 5300 feet at Dugout Butte to 3800 feet. The area has an easterly aspect down the toeslopes of the Cascades.

Plant Association Group and Vegetative Condition:

Mostly Dry MC (86%) or the elusive Wet PP. There are also a couple blocks, up to 700+ acres in size, of Wet MC, and some small lodgepole/aspen/cottonwood stands associated with lava flows and intermittent swamps. Mortality is relatively high. Canopy closure has been altered by selective harvest of large pine and Douglas fir.

Landscape Patterns and Fragmentation:

The condition of the unregenerated forest varies widely due to the drought and insect-related mortality, with remnant overstories of pine and Douglas fir, and understories of the same species or of true firs. There is a large patch of early seral shrub and grass communities associated with the Dugout Fire, and several smaller areas of hardwoods and riparian shrubs and forbs associated with wetlands.

The MSA is fragmented by two half sections of recently clearcut private lands and 38 smaller clearcuts cover 12% of the NFS lands in the MSA.

Stand Structure:

Approximately, 49% of the acres in this MSA are dominated by medium/large trees, 36% are dominated by small trees, 11% are dominated by seedlings and saplings and 3% are dominated by pole sized trees. There are only minor amounts of non-forest acres within this MSA. Of the acres dominated by medium/large trees and small trees only 43% and 15%, of these acres, respectively, or 26% of the MSA, are considered **potential** late-successional old growth.

Species Composition:

Considering all size classes, 60% of the mixed conifer acres in this MSA are classified as a mix of pioneer and climax species, 27% are classified as primarily (>75%) pioneer and 6% as primarily climatic.

When considering the composition of the overstory and understory components of the mixed conifer acres separately, the overstories (>21" DBH) are classified as primarily pioneer species on 60% of the acres, mixed pioneer and climax on 26% of the acres and primarily climax on only 5% of the acres. The understories (<21" DBH) are classified as primarily climax species on 51% of the acres, mixed pioneer and climax on 30% of the acres and primarily pioneer on 12% of the acres.

Stand Densities:

Approximately half of the stands were classified as being above the upper management zone (UMZ) and half were classified as being below the UMZ.

Mortality:

The mortality in this MSA is relatively high with 90 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 51% of the acres having basal area mortality greater than 30%. Of the forested acres (excluding regeneration harvest acres), 4% of the acres have mortality above 70%.

Snags and Coarse Woody Debris:

These plant associations typically provide moderate to high amounts of snags and large woody debris. Because of the extensive harvest this area has received, some areas are deficit in snags and down wood, especially in the large size classes. Other stands, where mortality has occurred, have much more than the amounts necessary for optimum habitat.

Insect and Disease Condition:

Both harvest and natural mortality from defoliators, bark beetles and root diseases have thinned the Dry MC stands. However, densities remain high enough in many areas to put stands at risk from further high intensity outbreaks.

Fire Hazard and Risk:

Fire risk in this MSA is relatively low (4 fires in the last 10 years) due to low to moderate amounts of human use, and no particular lightning attraction. Because of the eastern aspect and proximity to the mountains, the risk of a downslope afternoon wind-driven fire is moderate to high. Terrain is not otherwise a factor, except locally on the slopes of the buttes. Fire hazard, in terms of fuel arrangement varies widely, depending on the level of mortality or past harvest. In general, it is highest in the western portion where more mortality has occurred, and lower in the eastern portions where the development of multistoried stands is not as advanced, and mortality is lower. Past harvest on both public and private lands has generally been cleaned up with low fuel loads remaining.

Focal LS/OG Terrestrial Wildlife Species

(a) Northern spotted owl - one known nest site in MSA. Owl pair is below the 40% NRF threshold with 18% of its home range radius comprised of suitable NRF habitat. Approximately 24% of this MSA is on Sustainable PAGs and is suitable for short and long-term management as NRF habitat.

(b) Northern goshawk - Potential habitat and moderate to high probability of occurrence throughout the area.

(c) Great gray owl - Limited meadow habitat adjacent to Dry Creek - probability of occurrence moderate.

(d) Neotropical Migratory Birds (NMB) - Known occurrence of some LS/OG NMB species.

(e) Snag & Dead Wood Associated Species including pileated woodpeckers, Vaux's swift's and other cavity excavating/nesting species; high probability of occurrence throughout area.

(f) Bats - High probability of occurrence for S & M bat species and other common bats.

(g) Wolverine, fisher, and marten - Known occurrence of marten; moderate to high probability of use by fisher; moderate probability of use by wolverine. Riparian areas may function as important dispersal travel ways for these species as well as primary denning, resting, and foraging habitat.

(h) Lynx - Potential habitat especially in the western portions and in areas with spotted owl NRF habitat.

Focal Aquatic Species:

(a) Cascades frogs - Known occurrence in Dry Creek.

(b) Spotted frogs - Probability of occurrence low to moderate in Dry Creek

Focal Plant Species:

Low to moderate probability of occurrence of habitat for lichens in cottonwood stands associated with riparian drainages.

Known populations of S&M chanterelles

High probability of occurrence of habitat for penstemon peckii.

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads.

Social Context:

Road densities are fairly high in this MSA (over 6 miles per square mile), and most recreation is associated with the roads – driving, OHV riding, hunting, gathering forest products. There is an undeveloped campground at Dugout Lake, and OHVs and equestrians often use the surrounding area.

MSA Goals

Develop or maintain a contiguous, multi-storied, forested condition in Sustainable PAGs across the MSA to provide habitat for the northern spotted owl, northern goshawk, and a variety of species associated with snags and dead wood. Find and maintain those areas of MC Dry and Wet Pine that will best develop short term NRF. Stands should be managed to obtain or move towards the conditions identified for suitable habitat in NRF and Mixed Conifer climatic-climax. Connect the scattered blocks of NRF with high quality dispersal habitat managed as Fire Climax stands. Manage to provide and maintain a healthy riparian ecosystem in accordance with the Aquatic Conservation strategy to support the diversity of riparian associated species that utilize this MSA.

Management Objectives

Short-term (0-50 years): Reduce fragmentation as soon as possible and accelerate development of LS/OG conditions within young plantations/regenerated areas.

In areas of sustainable PAGs that are currently not providing NRF, begin developing stands that will provide NRF in the future (100 - 150 years). The highest priority for treatment are the stands with moderate to high (>30%) mortality that remain between the established plantations.

Rationale: Treating the leave strips between plantations avoids further fragmentation in the rest of the MSA, and facilitates the development of future habitat in large blocks.

Allow natural processes to continue in forested areas at less than catastrophic levels. Do not utilize risk reduction measures such as salvage and thinning unless it is determined that the ability of the MSA to function as habitat for the focal species is in jeopardy.

In areas outside existing NRF but not adjacent to private land, manage the Dry MC stands at densities which reduce risk of fire, insect and disease, while maintaining large snags and dead wood. Consider both multi-story & single story treatments.

In areas outside of existing NRF adjacent to private land, manage the Dry MC at lower densities and manage snags at the low end of the acceptable range. If any large snags are felled due to hazard leave them on site.

Long-term (50+ years): Maintain 20 to 25% of the MSA in suitable LS/OG climatic-climax habitat for focal species.

Rationale: Only about 24% of this MSA is on Sustainable PAGs. There are areas of Dry MC that could be managed as Climatic Climax habitat with some risk of long-term instability.

Where NRF habitat is not a priority, manage Dry MC 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 high intensity fires. In the interior of the MSA, manage Dry MC stands as Fire Climax stands that provide Dispersal Habitat as defined for Dry MC and pine stands. Provide and maintain an average of 35% canopy cover in dispersal habitat.

Management of Regenerated Areas:

Manage plantations and naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Consider moving large CWD into plantations from adjacent areas of high mortality.

Use a combination of mowing, thinning, and pruning to modify fuel profiles in plantations so that they will survive low intensity fires and can be used as part of the landscape-level fire management strategy.

Management of Forested Areas

In NRF habitat for the northern spotted owl, silvicultural or fuels treatments are not appropriate unless stands are determined to be losing the desired structure at a catastrophic level. This determination should be made by project wildlife biologists, fuels specialists, and silviculturists.

Rationale: Lack of existing owl NRF habitat within the CLSR and across the landscape make further degradation of this habitat type undesirable in the short-term. Known preventive measures for stand replacement events such as salvage and thinning would decrease the suitability of habitat for the northern spotted owl and other focal species. It is believed that the potential benefits of risk reduction do not justify lowering the quality of existing habitat at this time.

In areas that are not existing owl NRF emphasize thinning from below and precommercial thinning to develop younger stands into fire or climatic-climax LS/OG habitat as appropriate to the stand capability and location.

Fire Management

Suppression should be aggressive to avoid additional loss of NRF or developing NRF, but minimize high impact tactics such as dozer line and retardant. Aggressive suppression should also be used to prevent fires entering private lands to the east of the MSA. Consider a fuel break strategy along Rd 1028, combined with additional fuel reduction in the numerous plantations. Long term strategy should include an overall reduction in high intensity fire risk as a result of maintaining 50% to 60% of the area as fire climax LS/OG with frequent low intensity fire return intervals.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	0	5193	538	150
Acres of Mortality	0	260-779	38-54	0-150

Desirable mortality patches size varies in this MSA from 2 to 10 acres in the drier sites to 10 to 100 acres in wetter higher elevations PAGs. Smaller mortality patches should be well distributed across the PAG, primarily in MCW and climax stands of MCD. The risk of mortality patches spreading fire or disease to adjacent private lands is low as the private lands have low fuel loads and stand densities. The Dugout Lake Fire (1930) is the only large disturbance area in this MSA, but little standing mortality remains. One or two small fires of 25 to 100 acres could provide some desirable stand diversity.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability).

MANAGEMENT STRATEGY AREA D

This MSA is approximately 3600 acres in size, and includes two cinder cones - Graham Butte and Four Mile Butte. The MSA is bordered on the north, south, and east by interspersed sections and half sections of private lands, including Black Butte Ranch. Elevations range from 3500 to 3700 feet, except for the two cinder cones that loom a few hundred feet higher.

Plant Association Group and Vegetative Condition:

Most of the MSA is Dry Mixed Conifer (83%) dominated by ponderosa pine, grading east into nearly pure ponderosa pine stands. There is a large block of Wet Ponderosa Pine (section 24) that has generally higher site potential and more variety in species, especially shade tolerant trees such as Douglas fir and true firs. There are also a couple of small (less than 100 acre) stands of Wet Mixed Conifer. Mortality is generally low. Stand densities, especially understories, are very high throughout the MSA.

Landscape Patterns and Fragmentation:

The area is extensively fragmented by 40 clearcuts, covering about 29% of the MSA. Most of the section containing Graham Butte (section 29) is contiguous forest and the steeper slopes have had little if any past harvest. Another large block of partial cut, but relatively intact forest remains in sections 24 and 30. 4 plantations separate these stands from the Graham Butte, and the whole piece comprises one of the larger blocks of contiguous forest, albeit not untouched, in the LSR. The surrounding private lands are heavily cut over with almost no significant canopy cover remaining.

Stand Structure:

Approximately, 46% of the acres in this MSA are dominated by medium/large trees, 21 % are dominated by small trees, 30% are dominated by seedlings and saplings and 2% are dominated by pole sized trees. There are only minor amounts of non-forest acres within this MSA. Of the acres dominated by medium/large trees and small trees, 73% and 11%, of these acres, respectively, or 36% of the MSA, are considered **potential** late-successional old growth

Species Composition:

Considering all size classes, 25% of the mixed conifer acres in this MSA are classified as a mix of pioneer and climax species, 61% are classified as primarily (>75%) pioneer species and 2% as primarily climax species.

When considering the composition of the overstory and understory components of the mixed conifer acres separately, the overstories (>21" DBH) are classified as primarily pioneer species on 90% of the acres, mixed pioneer and climax on 6% of the acres and primarily climax on only 2% of the acres. The understories (<21" DBH) are classified as primarily climax species on 34% of the acres, mixed pioneer and climax on 19% of the acres and primarily pioneer on 47% of the acres.

No wet areas or hardwood stands are present in this MSA.

Stand Densities:

Approximately 76% of the acres were classified as being above the upper management zone (UMZ) and 24% of the acres were classified as being below the UMZ.

Mortality:

The mortality in this MSA is the lowest of any MSA with only 29 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and only 5% of the acres having basal area mortality greater than 30%.

Snags and Coarse Woody Debris:

Snag and CWD levels are relatively low, but probably a little higher than what existed historically under more frequent fire return intervals. Because of the proximity to town and easy access, many large snags have been removed for firewood. In areas that have been partial cut, activity fuels treatment has removed much of the large down wood. Plantations and adjacent private lands are nearly devoid of snags and CWD.

Insect and Disease Condition:

The mixed conifer stands, both dry and wet have been thinned by both harvest and natural mortality from defoliators, bark beetles and root diseases. However, because densities remain high on 75% of the acres and species composition is heavy to climax species on 1/3 to 1/2 of the acres, many acres remain at high hazard from further high intensity insect outbreaks and root disease infection.

Fire Hazard and Risk:

Low risk of fire occurrence, except around major road corridors and adjacent to Black Butte Ranch (two human caused fires in the last ten years). Moderate risk of fires moving east onto extremely expensively developed lands. Fire hazard is moderate for high intensity fires because of stand density and structure, and high fine fuel loads, especially shrub fields and needle draped bitterbrush under pine stands.

Focal LS/OG Terrestrial Wildlife Species

(a) White-headed woodpeckers - Extensive suitable habitat. Probability of occurrence high.

(b) Flammulated owls - Extensive suitable habitat. Known occurrence adjacent to this MSA; probability of occurrence is high.

(c) Snag & Dead Wood Associated Species including marten, pileated woodpeckers, Vaux's swift's and other cavity excavating/nesting species - high probability of occurrence throughout area.

(d) Bats - Known hibernaculum of Townsend's big-eared bat in Skylight Cave (entrance on private land). High probability of occurrence for S & M bat species and other common bats.

(e) Northern spotted owl - A small portion of an owl home range is contained in this MSA. The MSA is not in a designated CHU for this species and there is relatively little existing NRF. However, there are 531 acres of Sustainable PAG (15% of the MSA) that occurs in a contiguous patch that is suitable for long-term NRF habitat.

Focal Aquatic Species:

There are no known wet areas or bodies of water within the MSA.

Focal Plant Species:

High probability of peck's penstemon habitat throughout the MSA, especially in the eastern portions that are near adjacent known populations.

Known occurrence of S&M chanterelles.

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads.

Social Context:

Because of the proximity to town and easy access, the area receives moderate use by folks driving for pleasure or hunting, OHV travel, and forest product gatherers, especially firewood and mushrooms. Major roads in the area are part of the district snowmobile trail network. Eastern portions of the MSA are treated as "backyard" by adjacent residents of Black Butte Ranch. There are no facilities or particular features that attract camping, but some dispersed camping occurs during hunting season. The area around Graham Butte has attracted interest as an example of intact old growth pine forest, and the District has considered the area for an old growth interpretive trail.

MSA Goals

Develop and manage late-successional habitat as a landscape primarily dominated by sustainable fire-climax vegetation. Provide and maintain large snags across the MSA to create optimal habitat for focal species. Maintain sufficient canopy cover and structure to provide ponderosa pine-type dispersal habitat for spotted owls. Provide and maintain NRF habitat in a multi-storied forest on the block of sustainable PAG in section 24 west of Six Mile Butte. These stands should be managed to obtain or move towards the conditions identified for suitable habitat in NRF and climatic-climax.

Management Objectives

Short-term (0-50 years): Reduce fragmentation as soon as possible and accelerate development of LS/OG conditions within young plantations/regenerated areas.

Begin developing stands that will provide fire climax LS/OG habitat in the future (100 - 150 years). The highest priority for treatment are the stands with moderate to high (>30%) mortality that remain between the established plantations.

Rationale: Treating the leave strips between plantations avoids further fragmentation in the rest of the MSA, and facilitates the development of future habitat in large blocks.

Begin moving the future NRF block in section 24 as well as some of the adjacent intact stands towards a multi-story, high canopy cover condition. Thinning is appropriate to reduce stand densities and stress, and to increase dominance of long-lived pine and Douglas fir. Maintain other elements of LS/OG habitat including large trees (>21") of all species, large snags and down logs.

In areas not adjacent to private land, thin and maintain the Dry MC stands at densities that reduce risk of fire, insect and disease. Maintain large trees of all species, large snags and dead wood. Consider both multi-story & single story treatments.

In adjacent to private land, thin and maintain the Dry MC stands at densities which reduce risk of fire, insect and disease. Maintain large trees of all species, and manage snags at the low end of the acceptable range. If any large snags are felled due to hazard leave them on site.

Long-term (50+ years): Maintain 15 to 20% of the MSA in suitable LS/OG climatic-climax habitat for focal species. This should include the area in section 24 and adjacent intact stands in section 30. Graham Butte and the intact stands surrounding it should be maintained as pine-dominated fire climax, but connectivity to the adjacent NRF should be improved and maintained. Consider maintaining multi-storied pine stands of higher densities on the north slopes of Graham Butte.

Rationale: Only about 15% of this MSA is on sustainable PAGs. There are areas of Dry MC that could be managed as Climatic Climax habitat with some risk of long term instability.

Manage Dry MC 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 high intensity fires. In the interior of the MSA, manage Dry MC stands as Fire Climax stands that provide Dispersal Habitat as defined for Dry MC and pine stands. Provide and maintain an average of 35% canopy cover in dispersal habitat.

Management of Regenerated Areas:

Manage plantations and naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Consider moving large CWD into plantations from adjacent areas of high mortality.

Use a combination of mowing, thinning, and pruning to modify fuel profiles in plantations so that they will survive low intensity fires and can be used as part of the landscape-level fire management strategy.

Management of Forested Areas

Use burning and thinning to move stands toward fire-climax type habitat conditions.

Rationale: This type of habitat is limited in CLSR and provides the best opportunity to reduce fire hazard adjacent to private lands without reducing habitat capability.

Fire Management

Long-term objective should be to modify fuel profiles and stand structures to the extent that risk to adjacent private lands is reduced, and so that the MSA is resilient enough to absorb the effects of low intensity fire with minimal suppression response. High intensity fires that can be confined to the NRF habitat are acceptable, but not desirable.

Short-term objectives are to suppress fires when small. Standard suppression practices are ok, except that low impact methods should be used in and adjacent to NRF habitat.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	549	2979	60	0
Acres of Mortality	<10	149-447	<10	0

This is the driest portion of the LSR, and mortality patches should be small – ¼ to 2 acres in size, rarely up to 10 acres on wetter sites. Larger stand replacement events may have occurred historically, but only rarely. The proximity to high value private lands and the value of the NRF and other late-successional habitats in this MSA preclude the desirability of managing larger mortality patches. Even small patches should not be managed adjacent to private lands.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability) for the focal cavity nesting species.

MANAGEMENT STRATEGY AREA E

This is a small, 694 acre block on the Wilderness boundary in the western part of the LSR. It was separated out from MSA C because it contains habitat types unique to the LSR. Elevations range from 4700 to 4800 feet.

Plant Association Group and Vegetative Condition:

Primarily Dry MC (54%) and Lodgepole Pine (24%) PAGs around the fringe of the lava beds and to the east of Dugout Butte. There is a small patch of Wet MC (2%) around Dugout Lake, and a large area of sand dunes, shrub field and other non-forest type (20%) associated with the Dugout Fire of 1930, (1070 acres of which 635 are in the LSR). The Lodgepole pine PAG is found in approximately equal percentages in 3 MSAs. In this MSA the Lodgepole PAG represents 36% of the total Lodgepole PAG acreage found in the LSR. The remaining Lodgepole PAG acres are found in MSAs C (32%) and F (33%). Condition of the mixed conifer stands is generally good because of moderate to high precipitation in this area. Defoliators have had some impact. The LP stands are primarily mid to late successional - 100 to 150 years old, with mortality typical for that age class. LP stands associated with the 1930 fire are younger, but most of this area has been successfully reforested.

There is a very small riparian area associated with Dugout Lake.

Landscape Patterns and Fragmentation:

The biggest value of this MSA is its connection to a larger block of lodgepole stands that extends from the Wilderness Area. The MSA is not fragmented except by a few roads, and both forested stands and non-forest areas are in relatively large blocks.

Stand Structure:

Approximately, 23% of the acres in this MSA are dominated by medium/large trees, 45% are dominated by small trees, 10% are dominated by pole sized trees and 0% are dominated by seedlings and saplings. Non-forest areas account for 21% of the acres within this MSA. Of the acres dominated by medium/large trees and small trees, 69% and 18%, of these acres, respectively, or 31% of the forested acres within this MSA, are considered **potential** late-successional old growth

Species Composition:

Considering all size classes, 31% of the mixed conifer acres in this MSA are classified as a mix of pioneer and climax species, 43% are classified as primarily (>75%) pioneer species and 2% as primarily climax species.

When considering the composition of the overstory and understory components of the mixed conifer acres separately, the overstories (>21" DBH) are classified as primarily pioneer species on 10% of the acres, mixed pioneer and climax on 49% of the acres and primarily climax on only 19% of the acres. The understories (<21" DBH) are classified as primarily climax species on 21% of the acres, mixed pioneer and climax on 36% of the acres and primarily pioneer on 27% of the acres.

Stand Densities:

Approximately 72% of the acres were classified as being above the upper management zone (UMZ) and 26% of the acres were classified as being below the UMZ.

Mortality:

The mortality in this MSA is the third lowest of all the MSAs with 63 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 17% of the acres having basal area mortality greater than 30%.

Snags and Coarse Woody Debris:

These plant associations typically provide moderate to high amounts of snags and large woody debris. This area has not had extensive harvest like other portions of the LSR, but woodcutting and selective harvest have removed many of the largest live and dead trees. Other stands, where mortality is increasing, have much more than the amounts necessary for optimum habitat.

Insect and Disease Condition:

Because of high stand densities, conditions are favorable for the usual run of defoliators, root rots, and bark beetles. Currently, any effects are local and small in scale - well within the normal historic range.

Fire Hazard and Risk:

Risk of occurrence is low here - there have been no reported fires in the last ten years. The surrounding landscape patterns of lava fields, non-forested sand dunes, and the old fire tend to limit the size of any potential fire. Hazards are similar to the rest of the LSR and fuel loads will increase as the LP stands age. A stand replacement fire in the lodgepole LS/OG is inevitable and a normal part of succession in this plant association.

Focal LS/OG Terrestrial Wildlife Species

(a) Black-backed and three-toed woodpeckers and other LS/OG associated cavity nesters - Potential habitat throughout the MSA, especially in LP PAG. High probability of occurrence.

(b) Great gray owl - Limited habitat in Dugout Fire area. Probability of occurrence moderate.

(e) Neotropical Migratory Birds (NMB) - Known occurrence of some LS/OG NMB species.

(f) Snag & Dead Wood Associated Species including, pileated woodpeckers, Vaux's swifts and other cavity excavating/nesting species - high probability of occurrence throughout area.

(g) Bats - High probability of occurrence for S & M bat species and other common bats.

(h) Lynx - Potential habitat especially in the western portions and in areas with spotted owl NRF habitat.

(i) Wolverine, fisher, and marten - Known occurrence of marten; moderate to high probability of use by fisher; moderate probability of use by wolverine. Riparian areas may

function as important dispersal travel ways for these species as well as primary denning, resting, and foraging habitat.

Focal Aquatic Species

(a) Cascades frogs - Moderate probability of occurrence in lake/wetland areas.

(b) Spotted frogs - Probability of occurrence low to moderate in lake and wetlands.

(c) Salamanders including long-toed and northwestern salamander - Known occurrence in lake/wetland area.

Focal Plant Species:

Unsurveyed, but unique habitats with potential for unusual species.

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads.

Social Context:

Because of the proximity to town and easy access, the area receives moderate use by folks driving for pleasure or hunting, OHV travel, and forest product gatherers, especially firewood and mushrooms. There are no facilities or particular features that attract camping, but some dispersed camping occurs during hunting season. Horse groups and OHV riders use the Dugout Lake area, and OHV impacts to the dunes and non-forested areas are a concern.

MSA Goals

Maintain a contiguous patch of LS/OG lodgepole to serve as habitat for focal species.

Allow the natural cycling of lodgepole. It is recognized that this MSA may be all early successional habitat at some points in time, but the connection to the adjacent Wilderness should provide habitat while this is cycling.

Management Objectives

Short-term (0-50 years: In areas of sustainable PAGs that are currently not providing NRF, begin developing stands that will provide NRF in the future (100 - 150 years). About half of the Mixed Conifer stands are potentially sustainable habitat. In Dry MC stands, reduce stand densities and alter species composition to favor Douglas fir and ponderosa pine. Maintain elements of LS/OG such as large trees of all species, snags, and down logs.

In Lodgepole Pine stands, allow natural processes to continue without intervention. Thinning may be appropriate in younger stands to encourage development of larger trees.

Long-term (50+ years): Maintain 25 to 50% of the Mixed Conifer stands as suitable LS/OG climatic-climax habitat for focal species. This represents approximately 15 - 25% climatic-climax habitat over the entire MSA.

Allow natural processes to control the succession of the LP stands. Maintain the rest of the Dry MC stands as Fire Climax dispersal habitat.

Thinning of older LP stands is generally not productive, but younger stands may benefit with accelerated growth. Do not salvage in LP stands. Limited firewood use may be appropriate to reduce fuel loads. Maintain large LP snags and down logs as described for optimal habitat for LP focal species.

Management of Regenerated Areas:

Manage naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As naturally regenerated areas grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Management of Forested Areas

In NRF habitat for the northern spotted owl, silvicultural or fuels treatments are not appropriate unless stands are determined to be losing the desired structure at a catastrophic level. This determination should be made by project wildlife biologists, fuels specialists, and silviculturists.

Rationale: Lack of existing owl NRF habitat within the CLSR and across the landscape make further degradation of this habitat type undesirable in the short-term. Known preventive measures for stand replacement events such as salvage and thinning would decrease the suitability of habitat for the northern spotted owl and other focal species. It is believed that the potential benefits of risk reduction do not justify lowering the quality of existing habitat at this time.

In Mixed Conifer areas that are not existing owl NRF, emphasize thinning from below and precommercial thinning to develop younger stands into fire or climatic-climax LS/OG habitat as appropriate to the stand capability and location.

Thinning of older LP stands is not necessary or productive, but younger stands may benefit with accelerated growth. Do not salvage in LP stands.

Fire Management

Suppression should be aggressive to confine fires to lodgepole stands and avoid additional loss of NRF or developing NRF, but minimize high impact tactics such as dozer line and retardant. Consider a fuel break strategy along Rd 1030. Long term strategy should include an overall reduction in high intensity fire risk as a result of maintaining 50% to 60% of the area as fire climax LS/OG with frequent low intensity fire return intervals.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	0	372	16	170
Acres of Mortality	0	19-56	<10	0-170

Patches sizes in MC stands should be 2 to 10 acres and isolated from NRF. In lodgepole stands, mortality patch size should be governed by the natural cycle of insect attack- fire-regeneration. A stand replacement fire in the lodgepole LS/OG is inevitable and a normal part of succession in this plant association.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability).

MANAGEMENT STRATEGY AREA F

This MSA is about 2466 acres in size and includes both sides of the corridor along Hwy 242, McKenzie Highway. The western end is primarily lava flow. The MSA is bordered by Wilderness to the north and west, and Matrix lands to south. This MSA provides a narrow connection to the Trout LSR to the south. Elevations range from 3600 feet in the east, to 5200 feet near the summit of McKenzie Pass on Hwy 242.

Plant Association Group and Vegetative Condition:

Because of the linear nature of this MSA and the broad elevation range it encompasses, virtually all the local PAGs are represented here. The lower elevations are primarily pure ponderosa pine (12%) in stands with high density in the understories, but are otherwise healthy. The middle portion is Dry MC, (39%) changing to Wet MC and Mt Hemlock as the elevation increases. These stands have areas of high mortality from defoliators, bark beetles and rot disease. The upper elevations are primarily lava bed on the north side of the highway and Mt Hemlock on the south side. Non-forested lavas represent 24% of this MSA. The hemlock stands are relatively healthy, but have typical mortality with pockets of very high numbers of dead and down trees.

There is a very small riparian area associated with Lava Camp Lake, as well as a few small seeps along the edge of the lava flow.

Landscape Patterns and Fragmentation:

The high way corridor is relatively unfragmented as past harvest was planned to avoid impacts to scenic views. However 11 clearcuts (8% of the MSA) exist in the immediate background, especially in the Pine and Dry MC portions. The upper Wet MC and Mt Hemlock patches are large and contiguous with Wilderness stands to the south. The highway corridor and lava flow create a significant break in the forest structure, but do not seem to be a factor in any species movements.

Stand Structure:

Approximately, 20% of the acres in this MSA are dominated by medium/large trees, 42% are dominated by small trees, 4% are dominated by pole sized trees and 8% are dominated by seedlings and saplings. Non-forest areas account for 24% of the acres within this MSA. Of the acres dominated by medium/large trees, small trees and pole sized trees, 52%, 4% and 7%, of these acres, respectively, or 16% of the forested acres within this MSA, are considered **potential** late-successional old growth

Species Composition:

Considering all size classes, 27% of the mixed conifer acres in this MSA are classified as a mix of pioneer and climax species, 22% are classified as primarily (>75%) pioneer species and 2% as primarily climax species.

When considering the composition of the overstory and understory components of the mixed conifer acres separately, the overstories (>21" DBH) are classified as primarily pioneer

species on 61% of the acres, mixed pioneer and climax on 20% of the acres and primarily climax on only 3% of the acres. The understories (<21" DBH) are classified as primarily climax species on 38% of the acres, mixed pioneer and climax on 25% of the acres and primarily pioneer on 22% of the acres.

Stand Densities:

Approximately 55% of the acres were classified as being above the upper management zone (UMZ) and 17% of the acres were classified as being below the UMZ.

Mortality:

The mortality in this MSA is the second lowest of all the MSAs with 62 % of the forested acres (excluding regeneration harvest acres) having basal area mortality greater than 10%, and 8% of the acres having basal area mortality greater than 30%.

Snags and Coarse Woody Debris:

Snags and CWD amounts are consistent with the PAG descriptions in the other MSAs. There are pockets of high mortality in the Wet MC and Mt Hemlock stands. The Oregon Department of Transportation has been aggressive in felling hazard trees within their highway right-of-way. Felled hazard trees have been left on site, and in several areas concentrations of dead and down material are 5 to 10 times higher than historic levels.

Insect and Disease Condition:

Again, conditions are typical for the various PAGS. Defoliators, bar beetles, and root diseases have caused locally high amounts of dead or severely stressed trees.

Fire Hazard and Risk:

Risk of occurrence is very high in this MSA, both from human use along the highway, and because the upper portions of the MSA are in an active lightning track. There have been 12 fires in this MSA in the last 10 years. Fuel profiles and stand structures are very conducive to high intensity fires in the Mixed Conifer and Mt Hemlock PAGs. The proximity of strong pass winds and the "tunnel" nature of the highway corridor exacerbate the situation.

Focal LS/OG Terrestrial Wildlife Species

(a) Northern spotted owl - One known nest site in MSA. Owl pair is below the 40% NRF threshold with 18% of its home range radius comprised of suitable NRF habitat. Approximately 350 acres or 14% of this MSA is on Sustainable PAGs and is suitable for short and long-term management as NRF habitat.

(b) Northern goshawk - Potential habitat and moderate to high probability of occurrence throughout the area.

(c) Neotropical Migratory Birds (NMB) - Known occurrence of some LS/OG NMB species.

(d) Snag & Dead Wood Associated Species including marten, pileated woodpeckers, Vaux's swifts and other cavity excavating/nesting species; high probability of occurrence throughout area.

(e) Bats-High probability of occurrence for S & M bat species and other common bats.

(f) Wolverine, fisher, and marten - Known occurrence of marten; moderate to high probability of use by fisher; moderate probability of use by wolverine. The upper elevations of this MSA probably function as important dispersal travel ways for these species as well as primary denning, resting, and foraging habitat.

(g) Lynx - Potential habitat especially in the western portions and in areas with spotted owl NRF habitat.

Focal Aquatic Species

(a) Cascades frogs-Known occurrence in lake/wetland areas.

(b) Spotted frogs-Probability of occurrence low to moderate in lake and wetlands.

(c) Salamanders, including the long-toed and northwestern salamander-Known occurrence in lake/wetland area.

Focal Plant Species:

Allotropa virgata is known to occur

Noxious Weed Conditions:

Tansy ragwort, cheatgrass, and knapweeds are found in old harvest units and along roads. Knapweed is locally serious near town along McKenzie Highway and Rd 1028.

Social Context:

McKenzie Highway is a major travel and scenic route through the Cascades, but is only open from early July to October. The Dee Wright Observatory in the lava flows on the summit is a popular destination and rest stop. Other facilities in the MSA include a small campground at Lava Camp Lake, several small turn-out/viewpoints, Windy Point Viewpoint and the Black Crater trailhead. Near town, the MSA gets the usual traffic from sightseers, hunters and firewood and mushroom gatherers. Roads in the lower portions of the MSA are part of the District winter trail system, and the closed Highway is also a popular snowmobile and Nordic skiing destination.

MSA Goals

Maintain a contiguous, multi-storied, forested condition in sustainable PAGs across the MSA to provide habitat for the northern spotted owl, northern goshawk, and a variety of Snag & Dead Wood Associated Species. Stands should be managed to obtain or move towards the conditions identified for suitable habitat in NRF and mixed conifer climatic-climax. Provide resilient fire climax habitats in the lower portions of the MSA.

Management Objectives

Short-term (0-50 years): Reduce fragmentation as soon as possible and accelerate development of LS/OG conditions within young plantations/regenerated areas.

Allow natural processes to continue in forested areas at less than catastrophic levels. Do not utilize risk reduction measures such as salvage and thinning unless t the ability of the MSA to function as habitat for the emphasis species is in jeopardy.

Long-term (50+ years): Maintain 20 - 25% of the MSA in suitable LS/OG climatic-climax habitat for focal species.

Rationale: Only small, scattered portions of this MSA (14%) are on sustainable PAGs. This MSA provides an important connectivity corridor to the Trout LSR and the Wilderness, and climatic climax habitats should be concentrated and managed in a large block in the western portion of the MSA.

Provide fire climax habitat conditions in the lower portions of the MSA to reduce the risk of high intensity fires expanding far into the pine country. Maintain at least 50% of the Dry MC and Pine PAGs as dispersal habitat as defined for Dry MC and pine stands. Provide and maintain an average of 35% canopy cover in this dispersal habitat.

Management of Regenerated Areas:

Manage plantations and naturally regenerated stands to accelerate growth in order to develop LS/OG stands quickly.

As plantations grow, manage stand densities to maintain health and vigor, and to provide diversity of species and structure.

Consider moving large CWD into plantations from adjacent areas of high mortality.

Management of Forested Areas

In NRF habitat for the northern spotted owl, silvicultural or fuels treatments are not appropriate unless stands are determined to be losing the desired structure at a catastrophic level. This determination should be made by project wildlife biologists, fuels specialists and silviculturists.

Rationale: Lack of existing owl NRF habitat within the CLSR and across the landscape makes further degradation of this habitat type undesirable in the short-term. Known preventive measures for stand replacement events such as salvage and thinning would decrease the suitability of habitat for the northern spotted owl and other focal species. It is believed that the potential benefits of risk reduction do not justify lowering the quality of existing habitat at this time.

In areas that are not existing owl NRF emphasize thinning from below and precommercial thinning to develop younger stands into climatic-climax LS/OG habitat.

Fire Management

Suppression should be aggressive to avoid additional loss of NRF or developing NRF, but minimize high impact tactics such as dozer line and retardant. Aggressive suppression should

also be used to prevent fires entering the private lands to the east of the MSA. Consider a fuel break strategy along Hwy 242 that provides an east-west break in fuels in the corridor, but still maintains minimum habitat conditions appropriate to the PAG. The fuel break should provide for large untreated areas (several acres) for connectivity to Trout LSR. Combine with additional fuel reduction in the numerous plantations. Long term strategy should include an overall reduction in high intensity fire risk as a result of maintaining the lower Dry MC and Pine stands as fire climax LS/OG with frequent low intensity fire return intervals.

Management of Mortality

Desired Acres of Mortality by PAG				
PAG	**PPD**	**MCD**	**MCW**	**LPD/MTH**
Amount of PAG in MSA	300	955	247	156
Acres of Mortality	<10	48-143	17-25	0-156

Patches sizes in MC stands should be 2 to 10 acres and isolated from NRF. In lodgepole stands, mortality patch size should be governed by the natural cycle of insect attack- fire-regeneration. A stand replacement fire in the lodgepole LS/OG is inevitable and a normal part of succession in this plant association. Avoid trying to manage mortality patches from root rot or insect attack adjacent to the highway. Larger mortality patches, even though within the historic size range are not desirable because of the high fire occurrence, the fuel and weather conditions conducive to large fire development, and the risk to adjacent private lands.

Snags and Coarse Woody Debris

Snags and down wood should be provided evenly distributed across the MSA in amounts consistent with the best current science for providing 100% maximum population potential (the point where populations are limited by something other than habitat availability).

Reduce the continuity of the large areas of slash adjacent to Hwy 242. Leave concentrations up to 200 feet long and/or one acre. Use martin habitat requirements as a guide for these concentrations. In between the concentrations along the highway, maintain down wood levels at the low end of the desired habitat range. In future hazard tree treatment, remove material in excess to habitat needs at the low end of the desired range. Consider redistributing excess material to other deficit sites in the corridor.

IX. PRIORITIES and IMPLEMENTATION

This section identifies MSAs by priority for the primary management objectives. The tables identify the number of acres that should be considered as the starting point for additional project-level analysis for priority, prescription, and mitigation. The acres are derived primarily from the PAG and stand structure data, reduced by the number of acres within Riparian Reserves, and by acres of slope greater than 30% (usually the effective limit for economical mechanical access.) These numbers are best used for comparison between MSAs and for landscape-scale program of work planning.

Chapter IX of the LSRA is intended to provide both priorities by MSA for various LS-related objectives, and the upper limit of acres available for a particular treatment because they exceed the threshold defined in Chapter VII. From a practical standpoint, the maximum available acres are not likely to be treated because of limitations of time and money. Should funds be available, then the maximum treated would be limited by MSA objectives and the desired landscape condition based on the historic range of distribution and amount of plant structure stage.

MSA Priority for Management to Protect and Develop LS/OG Habitat:

	Priority 1	Priority 2
Management Strategy Areas	C, B, D, F, A	D, E, F
Rationale for Priority Rating	MSAs with owl activity centers ordered by amount of NRF in home ranges.	MSAs that provide dispersal habitat and/or habitat for other Focal LS/OG species

Priorities for Management to Reduce Risk of Habitat Loss:

	Priority 1	Priority 2	Priority 3
Management Strategy Areas	B, C	D, E, F	A
Rationale for Priority Rating	Areas where risk is high enough to outweigh short-term habitat loss	Areas where risk reduction is necessary to protect potential habitat	Cache RNA has very high risk, but RNA objectives preclude most management

Potential Areas for Treatment to Reduce Risk of Habitat Loss

(Remove dead in PP and MCD PAG with >15% mortality; or MCW, RIP, HE, and LP PAG with >25% mortality)

(Thin understory in MCD and PP PAGS with small and med/large size class; GBA>UMZ; and any understory)

	Remove Dead Material				Thin Understory		
PAG	LPP	MCD	MCW	HE	MCD	PP	MCW
MSA							
A		30	13				
B		1487	19		566		
C	36	3384	256	76	1256		89
D		651			1178	286	
E	61	194			108		
F		209	90	56	199	19	64
Total	97	5895	378	132	3307	305	153

Priorities for Management to Develop LS/OG

	Priority 1	Priority 2	Priority 3
Management Strategy Areas	B, C, D,	F, E	A
Rationale for Priority Rating	The priority is based on the condition of existing habitat and the need for higher percentages of LS/OG		

Potential Areas of Treatment to accelerate development of young, small-sized stands into medium and large-sized LS/OG stands:

(Where pole or small tree size class; GBA>UMZ; and understory is mixed or pioneer species)

Thin Understory (acres)				
PAG	MCW	LPP	MCD	PP
MSA				
A				
B		1	48	
C	1	62	584	
D			117	86
E	9	125	142	
F		102	194	97
Total	**10**	**290**	**1085**	**183**

Priorities for Management of Sensitive Plants

	Priority 1	Priority 2
Management Strategy Areas	D, C, B, F	C, B, A, F
Rationale for Priority Rating	MSAs with known populations of species that would benefit from low-intensity fire	MSAs with known populations of species that are suspected to benefit from fire and other disturbances but need more study of management effects

Priorities for Inventory of J2 Bryophytes, Lichens, and Mollusk Species

	Priority 1	Priority 2
Management Strategy Areas	D, B, C, F	A, E
Rationale for Priority Rating	Areas with known sites	Potential Habitat

Priorities for Management of Noxious Weeds

	Priority 1	Priority 2
Management Strategy Areas	F, C, D, B, A	E
Rationale for Priority Rating	Areas with known populations of species that are likely to spread	Areas with other known populations

Priorities for Fire Suppression

	Priority 1	Priority 2	Priority 3
Management Strategy Areas	B, D, A*	C, F	E
Rationale for Priority Rating	Areas where life, property, or improvements are at risk	Areas with riparian zones and important habitat	

*Cache Mountain Research Natural Area

Priorities for Plantation Management to Develop LS/OG

	Priority 1	Priority 2	Priority 3
Management Strategy Areas	C, B	D, F	E, A

Acres of regeneration areas available for management to enhance development of LS/OG stands:

MSA	HCC	HCP	HSH	HSH/HTH	HSL	TOTAL
A	**8**		**46**			**54**
B	**365**		**272**	**10**		**647**
C	**611**		**87**			**698**
D	**155**	**34**	**829**		**7**	**1025**
E						**0**
F	**70**	**29**	**90**			**189**

Priorities for Underburning

	Priority 1	Priority 2
Management Strategy Areas	D, C, B, F	E, A
Rationale for Priority Rating	MSAs that would benefit from low-intensity prescribed fire	MSAs where constraints of habitat, feasibility, and proximity to development would limit prescribed burning opportunities

Areas available for prescribed burning:

(Where PAG is PP or MCD; pole, small or med/large size class; <15% mortality; pioneer or mixed species understory; and GBA>UMZ)

	Acres	
PAG	MCD	PP
MSA		
A		
B	119	
C	664	
D	1050	372
E	84	
F	218	116
Total	2135	488

APPENDIX 1 – FIRE MANAGEMENT PLAN

FIRE MANAGEMENT ASSESSMENT

CACHE LATE-SUCCESSIONAL RESERVE

SISTERS RANGER DISTRICT

INTRODUCTION: PURPOSE AND NEED

Fire management planning is a critical component of Late-Successional Reserve Assessments. This planning effort is especially significant in LSRs 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, or insect and disease damage 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, 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 Cache 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, as identified in Appendix B8 of the FEIS on Management of Habitat for Late-Succession and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, includes fire suppression, wildfire hazard reduction and prescribed fire use.

Fire management planning and activities will be conducted in a manner compatible with the overall goals and objectives of the Cache LSR. The goals for fire management planning and the Fire Management Assessment for the Cache LSR are:

1. Protect and sustain late-successional habitat on the east side of the Cascade Mountains and within the Cache Late-Successional Reserve.
2. Reduce the current high risk of loss of late-successional habitat from large-scale, high intensity wildfires.
3. Improve the sustainability of the Late-Successional Reserve to provide late-successional habitat in the long term.
4. Begin the process of reintroducing fire into fire adapted ecosystems to improve, sustain and develop late-successional habitat in the long term.

The objectives for the Cache Late-Successional Reserve Fire Management Assessment are to:

1. Develop fire suppression strategies that protect human life and property while protecting and sustaining late-successional habitats and components.
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 for the use of "Wildfires meeting resource benefits" (Prescribed Natural Fire) in the Mount Washington Wilderness.

5. Protect adjacent resources when high intensity wildfire escapes from the Cache Research Natural Area.

This Fire Management Assessment does not include site-specific prescriptions. Additional analysis will be required for all site-specific projects and before prescribed natural fire can be implemented in the LSR.

HISTORIC CONDITIONS AND FIRE REGIMES

Fire is a process that has played a significant role in shaping the landscape of the Cache LSR. 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 also seemed to recognize the differences in the mixed conifer zone. "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". He also recognized the difference in fire's role in these areas. Colville writes, "In this zone, in the higher elevations of the yellow pine zone, where there is a large admixture 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".

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 Cache Late-Successional Reserve. Fire regimes in this assessment are described according to plant association groups.

Ponderosa Pine Plant Associations:

Little fire regime research has been completed in the ponderosa pine of the Cache LSR, 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.

Low intensity fire sizes are difficult to estimate because the fires left little evidence. "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. (Agee, 1992) "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. (Agee, 1993) "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 Plant Associations (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). The dry mixed conifer plant associations would have shorter fire return intervals while wet mixed conifer plant associations would have longer fire return intervals.

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 (trees and shrubs). 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 retard the effects of fires. The wetter soils and fuel conditions reduce the spread and intensity of fires on these sites. These conditions increase the length of time between fires, thereby increasing the fire return interval.

Fire return intervals in the mixed conifer plant association groups were estimated by Bork (1985) at 9 to 25 years. 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). 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. Fire return intervals for mixed conifer plant associations are quite variable and depend upon many other site-specific conditions.

The mixed conifer plant association groups of the Cache LSR have a moderate severity fire regime with a mix of low, moderate and high intensity fires all common. Historical fire intensities and frequencies ranged from frequent, low intensity fires to infrequent, high intensity fires. Most mixed conifer plant associations 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 Plant Associations (Mountain Hemlock)

Within the Cache LSR, 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. Most other disturbances operate at the tree or small stand scale. 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.

The mountain hemlock plant association of the Cache LSR is characterized by mountain hemlock as a major component of the overstory vegetation. Subalpine fir, pacific silver fir, white bark pine and lodgepole pine are all found in the overstory and understory.

"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 Plant Association

Lodgepole pine is usually present as a persistent early seral pioneer which 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 become, essentially, 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.

CURRENT CONDITION

Fire exclusion has had significant impacts to the historic fire regimes of forests on the east side of the Cascade Mountains and within the Cache LSR. The fire return intervals across the entire LSR have increased, except in the high elevation forests. The expected fire intensities for ALL fires in the LSR have also increased due to increases in fuel loadings and ladder fuels.

As fire intensities increase, the risks to firefighters and public safety increase. Firefighters spend an increased amount of their time suppressing high intensity wildfires, which contain dangerous fire conditions. With firefighters busy with high intensity fires, public safety becomes a more critical component of fire suppression. High intensity fires move more quickly, have longer spotting distances and more severe consequences than low intensity fires.

There have been 2 large fires in the Cache LSR from 1902 to 1994 burning 684, or 4% of the LSR. The Dugout Lake Fire burned a total of 1,070 acres, 635 that were in the LSR. This fire was caused by lightning and started July 12, 1930. Approximately 49 acres of the Big Lake Airstrip Fire burned into the Cache LSR. This fire totaled 7,000 acres and was started by lightning on August 8, 1967. There is no trend to show that there has been a decrease or increase in acres burned in large fires in the last 93 years.

Large fires in the Cache LSR and the Sisters Ranger District, generally burn from west to east. This is due to the generally westerly prevailing winds.

There have been 33 fire starts that have required suppression actions in the Cache LSR, from 1982 to 1996. This is an average of 3 fires per year. Seventy percent of those fires were lightning caused while thirty percent were human caused. Seventy three percent of the fires occurred in

July and August, generally under the driest conditions of the year. There is no indication that this trend will change through time.

As fuel loadings and fire intensities have increased across the LSR, the amount of smoke produced by wildfires has and will continue to increase correspondingly. 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 current vegetation in the Cache LSR, when burned under wildfire conditions, will produce significantly higher levels of particulate matter than under historic 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, depending upon the difficulty of suppression and risk to public and firefighter safety. This trend is expected to increase until a program of landscape level fuels reduction can be accomplished.

Ponderosa Pine Plant Associations

In ponderosa pine forests, where the historic fire-return interval was 8 to 12 years for low intensity fires and 150 years for stand replacement fires, 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" (Morrow 1985), 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, and the 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. The percentage of low intensity fires in the ponderosa pine has significantly decreased. As the fire intensities increase, the percentage of large ponderosa pine and late-successional habitat that will be killed or destroyed by a wildfire increases.

Fire behavior predictions for the ponderosa pine plant associations in the Cache LSR, 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.

Both 5-hour and 12-hour burning periods were used to estimate fire size, due to the reduced suppression forces available on the Sisters Ranger District and the Deschutes National Forest. Most fires on the Deschutes National Forest, that escape initial attack in the ponderosa pine plant associations, are one burning period fires. Fire suppression efforts during that first burning period are minimally effective.

The number and availability of fire suppression resources have decreased significantly in the last 10 years. This significantly increases the probability that a fire will escape initial attack. A complicating factor for estimating response times for resources is the nature of the lightning storms that produce approximately 70% of the fires in the Cache LSR. Most commonly, lightning storms reach the south end of the Deschutes National Forest and move north. As resources are

assigned to existing fires on the southern part of the forest, the amount of resources available for fires on the Sisters District decrease. If resources are available and dispatched to fires in the Cache LSR, 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 dry ponderosa pine plant associations of the LSR.

A combination of fuel model 9 (60% of the area) and fuel model 6 (40% of the area) was used to predict fire behavior. 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 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. With this type of fire behavior, direct attack by hand crews or equipment (dozers) would not be effective or safe. 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. Many hundreds of acres are generally burned in backfires to stop the spread of the main fire. Spotting under these conditions is a significant concern. Spotting can occur from one-quarter to three-quarters of a mile in front of the main fire. As the fire intensities increase, the percentage of large ponderosa pine and late-successional habitat that will be killed or destroyed by wildfires will increase.

For the development and long-term maintenance of late-successional habitat in the Cache LSR, the use of prescribed fire should be encouraged. Harvesting, thinning and other vegetation treatments should be designed to encourage the use of prescribed fire. Mechanical treatments will be necessary in many locations, prior to the use of prescribed fire; due to high stand densities, small tree sizes or heavy fuel loadings. The use of prescribed fire to reduce fuel loadings, reduce ladder fuels, reduce high intensity wildfires and maintain the late-successional conditions desired in the Cache LSR will be the most successful in the ponderosa pine plant associations.

Dry Mixed Conifer and Wet Ponderosa Pine Plant Associations

There has been a change in the fire regimes of the dry mixed conifer and wet ponderosa pine forests. The structural changes occurring in the dry ponderosa pine plant associations have also occurred in the wet ponderosa pine and dry mixed conifer plant associations. The increase in understory trees (ladder fuels) has been accompanied by a shift to more shade-tolerant species in that understory. There has also been a significant increase in the brush component of these stands. 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. There has been a significant decrease in low and moderate intensity fires.

The mixed conifer plant associations have changed the most 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 LSR. This can be attributed to the high quality sites that produce great amounts of ladder fuels (understory vegetation) and a brush component that enables 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 that the large buildup of fuels that

we have today, did not occur in the past. In areas of high mortality, expected fire intensities have increased. The combination of increased fuel loadings, increased brush component and high stand mortality have combined to significantly change the fire regimes and expected fire intensities in dry mixed conifer and wet ponderosa pine 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 4000 acre wildfire in 5 hours and a 9,000 acre wildfire in 12 hours. Flame lengths would range from 9 feet to 13 feet. The flame lengths and rates of spread produced by this wildfire would not allow direct attack with handcrews or equipment. Only indirect suppression tactics could safely be used.

In the high mortality stands and no treatment assumed, fire behavior was also predicted using 90th percentile weather and 10% slope. A combination of 60% fuel model 12 (medium logging slash) and 40% fuel model 2 was used. A fire would be approximately 4,000 acres in 5 hours and 15,000 acres in 12 hours. Flame lengths would be 12 to 15 feet. Only indirect suppression tactics could be safely used and the probability of them being successful in low. This type of fire behavior has the power to overpower its environment and go in any direction or all directions at one time. Models cannot accurately predict this type of fire behavior. When the weather conditions change significantly, there would be opportunities to suppress this type of fire. The consequences associated with this type of fire behavior a irreversible for decades. The area would be "nuked". Spotting distances would be from one-quarter to one-mile in front of the fire. If the fire reaches "blow-up" conditions, there is no way to estimate the distance or direction of the spotting. Spotting will pose safety hazards for all firefighters and the public.

Protection of the riparian zones in the mixed conifer plant associations is the most difficult due to the high fuel loading and high mortality in the surrounding stands. As the mortality increases and the dead trees continue to fall to the ground, our abilities to protect riparian areas will continue to decrease.

The consequences associated with a stand replacement fire are the most severe in the dry mixed conifer and wet ponderosa pine plant associations. The heavy fuel loadings, high mortality, and ladder fuels all contribute to these effects. High fuel loads, burned under high intensity wildfire conditions, consume so completely that soil damage should be expected. Soil damage to be expected under these conditions includes 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 occur under each large log or concentration of slash that consumes in the fire.

Wildfires in heavy fuel loadings can also have serious detrimental effects on riparian vegetation. Rather than decreasing intensity as the fire enters the wetter riparian areas, the fires may burn with higher intensities due to the heavier fuel loadings generally found in and around the riparian areas.

The high mortality found in many stands contributes to the high fuel loadings as the dead trees fall to the ground. While the trees are standing, they increase the safety concerns for firefighters due to potential injury or death from falling snags. These conditions may make it unsafe for suppression actions to occur in some stands. If it is unsafe for firefighters, they will need to move to a location where it is safe to attack the fire. With this action comes additional acres burned under high intensity conditions. As slope increases, the rate of fire spread and fire size increase.

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. There has been an increasing amount of decaying snags and logs due to the high mortality found in much of the LSR. As decay advances, the snags and logs become increasingly receptive to firebrands that start spot fires. The primary safety concern of the Black Crater fire, which occurred in July 1997 directly to the south 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 who must be concerned about not getting trapped between the main fire and the spot fires. Under some conditions, as the main fire builds in intensity, the spot fires have the potential to begin interacting with the main fire. Personnel working near the main fire could quickly and easily be cut off from their escape routes. As spot fires intensify and grow back to the main fire, the overall intensity of both fires increase, spotting increases and the cyclical interaction of the two fires make attack on the fires, from any location, dangerous.

Ladder fuels also 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. As fires move into the crowns of the trees, fire intensities increase exponentially. Crown fires are difficult to predict as they are able to move in any direction without regard to environmental conditions such as wind direction or changes in temperature. 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 all resources that come in contact with them.

Wet Mixed Conifer Plant Associations

In the wet mixed conifer plant associations, which historically had a moderate severity fire regime, the proportion of low intensity fires has declined (Agee, 1992). Small, low intensity fires have been effectively controlled. The only fires capable of having a landscape impact are those burning under severe fire weather where initial attack by fire suppression forces has failed. High intensity fires are now the dominant severity level found. "This represents a shift from a complex historic moderate fire severity regime to one of high fire severity." (Agee, 1992)

The fire behavior predictions calculated for the dry mixed conifer and wet ponderosa pine plant associations are very similar to what is found in the wet mixed conifer forests. High intensity wildfires should be expected and associated impacts will be the same as described for the previous plant association groups.

Fire Management Concerns For The Future In The Ponderosa Pine and Mixed Conifer Plant Associations:

The current conditions in the ponderosa pine and mixed conifer plant associations in the center of the Cache LSR are the farthest from their "historic range of variability" of any of the plant associations in LSR. Under the current conditions, these stands are not sustainable in the long term. Many of these stands have high mortality now. The highest level of mortality is in the white fir that is the primary component of the "many storied" stands that are most suitable for spotted owls and other late-successional species. Stand densities are high in all areas of the Cache LSR. In the mixed conifer plant associations, where the mortality is high, the snags create a significant fire hazard as well as a firefighter and public safety hazard. Where the densities are high, the crown fire potential becomes high and extreme.

The Deschutes National Forest Wildlife Tree and Log Implementation Strategy states that all species of snags will fall within 6 to 12 years of creation. The 10 to 12 inch dbh trees fall in 6 years while the 20+ inch DBH trees fall within 12 years. (All species have the same standing longevity according to the wildlife tree guide.) The trees in the moderate to high mortality stands have been dying since the early 1990's but the majority of them died in 1991. Using 1991 as the

starting point, most of the snags in those stands will be on the ground in the next 6 years. The smaller snags are falling to the ground now and will continue to fall.

The type of fire behavior and fire sizes to be expected, once the trees have reached the ground, was estimated earlier in this section in the description of the fire behavior in the high mortality stands. As the amount of "climatic climax" conditions increase within the Cache LSR, the amount of fire suppression resources needed to maintain that condition will increase. On the east side of the Cascades, the most effective method of creating climatic climax conditions is aggressive fire control. The opportunities to use prescribed fire and confine or contain suppression strategies on low intensity fires decrease as climatic climax increases.

For the development and maintenance of long-term late-successional habitat in the Cache LSR, the use of prescribed fire should be encouraged. Harvesting, thinning and other vegetation treatments should be designed to encourage the use of prescribed fire. Mechanical treatments will be necessary in many locations, prior to the use of prescribed fire; due to high stand densities, high mortality, brush species and existing high fuel loadings. Prescribed fire is an important tool for returning eastside forest ecosystems to their historic range of variability.

High Elevation Mountain Hemlock and Lodgepole Pine Plant Associations

There appear 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 Cache LSR have not been significantly aeffected by the fire exclusion that has occurred in the last 90 years. 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.

HAZARD/RISK ANALYSIS

A hazard/risk analysis was completed for the Cache LSR. This information will be incorporated into the identification of fire management strategy areas. This was a landscape level analysis based upon the best information available at the time. Specific stands within the LSR were not evaluated but the entire area was looked at on a large-scale basis. Within each of the rating areas, there will be stands that do not fit that rating. As project level analysis is completed, these stands can be identified. The ratings of Low, Moderate and High were based upon the relative conditions within the LSR and did not consider conditions outside the LSR.

Information used for this analysis included:

1. Fuel loadings. Fuel loading information was gathered through fuels inventories completed in association with stand exams. Photo series information was used to estimate fuel loadings and the information was collected in the late 1980's.
2. Fire occurrence information from 1982 to 1996.
3. Plant Association Groups.
4. Crown Fire Potential mapping from satellite imagery.
5. Personal knowledge of district employees who have extensive knowledge about the Sisters Ranger District and fire suppression. On August 20, 1997, Rock Gerke, Rod Bonacker, Mike Carnahan, Mark Rapp, Chuck Cook, Dave Priest, and Lorri Heath completed the Risk/Hazard Analysis for the Cache LSR.

HAZARD RATING:

The hazard rating developed for the Cache LSR was based upon fuel loadings, current stand conditions and the existence of mortality in some portions of the LSR. This classification rates the difficulty of fire suppression.

Fuel loading is a measure of the down, dead woody debris on a site. Fuel loadings were given a rating of low, medium or high based on the tons per acre of debris existing on the ground now.

Fuel loadings: Low = 5 to 15 tons per acre

Medium = 15 to 25 tons per acre

High = 25+ tons per acre

Current stand conditions were also given ratings of Low, Medium or High. Low was defined as open (widely spaced), 1-storied, and/or healthy stands. These stands would be the least complicated in terms of ease of fire suppression. Medium rated areas generally contained 2-storied, healthy stands where ladder fuels will have some impact on ease of suppression but will not be the primary concern. High hazard areas are locations with 2 to 3-storied stands, ladder fuels present and there is some level of stand mortality.

Mortality was rated by the stand or brush component within the stand. For example, a high percentage of frost-killed manzanita in an area would move it into a moderate or high rating just as if the stand had that same level of mortality. The criteria for Low, Medium and High mortality were based on the level of mortality that begins to effect suppression capabilities and not silvicultural or other resource concerns. A Low rating was given to areas with generally low

mortality (less than 20% in most stands). A Medium rating was given to areas with mortality of 20 to 40%. Any area with mortality levels greater than 40% were given a High rating. All three of these criteria were combined to give a final rating of Low, Medium or High Fire Hazard within the Cache LSR.

The majority of the Cache LSR is classified as a Medium or High hazard. The areas of Low hazard are the lava fields in the southwest portion of the LSR, Dugout Lake fire west of the 1030 Road, most of section 24 (T14 R9) and a narrow band south of 2067-900 and north of 2067-500. The Cache RNA is rated as a High+ hazard. The RNA has heavy fuel loadings (down and standing), high mortality levels and 2 to 3 storied stands in most areas. The Medium hazard areas include the ponderosa pine flats on the east edge of the LSR and an area of lodgepole pine the middle, western edge of the LSR. The rest of the LSR is classified as a High hazard. This is based upon the fuel loadings, stand mortality, ladder fuel presence and brush component found throughout the Cache LSR.

RISK RATING:

The Risk Rating for the Cache LSR 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, private property location, plantation locations, lightning fire occurrence, and human-caused fire occurrence. Within each of the rating areas, there will be stands that do not fit that rating. This was a landscape level rating and not all stands were looked at individually. As project level is analysis is completed, areas that do not meet the rating they were assigned can be identified.

The Cache LSR was rated as Medium and High Risk. The risk is High along Highway 242 due to the large number of people who travel this Scenic Byway during the summer months. The Cache RNA received a High risk rating because there is a high risk that a fire start in the RNA will quickly come out of the RNA towards private property and areas of high recreation use near Suttle Lake. The area within one-half to one mile of private property was rated as High risk due to the high "values at risk" if a wildfire should threaten private land-holdings. This area also contains hundreds of acres of plantations that represent a high "value at risk" if they were lost during a wildfire. The value of the plantations as future LSR habitat determine that this area is classified as High risk. The rest of the LSR is rated as Medium risk because of the moderate amount of recreation use, lack of specific "lightning paths", or other risks that would put this area in the Low or High risk category.

NRF habitat and known owl activity areas also represent a High value at risk, but their exact locations within the LSR are not known at this time. With the above exception, the rest of the LSR is rated as Medium Risk because of the moderate amount of recreation use, lack of specific lightning paths, or other risks of fire occurence.

FIRE INTENSITIES:

Fire intensities within the LSR were predicted. Fire intensity predictions were based upon the following criteria:

A. Existing fuel loadings and stand conditions including tree mortality and presence of spot fire receptors such as decayed ("punky" logs..
B. The fire is assumed to occur in July or August under average summer weather conditions (90^{th} percentile weather). (73% of the fires in the Cache LSR occur in July and August.)
C. The presence of ladder fuels and their potential to move the fire from the ground into the crowns of the trees.

D. The presence and species of the brush component.

The categories used to describe potential, predicted fire intensities were Low, Medium and High. An area with a Low Fire Intensity rating would burn under July and August conditions, as described above, with 2 to 4 foot flame lengths. Moderate Fire Intensity describes potential, predicted flame lengths of 4 to 8 feet. A High Intensity rating describes predicted flame lengths of 8 or more feet.

Actual fire behavior predictions were not calculated for this analysis. The experience of the people completing the analysis was used to used to predict fire intensities at a large scale, across the LSR. All personnel had experienced fire behavior in this LSR. Within each of the rating areas, there will be stands that do not fit that rating. This was a landscape level rating and not all stands were looked at individually. As project level is analysis is completed, areas that do not meet the rating they were assigned can be identified.

The Cache LSR has fire intensity ratings of High+, High and Low. The High+ or "Extreme" fire intensities rating are located in the Cache RNA, along Highway 242, and in the ponderosa pine flats east of the 1028 Road. The Cache RNA and Highway 242 ratings are based upon the existing heavy fuel loadings and high levels of mortality which will further increase fuel loadings as the stands continue to fall to the ground. High intensity fires with lower rates of spread can be expected here. The area east of Road 1028 were rated as High+ due to the abundance of multi-storied, healthy stands that create the ladder fuels that contribute to crown fire occurrence. The brush component in the area also contributes to the potential for crown fires. The areas of Low fire intensity ratings are the lava fields in the southwest corner of the LSR and the Dugout Lake fire area. The lava flows, even with sparse vegetation, should not support fire spread under average summer conditions, unless spotting becomes a concern. The Dugout Lake Fire burned under high intensity conditions in 1930 and has existing low fuel loadings, grass understories and 1 to 2 storied stands that should not support crown fire under average summer conditions. The rest of the LSR had predicted High Fire Intensity rating based upon the above criteria.

CACHE LATE SUCCESSIONAL RESERVE
FIRE MANAGEMENT STRATEGIES

Based upon direction provided in the Northwest Forest Plan; Deschutes Land and Resource Management Plan; Federal Wildland Fire Management Policy and Program Review; Cache 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 LSR.

All fire management suppression strategies are based upon the principle that firefighter safety is the highest priority during all wildfire suppression activities. This principle is not stated in each discussion of suppression strategies. Any suppression strategy selected must consider firefighter safety as the highest priority.

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.

The fuel break strategy is designed to provide a network of defensible zones for indirect attack on large fires. Fuelbreaks are usually areas with fuels modified so that only low intensity ground fres are possible. They are located along major roads to provide safe access and to minimize the amount of additional breaks in forest connectivity. Because most large fires on the Sisters RD are driven by prevailing afternoon winds, they generally spread from west to east. The fuelbreak network is accordingly primarily located on north-south roads. Most recent vegetation management projects have included a fuelbreak objective in order to connect the network across the landscape. Fuelbreaks proposed in the Cache LSR are designed to link fuelbreaks resulting from the Santiam Corridor and Restoration projects to the north and east.

The objectives for the Cache Late Successional Reserve Fire Management Plan:

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 for the use of "Wildfires used for resource benefits" (Prescribed Natural Fire) in the Mount Washington Wilderness
5. Protect adjacent resources when high intensity wildfire escapes from the Cache Research Natural Area.

MANAGEMENT STRATEGY AREA A

TOTAL ACRES: *1,543*

LOCATION BY NEAREST LANDMARK: Cache Research Natural Area

ADJACENT MANAGEMENT STRATEGY AREAS: B

SPECIAL AREAS OF CONCERN: Highest potential for endangering firefighter safety during fire suppression. This potential is based upon high levels of stand mortality, increasing fuel loadings, steep terrain and poor access or escape routes. High intensity stand replacement wildfires are expected.

PLANT ASSOCIATION GROUPS: Mostly Wet Mixed Conifer and High Elevation Mountain hemlock.

FIRE HAZARD RATING: High + (Extreme) due to steep terrain, high levels of stand mortality and increasingly heavy fuel loadings.

FIRE RISK RATING: High due to proximity to lightning storm tracks and dispersed recreation use that occurs adjacent to the MSA.

FIRE INTENSITY RATING: High + (Extreme)

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

Priority 1: Protect Firefighter and Public Safety.

The Cache Research Natural Area Establishment report provides guidance to fire managers regarding suppression tactics to be used for wildfires within the RNA or wildfires outside the RNA that threaten to enter the RNA.

All fires within the RNA, both natural and human-caused, should be suppressed quickly, minimizing costs. Suppression tactics should be similar to those used for fire suppression inside wilderness areas, as much as possible.

Due to the high probability of stand replacement wildfires within the RNA and the risk of spread onto adjacent high use recreational areas and private land, all suppression tactics are acceptable to preclude loss of the RNA or escapes from the RNA that threaten life, property or high value resources.

Low impact suppression tactics are preferred for all wildfire responses, but may not be effective due to high mortality, poor access and heavy fuel loadings.

Indirect suppression strategies are acceptable in areas of high snag densities or where firefighter safety may be jeopardized. Larger numbers of acres burned are acceptable to protect the public or firefighters. Caution should be used on every fire response to assure that firefighters have escape routes and safety zones that are easily accessible and effective.

Priority 2: Aggressive control of all wildfires that threaten to cause a significant loss of the values for which the RNA was established.

If loss of the RNA establishment value is predicted, the use of retardant and dozers may be acceptable.

Waterbodies within the RNA will require special consideration during suppression activities. These are the "values" for which this RNA was established. Lake and wetland areas are a special feature of this RNA and their aquatic life may be seriously affected by contamination with retardant.

Minimize removal of water from RNA lakes during wildfire suppression. Plan suppression tactics to avoid a visible drop in water level to protect aquatic species and minimize effects on aquatic research projects.

Priority 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. This suppression tactic may only be appropriate late in the fire season, in high elevation stands or on unusually wet years.

HAZARD REDUCTION RECOMMENDATIONS:

1. Continue the system of fuel breaks and landscape level fuels reduction that has been started with the Santiam Corridor and Santiam LSR Restoration projects to reduce the risk of wildfires entering or escaping from the Cache RNA.

OPPORTUNITIES:

1. Develop a Fire Management Plan which allows the use of prescribed fire (natural or managment ignited) to meet RNA objectives.

MANAGEMENT STRATEGY AREA B

TOTAL ACRES: *2,577*

LOCATION BY NEAREST LANDMARK: West of Cache Research Natural Area and east of private timber lands on the north end of the Cache LSR.

ADJACENT MANAGEMENT STRATEGY AREAS: B and C

SPECIAL AREAS OF CONCERN: High probability of high intensity, stand replacement wildfires moving east from the Cache RNA and downslope off of Cache Mountain. Two northern spotted owl home ranges. Private property adjacent to the eastern boundary of the MSA.

PLANT ASSOCIATION GROUPS: Dry Mixed Conifer

FIRE HAZARD RATING: High due to steep terrain with moderate to high fuel loadings in an area that is generally a dry south to east exposure.

FIRE RISK RATING: Moderate to High due to proximity to lightning tracks and high potential for a fire to spread from the Cache RNA into this MSA because of the westerly prevailing winds.

FIRE INTENSITY RATING: High to Extreme

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

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.

Priority 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 or the Cache RNA. 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 NRF (Nesting, Roosting and Foraging) habitat or developing NRF habitat is threatened.

Priority 3: Aggressive control of all wildfires that may threaten home ranges of the northern spotted owl or "core areas" for late-successional species.

The district wildlife biologist will map these sites and make this information available to the initial attack forces and the district Fire Duty Officer. The appropriate suppression tactics used to meet this goal while minimizing the use of dozers and retardant in and adjacent to NRF will be determined by the Initial Attack Incident Commander and Fire Duty Officer at the time of the fire response.

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

This information will be compiled and mapped by the district silviculturist and wildlife biologist. Once mapped, the information will be made available to the initial attack forces and the district Fire Duty Officer.

Priority 5: Consider the use of confine and contain suppression strategies for low intensity wildfires.

Once the long-term strategy of overall reduction in fire intensity has been completed, the use of confine and contain strategies will be appropriate. 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, this should be the most common suppression strategy.

HAZARD REDUCTION RECOMMENDATIONS:

1. Reduce fuel loadings, ladder fuels, brush component and fire intensities through the use of mechanical treatments and prescribed fire. Stands located adjacent to private property would be the highest priority stands to treat with these methods. The emphasis here would be to reduce the potential fire intensity on these sites. Fuels reduction in existing plantations would be the second priority for treatment. High stand densities or high levels of mortality may require the use of mechanical treatments prior to the use of prescribed fire. Use prescribed fire where possible. Prescribed fire may also be used to increase or maintain the amount or ponderosa pine, Douglas-fir and other fire tolerant species within this MSA.
2. Develop and maintain a shaded fuelbreak along Roads 2068-800, 1028 and 1028-600 that ties into the fuelbreaks developed in the Santiam Corridor and Santiam LSR Restoration projects. This shaded fuelbreak would be necessary if landscape level fuels reduction is not possible due to late-successional species concerns or other resource values. The shaded fuelbreak could be used as an anchor point during burn-out operations and as a place to "take a stand" during high intensity wildfires. Design shaded fuelbreaks to act as anchor points as well as meet visual quality objectives.
3. Maintain fuelbreaks developed in the MSA. Maintenance of the fuelbreaks will be as important as developing them. Prescribed fire and mechanical treatments can be used to maintain them. If maintenance does not occur, the fuelbreaks will be ineffective within a relatively short period of time.
4. Salvage harvest as much of the dead and dying material as needed to provide firefighter safety, public safety and protection for Late-Successional habitat in the long term. Post-harvest fuels treatment objectives should meet the fuel loading guidelines provided by the Deschutes National Forest Science Team for Late-Successional Reserves. Salvage material could be removed through the use of timber sales, "small sales", firewood programs (commercial and personal use) or service contracts with salvage rights. Commercial removal of this material would be acceptable.
5. Control of wildfires at the smallest size possible, with limited available resources, is the only method of protecting climatic climax stand conditions. Wildfire control is not always successful. The inability to protect these stands through their life cycles should be considered as part of other decisions made in the LSR or funding of suppression resources. Identification of the monetary value of late-successional habitat could be included in the NFMAS

calculations to provide the appropriate level of suppression resources to protect late-successional habitat.

OPPORTUNITIES:

1. Coordinate prescribed burning for hazard reduction with habitat improvement for other late-successional species associated with fire dependent ecosystems.

MANAGEMENT STRATEGY AREA C

TOTAL ACRES: 6,022

LOCATION BY NEAREST LANDMARK: West of the Mt. Washington Wilderness and east of the intermingled private lands, approximately in the west-central portion of the LSR.

ADJACENT MANAGEMENT STRATEGY AREAS: B, D, E and F

SPECIAL AREAS OF CONCERN: Home range for two pairs of northern spotted owls with a known nest site. Adjacent private property.

PLANT ASSOCIATION GROUPS: Dry Mixed Conifer and Wet Ponderosa Pine.

FIRE HAZARD RATING: Low, Moderate and High scattered throughout the MSA.

FIRE RISK RATING: Moderate due to low to moderate amounts of human use and no particular lightning attraction.

FIRE INTENSITY RATING: High except in the Dugout Lake Fire area where it is low.

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

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.

Priority 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 or the Cache RNA. 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 NRF (Nesting, Roosting and Foraging) habitat or developing NRF habitat is threatened.

Priority 3: Aggressive control of all wildfires that may threaten home ranges of the northern spotted owl or "core areas" for late-successional species.

The district wildlife biologist will map these sites and make this information available to the initial attack forces and the district Fire Duty Officer. The appropriate suppression tactics used to meet this goal while minimizing the use of dozers and retardant in and adjacent to NRF will be determined by the Initial Attack Incident Commander and Fire Duty Officer at the time of the fire response.

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

This information will be compiled and mapped by the district silviculturist and wildlife biologist. Once mapped, the information will be made available to the initial attack forces and the district Fire Duty Officer.

Priority 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.

HAZARD REDUCTION RECOMMENDATIONS:

1. Reduce fuel loadings, ladder fuels, brush component and fire intensities through the use of mechanical treatments and prescribed fire. Stands located adjacent to private property would be the highest priority stands to treat with these methods. The emphasis here would be to reduce the potential fire intensity on these sites. Fuels reduction in existing plantations would be the second priority for treatment. High stand densities or high levels of mortality may require the use of mechanical treatments prior to the use of prescribed fire. Use prescribed fire where possible. Prescribed fire may also be used to increase or maintain the amount or ponderosa pine, Douglas-fir and other fire tolerant species within this MSA.
2. Develop and maintain a shaded fuelbreak along Road 1028 that ties into the fuelbreaks developed in MSA B, Santiam Corridor and Santiam LSR Restoration projects. This shaded fuelbreak would be necessary if landscape level fuels reduction is not possible due to late-successional species concerns or other resource values. The shaded fuelbreak could be used as an anchor point during burn-out operations and as a place to "take a stand" during high intensity wildfires. Design shaded fuelbreaks to act as anchor points as well as meet visual quality objectives.
3. Maintain fuelbreaks developed in the MSA. Maintenance of the fuelbreaks will be as important as developing them. Prescribed fire and mechanical treatments can be used to maintain them. If maintenance does not occur, the fuelbreaks will be ineffective within a relatively short period of time.
4. Salvage harvest as much of the dead and dying material as needed to provide firefighter safety, public safety and protection for late-Successional habitat in the long term. Post harvest fuels treatment objectives should meet the fuel loading guidelines provided by the Deschutes National Forest Science Team for Late-Successional Reserves. Salvage material could be removed through the use of timber sales, "small sales", firewood programs (commercial and personal use) or service contracts with salvage rights. Commercial removal of this material would be acceptable. This recommendation has limited opportunities in this MSA due to the MSA goals for retaining NRF in the short term.
5. Control of wildfires at the smallest size possible, with limited available resources, is the only method of protecting climatic climax stand conditions. Wildfire control is not always successful. The inability to protect these stands through their life cycles should be considered as part of other decisions made in the LSR or funding of suppression resources. Identification of the monetary value of late-successional habitat could be included in the NFMAS

calculations to provide the appropriate level of suppression resources to protect late-successional habitat.

OPPORTUNITIES:

1. Coordinate prescribed burning for hazard reduction with habitat improvement for other late-successional species associated with fire dependent ecosystems.

MANAGEMENT STRATEGY AREA D

TOTAL ACRES: *3,600*

LOCATION BY NEAREST LANDMARK: Eastern portion of the LSR including Graham Butte and Four Mile Butte.

ADJACENT MANAGEMENT STRATEGY AREAS: C and F

SPECIAL AREAS OF CONCERN: Adjacent private property. Dense ponderosa pine understories that put the overstory ponderosa pine at risk from high intensity wildfires. Stands with high levels of mortality. Portion of one NSO home range.

PLANT ASSOCIATION GROUPS: Dry Mixed Conifer and Wet Ponderosa Pine

FIRE HAZARD RATING: Moderate to High due to stand densities, fine fuel loadings and shrub component.

FIRE RISK RATING: High due to proximity to Black Butte Ranch and the potential for high intensity wildfires to move into expensively developed lands. Well traveled road corridors that increase the risk of human caused fires also contribute to the high risk rating.

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-draped bitterbrush under the ponderosa pine stands quickly develop into high intensity wildfires shortly after they start.

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

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.

Priority 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 NRF (Nesting, Roosting and Foraging) habitat or developing NRF habitat is threatened.

Priority 3: Aggressive control of all high intensity wildfires that threaten the survival of the large overstory ponderosa pine or areas managed for climatic climax.

Information about the location of areas to be managed as climatic climax will be compiled and mapped by the district silviculturist and wildlife biologist. Once mapped, the information will be made available to the initial attack forces and the district Fire Duty Officer.

The suppression tactics to be used if 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.

Priority 4: 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 MSA.

HAZARD REDUCTION RECOMMENDATIONS:

1. Reduce fuel loadings, ladder fuels, brush component and fire intensities through the use of mechanical treatments and prescribed fire. Landscape level fuels treatments to meet MSA objectives is the priority here. Stands located adjacent to private property would be the highest priority stands to treat with these methods. The emphasis here would be to reduce the potential fire intensity on these sites. Fuels reduction in existing plantations would be the second priority for treatment. High stand densities or high levels of mortality may require the use of mechanical treatments prior to the use of prescribed fire. Use prescribed fire where possible. Prescribed fire may also be used to increase or maintain the amount or ponderosa pine, Douglas-fir and other fire tolerant species within this MSA.
2. Modify fuel profiles adjacent to private property to generate low intensity wildfires under average summer weather conditions. Mechanical treatments and/or prescribed fire could be used to reduce fuel loadings, ladder fuels and brush component.
3. Thin understory trees to reduce ladder fuels. Mechanical treatments and prescribed fire are both appropriate tools. In heavily stocked stands, mechanical treatments will generally be required. In less heavily stocked stands, prescribed fire can be used to thin understory trees. This decision must be made on the ground after viewing the specific location.
4. Salvage harvest as much of the dead and dying material as needed to provide firefighter safety, public safety, reduced risk of wildfire moving onto or out of private property, and protection for late-Successional habitat in the long term. Post harvest fuels treatment objectives should meet the fuel loading guidelines provided by the Deschutes National Forest Science Team for Late-Successional Reserves. Salvage material could be removed through the use of timber sales, "small sales", firewood programs (commercial and personal use) or service contracts with salvage rights. Commercial removal of this material would be acceptable. This recommendation may have limited opportunities to the relative good health of the stands in this MSA.
5. Control of wildfires at the smallest size possible, with limited available resources, is the only method of protecting climatic climax stand conditions. Wildfire control is not always successful. The inability to protect these stands through their life cycles should be considered

as part of other decisions made in the LSR or funding of suppression resources. Identification of the monetary value of late-Successional habitat could be included in the NFMAS calculations to provide the appropriate level of suppression resources to protect late-Successional habitat

OPPORTUNITIES:

1. Use prescribed fire, where possible, to establish and maintain fire climax conditions. Prescribed fire can be used to reduce fuel loadings, reduce ladder fuels, reduce fire intensities and maintain or increase ponderosa pine, Douglas-fir, western larch and other fire tolerant species.
2. Coordinate prescribed burning for hazard reduction with habitat improvement for other late-successional species associated with fire dependent ecosystems

MANAGEMENT STRATEGY AREA E

TOTAL ACRES: *698*

LOCATION BY NEAREST LANDMARK: Adjacent to the wilderness boundary on the end of the LSR. It includes lava fields and Dugout Lake.

ADJACENT MANAGEMENT STRATEGY AREAS: C and F

SPECIAL AREAS OF CONCERN: Unique, large and relatively old stand of lodgepole pine. Stand replacement fire in the lodgepole stand is inevitable and acceptable.

PLANT ASSOCIATION GROUPS: Primarily Lodgepole Pine and Dry Mixed Conifer around the fringe of the lava fields. Wet Mixed Conifer around Dugout Lake. Sand dunes, shrub fields and other non-forest types associated with the Dugout Fire of 1930.

FIRE HAZARD RATING: Moderate. Fuel loadings will increase as the lodgepole stand ages.

FIRE RISK RATING: Low due infrequent lightning occurrence and small amount of human use of the area.

FIRE INTENSITY RATING: Low to Moderate depending upon the age of the lodgepole pine stand. A stand replacement, high intensity fire is the lodgepole pine plant associations is inevitable.

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

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". Caution should be used on every fire response to assure that firefighters have escape routes and safety zones that are easily accessible and effective.

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

Information about the location of areas to be managed as climatic climax will be compiled and mapped by the district silviculturist and wildlife biologist. Once mapped, the information will be made available to the initial attack forces and the district Fire Duty Officer.

Priority 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 (lava flows and sand dunes) would be acceptable. Currently, this suppression strategy has limited opportunities.

Priority 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 NRF stands. 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.

HAZARD REDUCTION RECOMMENDATIONS:

1. Develop and maintain a shaded fuelbreak along Road 1030 that ties into the fuelbreaks developed in MSA C, Santiam Corridor, Santiam LSR Restoration and Highway 242. This shaded fuelbreak would be necessary if landscape level fuels reduction is not possible due to late-successional species concerns or other resource values. The shaded fuelbreak could be used as an anchor point during burn-out operations and as a place to "take a stand" during high intensity wildfires. Design shaded fuelbreaks to act as anchor points as well as meet visual quality objectives.
2. Maintain fuelbreaks developed in the MSA. Maintenance of the fuelbreaks will be as important as developing them. Prescribed fire and mechanical treatments can be used to maintain them. If maintenance does not occur, the fuelbreaks will be ineffective within a relatively short period of time.
3. Reduce fuel loadings, ladder fuels and brush component through the use of mechanical treatments and prescribed fire. High mortality and high stand densities will generally require the use of mechanical treatments prior to the use of prescribed fire. Prescribed fire can be used to maintain the late-successional conditions once they are created.
4. Control of wildfires at the smallest size possible, with limited available resources, is the only method of protecting climatic climax stand conditions. Wildfire control is not always successful. The inability to protect these stands through their life cycles should be considered as part of other decisions made in the LSR or funding of suppression resources. Identification of the monetary value of late-Successional habitat could be included in the NFMAS calculations to provide the appropriate level of suppression resources to protect late-Successional habitat

OPPORTUNITIES:

1. Use prescribed fire, where possible, to establish and maintain fire climax conditions. Prescribed fire can be used to reduce fuel loadings, reduce ladder fuels, reduce fire intensities and maintain or increase ponderosa pine, Douglas-fir, western larch and other fire tolerant species. It can also be used to maintain and increase fire climax, late-successional habitats.
2. Coordinate prescribed burning for hazard reduction with habitat improvement for other late-successional species associated with fire dependent ecosystems.

MANAGEMENT STRATEGY AREA F

TOTAL ACRES: *2,500*

LOCATION BY NEAREST LANDMARK: Highway 242 (McKenzie Highway) corridor.

ADJACENT MANAGEMENT STRATEGY AREAS: C, D and E

SPECIAL AREAS OF CONCERN: Existing excessive fuel loadings along Highway 242 from previous hazard tree removal. Campground at Lava Camp lake. Scenic Byway-Highway 242. Strong pass winds that "tunnel" down the highway corridor. Known spotted owl nest site.

PLANT ASSOCIATION GROUPS: All of the plant association groups are included in this MSA due to it's linear nature that encompasses a broad elevation range.

FIRE HAZARD RATING: High due to heavy fuel loadings and high stand densities.

FIRE RISK RATING: High + (Extreme) due to the high level of human use along Highway 242 and because the upper portions of the MSA are in an active lightning track.

FIRE INTENSITY RATING: High + (Extreme) due to dense stand structure, heavy fuel loadings, strong winds across the top of the pass and the "tunnel" nature of the highway corridor.

FIRE SUPPRESSION STRATEGIES AND PRIORITIES:

Priority 1: Protect firefighter and public safety.

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

Follow the Deschutes Land and Resource Management Plan (LRMP) standards and guidelines for fire suppression in the Scenic Views allocation.

Priority 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 and standards and guidelines for the Deschutes LRMP for that allocation. The use of low impact tactics should be considered when NRF (Nesting, Roosting and Foraging) habitat or developing NRF habitat is threatened. Follow the Deschutes LRMP standards and guidelines for fire suppression in the Scenic views allocation.

Priority 3: Aggressive control of all wildfires that may threaten spotted owl nest sites, home ranges or "core areas" for late-successional species.

The district wildlife biologist will map these sites and make this information available to the initial attack forces and the district Fire Duty Officer. The appropriate suppression tactics used to meet this goal while minimizing the use of dozers and retardant in and adjacent to NRF will be

determined by the Initial Attack Incident Commander and Fire Duty Officer at the time of the fire response

Priority 4: Aggressive control of wildfires that threaten areas that will be managed for climatic climax.

Information about the location for areas to be managed for climatic climax will be compiled and mapped by the district silviculturist and wildlife biologist. Once mapped, the information will be made available to the initial attack forces and the district Fire Duty Officer.

Priority 5: Consider minimizing the use of dozers and aerial retardant in and around NRF habitat, if firefighter and public safety will not be jeopardized.

Larger numbers of acres burned are acceptable to provide firefighter and public safety. The balance of safety and use of low impact tactics must be weighed and decided at the time of fire ignition and response. The initial attack incident commander will determine tactics at the time of the fire response.

The district wildlife biologist will map these sites and make this information available to the initial attack forces and the district Fire Duty Officer. The appropriate suppression tactics used to meet this goal while minimizing the use of dozers and retardant in and adjacent to NRF will be determined by the Initial Attack Incident Commander and Fire Duty Officer at the time of the fire response.

Priority 6: Consider the use of confine and contain suppression strategies for low intensity wildfires.

Once the long term strategy of overall reduction in fire intensity has been completed, the use of confine and contain strategies will be appropriate. 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, this should be the most common suppression strategy.

HAZARD REDUCTION RECOMMENDATIONS:

1. Reduce fuel loadings, ladder fuels, brush component and fire intensities through the use of mechanical treatments and prescribed fire. Stands located adjacent to private property would be the highest priority stands to treat with these methods. The emphasis here would be to reduce the potential fire intensity on these sites. High stand densities or high levels of mortality may require the use of mechanical treatments prior to the use of prescribed fire. Use prescribed fire where possible. Prescribed fire may also be used to increase or maintain the late-successional conditions once they are created.
2. Modify fuels adjacent to private property and along Highway 242 to generate low intensity wildfires under average summer weather conditions. Mechanical treatments and/or prescribed fire could be used to reduce fuel loadings, ladder fuels and brush component.
3. Consider development and maintenance of a shaded fuelbreak along Highway 242 that would provide an east-west break in fuels along the highway corridor. This shaded fuelbreak would only be necessary if landscape level fuels reduction is not possible due to late-successional species concerns or other resource values. The shaded fuelbreak could be used as an anchor point during burn-out operations and as a place to "take a stand" during high intensity

wildfires. Design shaded fuelbreaks to act as anchor points as well as meet visual quality objectives.

4. Maintain any fuelbreaks developed in the MSA. Maintenance of the fuelbreaks will be as important as developing them. Prescribed fire and mechanical treatments can be used to maintain them. If maintenance does not occur, the fuelbreaks will be ineffective within a relatively short period of time.
5. Salvage harvest as much of the dead and dying material as needed to provide firefighter safety, public safety and protection for late-Successional habitat in the long term. Post harvest fuels treatment objectives should meet the fuel loading guidelines provided by the Deschutes National Forest Science Team for Late-Successional Reserves. Salvage material could be removed through the use of timber sales, "small sales", firewood programs (commercial and personal use) or service contracts with salvage rights. Commercial removal of this material would be acceptable.
6. Control of wildfires at the smallest size possible, with limited available resources, is the only method of protecting climatic climax stand conditions. Wildfire control is not always successful. The inability to protect these stands through their life cycles should be considered as part of other decisions made in the LSR or funding of suppression resources. Identification of the monetary value of late-successional habitat could be included in the NFMAS calculations to provide the appropriate level of suppression resources to protect late-successional habitat.

OPPORTUNITIES:

1. Use prescribed fire, where possible, to establish and maintain fire climax conditions. Prescribed fire can be used to reduce fuel loadings, reduce ladder fuels, reduce fire intensities and maintain or increase ponderosa pine, Douglas-fir, western larch and other fire tolerant species. It can also be used to maintain and increase fire climax, late-successional habitats.
2. Coordinate prescribed burning for hazard reduction with habitat improvement for other late-successional species associated with fire dependent ecosystems

APPENDIX 2 – CACHE RNA SPECIES LISTS

Table I. Plant species list for Cache Mountain RNA. Species are listed by life form and plant association types, and compiled from 1994 field inventories by Cindi O'Neil, Botanist, Deschutes National Forest. **Codes are as follows: CDS6-13** = Mixed conifer/snowberry forb; **CMS2-16** = Mountain hemlock/big huckleberry/ beargrass; **CMS1-14** = Mountain hemlock/grouse huckleberry; **CWS9-11** = Englemann spruce; **NRL9-12** = Steep, xeric, rock garden). Information is lacking for the mixed conifer/snowbrush/sedge-brakenfern (CWC2-13) and mixed conifer/manzanita (CWS9-11) associations. Taxonomic authority for scientific names follows Hitchcock et. al. (1973) and Little (1979).

Plant Association	1 **CDS6-13**	2 **CMS2-16**	3 **CMS1-14**	4 **CWS9-11**	5 **NRL9-12**	6 **boulder field**
Species Name						
TREES						
Abies amabilis	X					
Abies concolor	X	X	X	X		
Abies lasiocarpa		X	X			
Abies magnifica var. shastensis	X					
Picea engelmannii			X	X		
Pinus contorta		X	X			
Pinus monticola	X	X	X	X		
Pinus ponderosa	X					
Pseudostuga menziesii	X					
Tsuga mertensiana		X	X	X		
SHRUBS						
Acer circinatum	X					
Alnus incana	X			X		
Amelanchier alnifolia			X	X		
Arctostaphylos nevadensis	X					
Arctostaphylos patula	X	X				
Berberis repens		X				
Berberis nervosa	X					
Castanopsis chrysophylla	X					
Ceanothus velutinus	X					
Cornus canadensis	X			X		
Cryptogramma crispa						X
Happlopappus bloomeri			X			
Holodiscus dumosus						X
Juniperus communis						X
Lonicera conjugialis				X		
Lonicera involucrata			X	X		
Pachistima myrsinites			X			X
Ribes lacustre	X			X		
Ribes viscosissimum	X	X				
Rosa gymnocarpa	X	X				X
Rubus lasiococcus	X	X	X	X		
Rubus parviflorus						X

Plant Association	1	2	3	4	5	6
	CDS6-13	CMS2-16	CMS1-14	CWS9-11	NRL9-12	boulder field
Species Name						
Rubus ursinus				X		
Salix boothii				X		
Salix eastwoodii	X			X		
Salix lemmonii				X		
Salix sitchensis				X		
Sambucus cerulea	X			X		
Spirea douglasii				X		
Symphoricarpos albus	X		X			
Symphoricarpos mollis	X	X	X			
Vaccinium membranaceum		X				
Vaccinium occidentale		X	X	X		
Vaccinium ovatum			X			
Vaccinium scoparium			X			
GRASSES						
Calamagrostis rubescens	X	X				
Festuca idahoensis		X				
Sitanion hysterix						
Stipa occidentalis						
SEDGES and RUSHES						
Carex nigricans				X		
Carex pennsylvanica		X			X	
Carex rostrata				X		
Juncus balticus				X		
FORBS						
Achillea millefolium					X	
Actea rubra	X					
Adenocaulon bicolor	X					
Anaphalis margaritacea	X	X				
Anenome deltoidea	X	X				
Anenome lyalli		X				
Antennaria sp.					X	
Aquilegia formosa	X					
Arabis sp.						
Arnica latifolia	X	X				
Asarum caudatum	X					
Aster subspicatus						
Athyrium filix-femina	X					
Calochortus subalpinus					X	
Castilleja miniata var. miniata					X	
Chimaphila menziesii	X	X				
Chimaphila umbellata	X	X	X	X		
Cirsium vulgare	X	X	X			

Plant Association	1	2	3	4	5	6
	CDS6-13	CMS2-16	CMS1-14	CWS9-11	NRL9-12	boulder field
Species Name						
Clintonia uniflora	X	X	X	X		
Cheilanthes gracillima						X
Cornus canadensis	X			X		
Delphinium sp.					X	
Dicentra formosa	X					
Disporum hookeri	X					
Epilobium angustifolium	X	X	X	X		
Equisetum arvense				X		
Fragaria vesca	X	X	X			
Fragaria virginiana		X				
Galium asperrimum	X	X	X			
Galium triflorum	X					
Gaultheria humifusa				X		
Geum macrophyllum var. macrophyllum	X					
Gilia aggregata		X				
Goodyeria oblongifolia	X					
Habenaria saccata	X					
Hieraceum albiflorum	X	X	X			
Hypopitys monotropa	X					
Lilium columbianum				X		
Linnea borealis	X					
Listeria caurina	X	X				
Lomatium martindalei					X	
Luzula divaricata		X	X			
Lupinus albicaulis		X	X			
Mimulus alsinoides						X
Microseris alpestris		X	X			
Mitella caulescens	X					
Mitella pentandra				X		
Mitella trifida					X	
Montia parviflora var. flagellaris						X
Montia siberica	X					
Ozmorhiza purpurea	X	X	X	X		
Pedicularis racemosa				X		
Penstemon cardwellii					X	
Penstemon cinicola		X	X			
Penstemon fruiticosus var. fruiticosus					X	
Penstemon rupicola						X
Phacelia hastata		X	X			
Potentilla drummondii				X		
Pteridium aquilinum	X	X		X		
Polystichum munitum	X					
Pyrola secunda	X	X	X	X		
Pyrola picta	X	X				
Ranunculus sp.				X		
Saxifraga arguta	X					

Plant Association	1 CDS6-13	2 CMS2-16	3 CMS1-14	4 CWS9-11	5 NRL9-12	6 boulder field
Species Name						
Saxifraga occidentalis					X	X
Sedum oregana					X	
Senecio triangularis		X		X		
Smilacina racemosa	X					X
Smilacina stellata	X	X	X	X		
Streptopis roseus	X			X		
Tiarella trifoliata var. unifoliata	X			X		
Trillium ovatum	X	X		X		
Veronica americana	X					
Veronica serpilifolia	X					
Veronica wormskajoldii			X			
Viola glabella		X				
Viola nutallii var. bakeri		X	X			
Viola orbiculata	X	X		X		
Viola palustris				X		
Xerophyllum tenax	X	X		X		

Table 2. Wildlife species list for Cache Mountain RNA. Wildlife field surveys were conducted in Cache Mountain RNA in 1994 by Tom Darden, Deschutes National Forest Biologist, and Deanna Olson, Forest Service Research Ecologist. The following list includes wildlife species known to occur, as well as species that may occur in the RNA. Species not actually seen or otherwise detected during surveys but that have a high probability of occurring in the RNA are marked with an asterisk (*). Species identifications were determined from Hall and Kelson (1959), Nussbaum et. al. (1983), and Robbins et al. (1966).

BIRDS

Accipiter cooperii*	Cooper's hawk
A. gentilis*	Northern goshawk
A. striatus*	Sharp-shinned hawk
Anas platyrhynchos	Mallard
Ardea herodias	Great blue heron
Bonasa umbellus*	Ruffed grouse
Bubo virginianus*	Great horned owl
Buteo jamaicensis*	Red-tailed hawk
Carduelis pinus	Pine siskin
Carpodacus cassinii	Cassin's finch
Catharus guttatus	Hermit thrush
Certhia americana	Brown creeper
Chordeiles minor	Common nighthawk
Colaptes auratus	Northern flicker
Contopus sordidulus	Western wood-peewee
Corus corax	Common raven
Cyanocitta stelleri	Stellar's jay
Dendragapus obscurus*	Blue grouse
Dendroica auduboni	Yellow-rumped warbler
D. occidentalis	Hermit warbler
D. townsendi	Townsend's warbler
Dendrocopos villosus	Hairy woodpecker
Dryocopus pileatus	Pileated woodpecker
Empidonax oberholseri	Dusky flycatcher
E. trailii	Willow flycatcher
Falco sparveriua*	American kestrel
Geothlypis trichas	Common yellowthroat
Haliaeetus leucocephalus*	Bald eagle
Hesperionana vespertina	Evening grosbeak
Junco hyemalis	Dark-eyed junco
Loxia curvirostra	Red crossbill
Megaceryle alcyon	Belted kingfisher
Melospiza melodia	Song sparrow
Nucifraga columbiana	Clark's nutcracker
Nuttailornis borealis	Olive-sided flycatcher
Oreortyx pictus	Mountain quail
Oporornis tolmiei	MacGillivray's warbler
Pandion haliaetus	Osprey
Parus atricapillus*	Black-capped chickadee
P. gambeli	Mountain chickadee
Passerina amoena	Lazuli bunting
Perisoreus canadensis	Gray jay
Picoides arcticus	Black-backed woodpecker

Piranga ludoviciana	Western tanager
Podiceps nigricollis	Eared grebe
Selasphorus rufus	Rufous hummingbird
Sitta canadensis	Red-brested nuthatch
Sphyrapicus ruber	Red-brested sapsucker
Spizella passerina	Chipping sparrow
Strix occidentalis*	Northern spotted owl
Troglodytes aedon	House wren
T. troglodytes	Winter wren
Turdus migratorius	American robin
Vireo gilvus	Warbling vireo
Vermivora celata	Orange-crowned warbler
Zenaida macroura	Morning dove
Zonotrichia leucophrys	White-crowned sparrow

AMPHIBIANS

Ambystoma macrodactylum	Long-toed salamander
A. gracile	Northwestern salamander
Ascaphus truei*	Tailed frog
Bufo boreas	Western toad
Dicamptodon tenebrosus*	Pacific giant salamander
Hyla regilla	Pacific treefrog
Rana cascadae	Cascades frog
R. pretiosa*	Spotted frog
Taricha granulosa	Rough-skinned newt

REPTILES

Eumeces skiltonianus*	Western skink
Gerrhonotus coeruleus*	Northern alligator lizard
Phrynosoma douglassi	Short-horned lizard
Sceloporus occidentalis*	Western fence lizard
S. graciosus*	Sagebrush lizard
Thamnophis elegans	Western terrestrial garter snake
T. ordinaoides*	Northwestern garter snake
T. sirtalis*	Common garter snake

MAMMALS

Canis latrans*	Coyote
Cervus canadensis	Elk
Clethrionomys gapperi	Boreal redback vole
Eptesicus fuscus*	Big brown bat
Erethizon dorsatum*	Porcupine
Eutamias amoenus	Yellow pine chipmunk
E. townsendi	Townsend chipmunk
Felis concolor*	Mountain lion
Glaucomys sabrinus*	Northern flying squirrel
Lasionycytris noctivagans*	Silver-haired bat
Lasiurus cinereus*	Hoary bat
Lynx rufus*	Bobcat
Marmota flaviventris	Yellowbelly marmot
Martes americana*	American marten

Microtus oregoni	Oregon vole
Mustela frenata*	Longtailed weasel
Myotis californicus*	California myotis
M. evotis*	Long-eared myotis
M. lucifugus*	Little brown myotis
M. subulatus*	Small-footed myotis
M. thysanodes*	Fringed myotis
M. volans*	Long-legged myotis
M. yumanensis*	Yuma myotis
Neotoma cinerea*	Bushytail woodrat
Odocoileus hemionus	Mule deer
Peromyscus maniculatus	Deer mouse
Phenacomys intermedius	Mountain phenacomys
Pipistrellus hesperus*	Western pipistrel
Plecotus townsendi*	Western big-eared bat
Procyon lotor*	Raccoon
Sciurus griseus	Western gray squirrel
Sylvilagus nuttalli*	Mountain cottontail
Sorex merriami*	Merriam shrew
S. vagrans	Vagrant shrew
Spermophilus lateralis	Golden-mantled squirrel
Tamisciurus douglasi	Douglas' squirrel
Taxidea taxus*	Badger
Thomomys talpoides	Northern pocket gopher
Ursus americana	Black bear

Table 3. Butterfly species list for Cache Mountain RNA. The following butterfly species have been observed within Cache Mountain RNA. Field surveys were conducted in 1994 by Dr. Jeff Miller and Dr. Paul Hammond of Oregon State University's Entomology Department, and by Maret Pajutee, Deschutes National Forest Ecologist. An asterisk (*) denotes species that typically occur on the west side of the Cascade Mountains. Species identifications were determined from Dornfeld (1980) and Scott (1986).

	Boloria epithore	Western meadow fritillary
	Cercyonis oetus	Least woodnymph
	Cercyonis pegala	Large woodnymph
	Coenonympha tullia	Common ringlet
	Colias eurytheme	Orange sulfur
	Colias occidentalis	Western sulfur
	Everes amyntula	Western tailed blue
	Hesperia comma	Comma skipper
	Limenitis lorquini	Lorquin's admiral
*	Lycaena mariposa	Mariposa copper
*	Nymphalis californica	California tortoiseshell
	Ochlodes sylvanoides	Woodland skipper
	Oeneis nevadensis	Great arctic
*	Parnassius clodius	Clodius parnassian
	Phyciodes campestris	Field crescent
	Pieris napi	Veined white
*	Plebejus icariodes	Common blue
*	Plebejus idas	Northern blue
*	Polites sonora	
	Speyeria atlantis	Atlantis fritillary
	Speyeria hydaspe	Hydaspe fritillary
	Speyeria zerene	Xerene fritillary
	Thorybes pylades	Northern cloudywing

APPENDIX 3 – PLANT SPECIES OF CONCERN

Table A: The following Plant Species of Concern are found within the CLSR

Species	Common Name	Type	Status	Occurrence	Plant Assoc. Group
Penstemon peckii	Peck's Penstemon	Vascular Plant	Sensitive	**SISTERS ENDEMIC**	PP, MCW, MCD
Allotropa virgata	Candystick	Vascular Plant	S &M 1	high N.America	MCD, MCW, LP
Collomia debilis var. larsenii	Larsens Collomia	Vascular Plant	ONHP List 4 Taxa of concern	Regional endemic	Talus slopes, non-forest
Cantharellus cibarius	Golden Chanterrelle	Fungi	S & M/ 3 & 4	Circumboreal?	PP, MCW, MCD
Gomphus floccosus	Scaly Vase	Fungi	S & M/ 3	North America	PP,MCW, MCD
Lobaria hallii		Rare nitrogen fixing Lichen	S & M/ 1&3	North America	PP, MCW, (MCD?)
Lobaria pulmonaria		Nitrogen fixing Lichen	S & M/ 4	PNW	MCD, (MCW?)

Table B. Species of Concern that have the potential to occur within the watershed.

Species	Common Name	Type	Status	Probability of Occurrence	Plant Assoc. Group
Agoseris elata	Tall Agoseris	Vascular Plant	Sensitive	Moderate PNW endemic	PP, MCW, MCD
Artemisia ludoviciana estesii	Estes' Artemisia	Vascular Plant	Sensitive	low Central OR endemic	Riparian
Arnica viscosa	Shasta Arnica	Vascular Plant	Sensitive	low Regional endemic	Lava, High elevation forest
Aster gormanii	Gorman's Aster	Vascular Plant	Sensitive	moderate OR endemic	Lava
Botrychium pumicola	Pumice Grapefern	Vascular Plant	Sensitive	moderate Central OR endemic	Lava, LP,High elevation forest
Calamagrostis breweri	Brewer's Reedgrass	Vascular Plant	Sensitive	low Regional endemic	Grassland
Calochortus longebarbatus longebarbatus	Long-bearded Mariposa	Vascular Plant	Sensitive	low Regional endemic	PP
Campanula scabrella	Rough Harebell	Vascular Plant	Sensitive	moderate PNW endemic	Lava/Rock
Carex livida	Pale Sedge	Vascular Plant	Sensitive	moderate circumboreal	Riparian
Castilleja chlorotica	Green-tinged Paintbrush	Vascular Plant	Sensitive	low Central OR endemic	PP, LP
Cymopteris nivalis	Snowline Cymopteris	Vascular Plant	Sensitive	moderate North Great Basin	Lava/Rock
Draba aureola	Golden Alpine Draba	Vascular Plant	Sensitive	moderate Regional endemic	Lava/Rock

Gentiana newberryi	Newberry's Gentian	Vascular Plant	Sensitive	moderate Regional endemic	Grassland
Hieracium bolanderi	Bolander's Hawkweed	Vascular Plant	Sensitive	low Regional endemic	Lava, High elevation Forest
Lobelia dortmanna	Water Lobelia	Vascular Plant	Sensitive	high circumboreal	Lakes
Lycopodium complanatum	Ground Cedar	Vascular Plant	Sensitive	low circumboreal	Riparian
Ophioglossum vulgatum	Adder's Tongue	Vascular Plant	Sensitive	low circumboreal	Grassland, riparian
Alpova alexsmithii		Rare False Truffle/ Fungi	S &M/ 1,3	Cascade endemic	High elevation forest, TSME
Gastroboletus ruber		Rare Bolete/Fungi	S & M/ 1, 3	Cascade endemic	High elevation forest
Hygrophorus caeruleus		Uncommon gilled Mushroom/ Fungi	S & M/ 1,3	PNW endemic	MCW, (MCD?)
Hydnothryna, Trappe #787792 Martellia, Trappe #5903		Rare Undescribed False Truffles	S & M/ 1,3	rare local endemics	High elevation forest
Nivatogastrium nubigenum		False truffle/ Fungi	S &M/ 1,3	high/Known on Sisters District/ OR & ID	LP, High elevation Forest
Rhizopogon flavofibrillosus		Rare false truffle/ Fungi	S &M/ 1,3	high/Known on Sisters District/ Regional endemic	LP, High elevation Forest

Rhizopogon truncatus		False truffle/ Fungi	S &M/3	high/Known on Deschutes/ N Am	High elevation Forest
Elaphomyces subviscidus		Rare truffle/Fungi	S & M/ 1,3	high/Known on Sisters District/ Cascades & AZ	LP,
Hydrothyria venosa		Aquatic lichen	S &M /1,3	high/Known on Deschutes/ N.Am	Riparian
Nephroma helveticum		Nitrogen fixing Lichen	S & M/4	PNW?	MCD, (MCW?)
Nephroma resupinatum		Nitrogen fixing Lichen	S & M/4	PNW?	MCD,MC W
Pseudocyphellaria anomala		Rare nitrogen fixing lichen	S & M/ 4	PNW endemic?	MCD, MCW
Pseudocyphellaria anthrapsis		Nitrogen fixing Lichen	S & M/4	PNW?	MCD, (MCW?)

APPENDIX 4 – Desired Condition for Late-Successional Habitats

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
MII (Climatic)	25 - 40 tons/ac. or 2700 - 4300 ft²/ac. Snags: 85% > 21" dbh (ex. 6-15/ac), 15% 15-21" dbh (ex. 2-3/ac) Logs: 100% > 31" dia. and 33' long (ex. 7-24/ac)	ave 70%	2 - 3	TPA	275	80	80	17	24	25	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. Tree Species: PIMO - Blister rust ABMAS - Heartrot
				BA	433	4	21	13	42	[illegible]	107	177	
Indicators: AM, BO				Stand SDI	620	10	43	23	66	[illegible]	148	≥ 187	

PAG's	Snags/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	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)	25 - 35 tons/ac. or 2200 - 3100 ft²/ac.			TPA	357	150	70	70	30	15	12	10	PWP - Roosts stands of white fir with > 4 TPA >20" live or dead.
	Snags:												NSO - ≥ 40% of white fir understory > 8" dbh.
	60% 9-16" dbh (ex. 9-17/ac),												Tree Species:
	20% 16-25 dbh (ex. 1-2/ac),			BA	270	7	19	55	53	14	51	71	PIPO and PSME - Large Tree component LOAC, TSME, TABR - Species diversity
Indicators: PWP, NSO	20% >25"dbh (ex. 1-2/ac)	> 70%	1 - 3										
	Logs												
	60% 16-25" dia. (ex. 7-16/ac),			Stand SDI	476	18	37	97	85	66	74	≥ 78	
	40% >25" dia. (ex. 3-6/ac)												

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
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	[redacted]gs/Logs (Tons/Acre & Ft²/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	[redacted] 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 (es. .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	

PAG's	Snags/Logs (Tons/Acre & Ft³/Acre)	Canopy Cover	Canopy Layers	Total Mean		Sapling 1.0 - 4.9"	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 ft³/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			

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"	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				

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
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 occurr[illegible] 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 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.

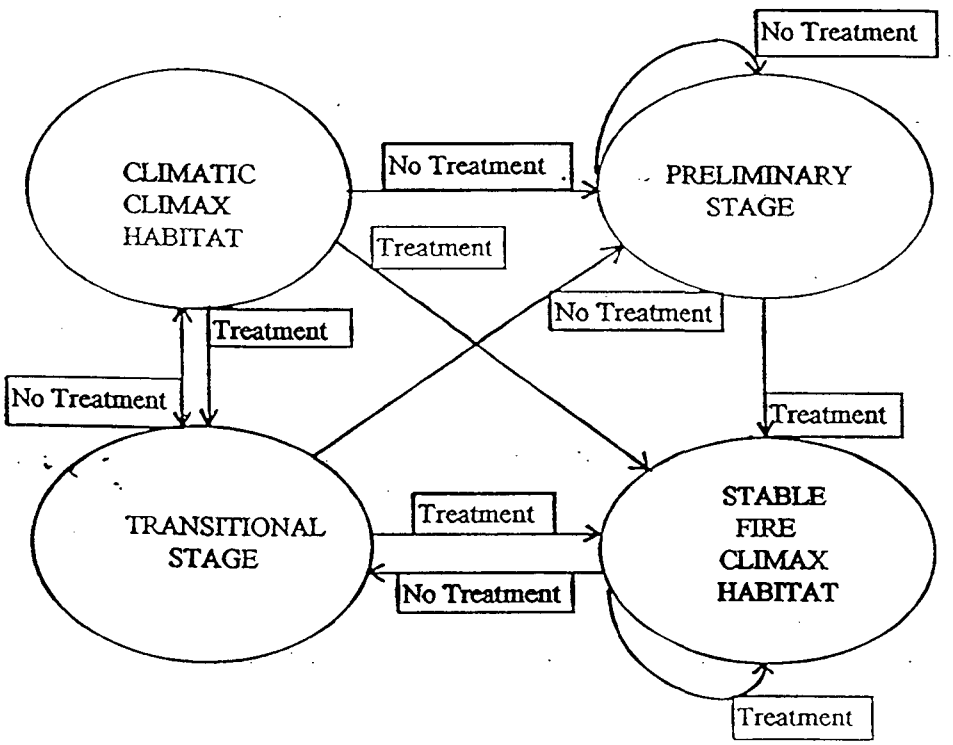
Cycling Suitable Habitat:

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 <u>might</u> 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 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	P C.
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	
	CL-M2-11	Lodgepole pine/bearberry	L2	
	CL-S2-12	Lodgepole pine/bitterbrush/sedge	L4	5
	CL-S2-13	Lodgepole pine/bitterbrush/forb	L2	6
	CL-M1-11	Lodgepole pine/sedge-grass wetland	L1	5
	* 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	

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)

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)

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)		*.0-15 mi² Distance between occupied nests .6-2 miles (J)	*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 * .5 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 (V)	• ≥ 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 56 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 [illegible] mi² (J) *30 [illegible] mi² (I), *2[illegible] mi² (AB) Juvenile *60 [illegible] mi² (I) *61 [illegible] 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)

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)

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APPENDIX 5 – Snag, GTR and Down Wood Recommendations

APPENDIX 5 – Snag, GTR and Down Wood Recommendations

SNAG REQUIREMENTS

	Snags/acre			Snags/Acre			Snags/Acre			Snags/Acre		
	Climatic Climax MC			Fire Climax MC			P.Pine >30% CC			P.Pine <30% CC		
Focal Species *	10-14.9"	15-24.9"	25+"	10-14.9"	15-24.9"	25+"	10-14.9"	15-24.9"	25+"	10-14.9"	15-24.9"	25+"
Spotted owl (stoc)	0	6	5	0	wh	am	n/a*	n/a	n/a	n/a	n/a	n/a
Bald eagle (be)	0	0	stoc	0	0	am	0	0	wh (+1be)*	0	0	wh (+1be)
American marten (am)	0	stoc	stoc	hy	0	2	n/a	wh,pc	wh,pc	n/a	n/a	n/a
Goshawk	hy	stoc	stoc	0	wh,pc*	am,wh	n/a	n/a	n/a	n/a	n/a	n/a
Vaux's swift	0	stoc	stoc	0	wh	wh,ws	0	wh,pc	wh,ws	0	wh,fl	wh
Big-eared bat	0	stoc	stoc	0	wh,pc	am,wh	wh	wh	wh	wh	wh	wh
Flammulated owl	0	stoc	stoc	0	wh,pc	wh,pc	0	0	wh,pc	0	wh,pc	wh,pc
Great gray owl	0	stoc	stoc	0	wh	am	n/a	n/a	n/a	n/a	n/a	n/a
White-headed WP (wh)	0	stoc	stoc	0	1	1	0	1	1	0	1	1
Pileated WP	0	stoc	stoc	0	0	wh,am	n/a	n/a	n/a	n/a	n/a	n/a
Williamson's WP (ws)	0	stoc	stoc	0	0	0.33	0	0	0.33	n/a	n/a	n/a
Lewis WP(l)	0	stoc	stoc	0	0.48	0	0	0.48	0	0	wh	0
Flicker (fl)	n/a	stoc	stoc	0	0.48	0	0	0.48	0	0	0.48	0
Black-backed WP(bb)	0	stoc	stoc	0	0.12	0	0	0.12	0	n/a	n/a	n/a
Three-toed WP (tt)	0	stoc	stoc	0	0.06	0	n/a	n/a	n/a	n/a	n/a	n/a
Hairy WP (hy)	1.92	stoc	stoc	1.04	0	0	0.96	0	0	0	0	0
Sub Totals	1.92	6	5	1.04	2.14	3.33	0.96	2.08	1.33 (2.33)	0	1.48	1 (2)
Totals	12.92			6.51			4.37(5.37)			2.48(3.48)		

Snag Requirements *- The table provides the number of snags/acre that should be provided for each species. The species and snags/acre needed for each species varies depending on the late-successional objective (climatic climax, fire climax, ponderosa pine with > 30 % canopy cover, and ponderosa pine with < 30% canopy cover). Many of the snags needed by one species may be provided by retaining snags for another. For example, in the Fire Climax Mix Conifer (MC), 15-24.9" dbh snags column. The goshawk snag needs are provided by leaving snags for the white-headed woodpecker (wh), other primary cavity excavator (pc) species and the american marten (am).*

***Focal species** literature references for: Spotted owl - Gerdes, M. 1995. DNF northern spotted owl habitat study on upper canyon creek. In the DNF late successional reserves. A late successional reserve overview. **Bald eagle** - Personel communication with F.Isaacs (2/27/97). No snag density guidelines, but 2/acre is appropriate. Leave the largest snags. **American marten** - The Idaho state conservation effort. Draft:Habitat conservation assessment for the american marten in idaho. 1995. 32pp. **Northern goshawk** - USDA forest service, southwestern region.1991. Management recommendations for the northern goshawk in the southwestern united states. **Vaux's Swift** - Bull, Evelyn L.;Collins, Charles T. 1993. Vaux's swift (Chaetura vauxi). In: Poole, A.; Gill E. eds. tTe birds of north america, no.77. Philadelphia, PA. **Big-eared bat** - no snag density guidelines. Bat needs assumed to be met by snags retained for other species. **Flammulated owl** - Northwest Forest Plan. pg C-47, & Bull,E.L., M. Henjum and R.Rohweder. 1988. Home range and dispersal of great gray owls in northeastern oregon. J:Raptor Res. 22(4):107-115. **Great gray owl** - No snag density guidelines. Owl needs assumed to be met by snags retained for other species. **White-headed woodpecker** - Idaho state conservation effort. A species conservation assessment and strategy for white-headed woodpeccker. 1995. 21pp. **Pileated woodpecker** - Bull Evelyn, and R.holthausen. 1985. Habitat use and management of pileated woodpeckers in northeastern oregon. Journal of wildlife managment. 57(2):335-345(1993). **Williamson sapsucker, Lewis , flicker, black-backed , three-toed ahd hariry woodpeckers** - Nietro, et.al. 1985. In USDA Forest service. Deschutes national forest wildlife tree and log implementation strategy. 52pp.*

** **whw(+1be)** = add 1 snag/acre to total when in a bald eagle nesting, roosting and foraging area.*

**pc - primary cavity excavators = ws,l,fl,bb,tt,hy.*

GREEN TREE REPLACEMENT (GTRS) REQUIREMENTS

Climatic Climax Mixed Conifer			
GTR Size Class	Snags Needed	GTRs Needed-Regeneration	GTRS Needed-Thinning
10-14.9	1.92	10.86	6.08
15-24.9	6	24	12.75
25+	5	11.66	5.42
Totals/Acre	12.92	46.52	24.25

Fire Climax Mixed Conifer			
GTR Size Class	Snags Needed	GTRs Needed-Regeneration	GTRS Needed-Thinning
10-14.9	1.04	5.88	3.28
15-24.9	2.14	8.56	4.55
25+	3.33	7.66	3.59
Totals/Acre	6.51	22.1	11.26

Ponderosa Pine >30% CC			
GTR Size Class	Snags Needed	GTRs Needed-Regeneration	GTRS Needed-Thinning
10-14.9	0.96	5.43	2.95
15-24.9	2.08	8.32	4.36
25+	1.33(2.33)	3.06	1.44(2.52)
Totals/Acre	4.37 (5.37)*	16.81(19.11)	8.75(9.83)

*Where bald eagles occur provide 1 additional snag/acre.

Ponderosa Pine <30%CC			
GTR Size Class	Snags Needed	GTRs Needed-Regeneration	GTRS Needed-Thinning
10-14.9	0	6.66	4.16
15-24.9	1.48	5.92	3.15
25+	1(2)	2.3(4.6)	1.08(2.16)
Totals/Acre	2.48(3.48)	14.88(17.18)	8.38(9.46)

REGIONAL ECOSYSTEM OFFICE

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MEMORANDUM

DATE: July 19, 2000

TO: Harv Forsgren, Regional Forester, Region 6

FROM: Curtis A. Loop, Acting Executive Director Curtis A. Loop

SUBJECT: Regional Ecosystem Office Review of Cache Lake LSRA in the Deschutes National Forest

Summary

The Regional Ecosystem Office (REO) and the interagency Late-Successional Reserve (LSR) Work Group have reviewed the Cache Late-Successional Reserve Assessment (LSRA). The REO finds that the Cache LSRA provides a sufficient framework and context for future projects and activities within the LSR. Future silviculture and salvage activities described in this LSRA, with the exceptions and assumptions noted below, that meet both the criteria and objectives of the LSRA and the Standards and Guidelines (S&Gs) in the Northwest Forest Plan (NFP) are exempted from project-level REO review.

Basis for the review

Under the S&Gs for the NFP, a management assessment should be prepared for each large LSR (or group of smaller LSRs) before habitat manipulation activities are designed and implemented. As stated in the S&Gs, these assessments are subject to the REO review. The REO review focuses on the following:

1. This review considers whether the assessment contains sufficient information and analysis to provide a framework and context for making future decisions on projects and activities. The eight specific subject areas that an assessment should generally include are found in the NFP (S&Gs, page C-11). The REO may find that the assessment contains sufficient information or may identify topics or areas for which additional information, detail, or clarity is needed. The findings of the review are provided to the agency or agencies submitting the assessment.

2. The review also considers treatment criteria and potential treatment areas for silviculture, risk-reduction, and salvage activities if addressed in the LSRA. When treatment criteria are clearly described and their relationship to achieving desired late-successional conditions are also clear, subsequent projects and activities within the LSR(s) may be exempted from further REO review, provided they are consistent with the LSRA criteria and NFP S&Gs. The REO authority for developing criteria to exempt these actions is found in the S&Gs (pages C-12, C-13, and C-18). If such activities are not described in the LSRA and exempted from further review in this memo, they remain subject to future REO review.

Scope of the Assessment and Description of the Assessment Area
The Cache LSRA encompasses the northern 17,145 acres of the Cache/Trout LSRA on the Sisters Ranger District, Deschutes National Forest. The southern boundary of the Cache LSR is a half-mile wide connection to the Trout LSR. There are 1,600 acres of private land withing the LSR boundary. The LSR includes most (1,614 acres) of the recently established Cache Mountain Research Natural Area. Almost 3/4 (72%) of the LSR is in a mixed conifer dry plant association group (PAG), with 11% in a mixed conifer wet PAG. The remainder of the LSR comprises primarily small amounts of ponderosa pine, lodgepole pine, and dry mountain hemlock PAGs or sites not capable of being forested.

The LSRA identifies 4 major vegetation trends: (1) greatly increased stand densities; (2) increasing mortality of larger trees and insect and disease damage; (3) species composition shifting from early to late-seral species; and (4) stand structure shifting from larger to smaller trees and from single or double canopy layers to multi-canopy layers. Given these trends, and considering the majority of dry plant groups in the LSR, there is concern over the occurrence of large-scale stand replacing events.

Review of the Assessment
After the Cache LSRA was submitted for review, the Forest also sent additional information based on questions from the work group. These documents included: forest paper entitled "Definition and Procedures for Classifying Stands as Imminently Susceptible to Insect Attack and Wildfire"; a forest document entitled "Deschutes National Forest: A Late-Successional Reserve Overview" (Sept. 1, 1995); a revision of Chapter IX of the LSRA, "Priorities and Implementation", which provided data missing in the original LSRA regarding treatment acres and priorities; a documented response to REO questions dated June 2, 1999; a connectivity strategy dated March 16, 2000; and a document outlining management of mortality areas in the LSR dated May 31, 2000. In addition, the work group members had a field visit to the site on August 17, 1999.

The REO finds the LSRA provides a sufficient framework and context for designing future actions. The assessment provides specific objectives and criteria and identifies possible treatments to achieve and maintain desired conditions. The descriptions of current conditions (forest structure, composition, and vegetation patterns) provide a framework for identification, design, and prioritizing treatments. The LSRA includes treatment types and management strategies at two scales; the stand scale and the broader scale of Management Strategy Areas.

REO Work Group Findings, Additional Clarifications, and Assumptions
The following either clarify statements in the LSRA or modify criteria in the LSRA based upon discussions and agreements with the Forest.

1. Tree culturing will not occur where large dominant pine trees are growing. Clumps having 2 or more closely spaced large dominant and co-dominant trees of similar size age are important LSR habitat components. Culturing will not remove individual trees from these clumps.

2. On page 111 of the review document, the second paragraph recommends against thinning white fir dominated stands and notes that regeneration harvests may be the best way to accomplish conversion of these stands to ponderosa pine. Based on conversations with the forest, we understand that regeneration harvest in white fir stands is not a proposal for treatment within the Cache LSR, and is therefore not exempted from REO review.

3. Page 98 of the LSRA, describes seven situations where removal of large (>21" dbh) trees may occur in the LSR:

   - The first four situations refer to removal of large white fir. We understand the need to remove large white fir in some situations, but we also feel it is important to consider the value of white fir on the landscape and realize that there may be places where it is more desirable to retain these trees than to promote the establishment of other species at their expense. Therefore, removal of large white fir needs to be done in consideration of the uniqueness of the white fir to be removed in the stand and on the landscape.

   - The next two situations refer to removing declining trees (those likely to die in 5-20 years). These actions are not exempted from REO review.

   - The last situation refers to removing large trees that are determined "to be hazards to restoration or risk reduction activities." We assume this statement refers to hazards to human safety that may occur within restoration or risk reduction projects, and not a hazard to the project itself.

4. Where "Small Group Shelterwood" treatments are described on page 113, we understand that it will be replaced with the following language:

   Small Group Shelterwood treatments are designed to reduce the spread of root rot and subsequent loss of late-successional conditions and natural diversity in vast areas over time by removing susceptible tree species from small (2-9 acre) root rot pockets. Where they exist, leave all or most (thin from below if necessary) of the resistant tree species; e.g., pine and larch. If short-term structure is needed, consider leaving 10 to 15 of the largest (>21" dbh) trees of root rot susceptible species, and interplant with seral, resistant species. Also, in order to create a mix of composition and structure across the landscape to benefit development and retention of late-successional conditions, small group treatments can be used to reestablish seral species where no seed source remains.

5. Coarse woody debris amounts to be retained within treatment areas will be derived from Appendix 4, Table 1. Table 1 describes two units of measurement for down wood; the forest will use the number of pieces rather than volume to determine coarse wood retention levels.

6. In fuel breaks, snag and coarse woody debris levels will be met, but will be retained at the low end of the ranges described in Appendix 4, Table 1.

7. As described in the June 2, 1999 response to questions from the forest, the maximum dbh of lodgepole to be removed from treatments units was reduced from 12" to 9".

8. Where there may be potential conflicts between stand treatment criteria in the LSR and treatment criteria described within a particular Management Strategy Area (MSA), the criteria in the MSA will take precedence over the stand treatment criteria.

9. A table found on page 5 of a revised version of Chapter IX Priorities and Implementation is titled "Acres of regeneration areas available for management to enhance development of LS/OG stands". Regeneration areas refer to areas that have previously been harvested by clearcut, shelterwood, or other regeneration techniques, and not areas that are available for regeneration harvest.

Conclusion

Based upon a review of the Forest documentation and discussions with the Forest staff, the REO finds that the LSRA provides a sufficient framework and context for decision-makers to proceed with project development and analysis. As identified above, silviculture and salvage activities described in this LSRA, with the exceptions and assumptions noted above, that meet both the criteria and objectives of the LSRA and the Standards and Guidelines (S&Gs) in the Northwest Forest Plan (NFP) are found to be consistent with NFP LSR S&Gs and exempted from project-level REO review.

cc: REO Reps
William Anthony, Sisters District Ranger, Deschutes National Forest
LSR Work Group
Lisa Freedman, FS

1549/ly