Browns/Wickiup Watershed Analysis

and

Browns/Round Mountain Late-Successional Reserve Assessment

Deschutes National Forest

December 1997

BROWNS/WICKIUP WATERSHED ANALYSIS
and
BROWNS/ROUND MTN. LATE-SUCCESSIONAL RESERVE ASSESSMENT
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and
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AND
BROWNS MOUNTAIN/ROUND MOUNTAIN LATE-SUCCESSIONAL RESERVE ASSESSMENT

Dechutes National Forest
Bend-Fort Rock Ranger District
December, 1997

ABSTRACT

The Browns/Wickiup Watershed Analysis and Browns/Round Mtn. Late-Successional Reserve Assessment has been completed for the Browns and Wickiup subwatersheds located on the Bend-Fort Rock District of the Deschutes National Forest. The Late-Successional Reserve Assessment for Browns and Round Mountain LSRs is included as a separate chapter. It is provided to fulfill assessment criteria identified in Northwest Forest Plan (USDA et al, 1994) guidelines. The analysis and assessment covers a landscape comprised of a variety of Deschutes National Forest Land and Resource Management Plan (LRMP) allocations, including (but not all) of the following designations: General Forest, Matrix, Roadless, Old Growth, Dispersed Recreation, Intensive Recreation, Bald Eagle Management Areas, and Late-Successional Reserves.

The three primary issues guiding the watershed analysis are: 1) vegetative health and sustainability, 2) increased recreational use and the associated resource impacts to wildlife, vegetation, soils and water quality, and 3) future maintenance of recreation infrastructures. A summary of analysis results is found within the document in Chapter II.

Vegetative health is identified as "at greatest risk" to loss within the dry forest types as a result of fire exclusion, high stand densities and shifts in species composition. Long-term sustainability of the dry forest types is a concern due to the presence of stand densities in excess of known stable densities identified for these types of forests.

Recreation use is approaching the carrying capacity for the physical and character setting in some portions of the watershed, especially around Wickiup Reservoir. Opening weekend of fishing season and prime summer weekends have an estimated 3,000 campers in developed and dispersed sites along the reservoir shores. Although the capacity of existing developed and dispersed sites is being tested throughout the recreation season, the recreation experience for most campers generally remains a positive one, even at relatively high use levels.

Damage to resources as a result of recreation use is occurring within Riparian Reserves, although the objectives of the Aquatic Conservation Strategy of the Northwest Forest Plan are being met in most areas. The primary resource concerns in Riparian Reserves include: wildlife disturbance, soil compaction, disposal of human waste, integrity of the recreation character setting, and invasion of noxious weeds. Recreation infrastructures are deteriorating and in need of upgrade improvements, site redesigns and, in some cases, replacement.

The Browns Mountain LSR is identified as "substantially departed" from historic vegetative conditions. Most stands within the dry forest types currently carry high levels of management risk and need density reduction to function as long-term sustainable habitat. In general, the density of the forest is at a nonsustainable and unstable condition which places most stands at risk of mortality from insect and disease agents and future fire events.

The Round Mountain LSR is very small (224 acs.) but occupies a strategic location between the Browns Mountain and Sheridan Mountain LSRs. Connectivity between the LSRs (Figure

7-3) was analyzed and addressed by specific recommendations found in Chapters VI and VII. Habitat management options within the Round Mountain LSR are more limited because of the steep slopes. There is a concern for the potential edge effects and wildfire risks from adjacent lands.

As a result of current conditions and the lack of controversial land designations beyond LSR status, the Browns Mountain LSR is identified as an area that provides a unique opportunity for management actions to remedy current risks. In the context of other LSRs, Browns Mountain LSR currently provides an unencumbered landscape where management actions are not limited by the lack of critical owl habitat or controversial land allocations. Opportunities exist to reduce stand densities and high risk fuels within the Browns Mountain LSR providing stable replacement habitat should forest conditions for suitable late-successional habitat deteriorate within the Cultus and Davis Mountain LSRs.

Chapter I:

Introduction and Watershed Characterization

Chapter I
Introduction and Watershed Characterization

Introduction

The Browns/Wickiup Watershed Analysis and Late-Successional Reserve (LSR) Assessment has provided the opportunity for an interdisciplinary team of social, physical and biological specialists to analyze existing resource conditions while attempting to further understand the interactions and impacts of past and current human uses within the present ecosystems. Analysis of the social, physical, and biological components for Browns and Wickiup subwatersheds are summarized to determine strategies for sustaining resource conditions into the future.

The terms "watershed" and "subwatershed" are used interchangeably throughout the text. Browns subwatershed and Wickiup subwatershed are combined into one "watershed" within this document. A description of the baseline conditions of the water resources and adjacent riparian habitats is included in order to assess their compliance with the objectives of the Aquatic Conservation Strategy. Non-compliant areas are identified as restoration priorities.

The Browns/Wickiup Watershed Analysis and Late-Successional Reserve Assessment (LSR) combines two previously separate reviews into one document. The Browns/Round Mtn. LSRs were analyzed as one of six landscape sub-areas within the watershed, with the LSR as a separate chapter. The resource conditions for the LSRs are referenced at a landscape scale, but are described in greater detail in the LSR assessment as a result of more extensive vegetation and habitat data. As a result, Chapter VII, entitled "Browns/Round Mtn. LSR Assessment", contains references to previous chapters of the watershed analysis in order to condense text and reference material from similar analyses and assessments. Interpretation of many processes within the LSR chapter needs to be within the context of the entire watershed analysis.

The results of an integrated analysis can be found by the reader by referencing the sections "Management Recommendations and Opportunities" in Chapter VI and "Treatment Implementation Schedule and Recommendations" in Chapter VII. These sections include recommendations for restoration, protection and enhancement of various resources, such as Late- and Old-Successional stands, perennial and ephemeral stream channels, and associated riparian habitats. Included are recommended changes for recreational uses around Wickiup Reservoir. The Appendix contains additional rationale and detail which may not be found in the primary chapters of this document.

Watershed Characterization

The Browns/Wickiup Watershed is located on the southwestern edge of the Bend-Ft. Rock District, and contains approximately 56,600 acres, including 18,900 acres of the Crescent Ranger District. Approximately 75% lies within the Northwest Forest Plan (NWFP) boundary (Figure 1-5, Forest Plan Management Areas and NWFP Allocations). The watershed is surrounded by volcanic peaks (The Twins to the west, Davis Mountain to the south, Wickiup and Gilchrist Buttes to the east, and Browns Mountain, Shukash Butte and Round Mountain to the north) and is dominated by Wickiup Reservoir. Wickiup Reservoir encompasses approximately 10,000 acres and was constructed to store irrigation water. It has become a popular recreation area (Figures 1-2 and 3-13).

Landscape Areas

The watershed was divided into six landscape areas (Figure 3-1, further described in Chapters III and IV) based on the physical characterizations of the watershed. Landscape area two contains approximately 1,030 acres of private land. Landscape area six is the two Late-Successional Reserves (Browns and Round Mountains), with approximately 2,480 and 200 acres (respectively) which lie outside of the Browns/Wickiup Watershed boundary. The portion of the watershed surrounding Wickiup reservoir is part of the LaPine basin. This area functions as a cold air sink throughout the year and has seasonally high water tables. Morning surface temperatures in the LaPine basin are often below freezing, even during the summer months. The extreme western portion of the watershed is located on the glaciated slope of the highest feature within the watershed, the 7,000 foot shield volcano called the Twins. The lower elevation of the Twins relative to the predominant features of the Cascade Range allows greater amounts of precipitation to cross over the crest. The watershed receives annual precipitation varying from 45 inches in the western portion down to 25 inches in the eastern portion. Precipitation falls primarily in the form of snow, with occasional spring, summer and late fall rains.

Water

The watershed has few streams (Figure 3-10, Table 3-7). Browns Creek and a section of the Deschutes River are the only two perennial, fish bearing streams within the watershed. The porous surface soils, composed of ash and pumice overlain on glacial till, glacial outwash, and basaltic lava, readily absorb and transfer precipitation (snow melt and rainwater) to subsurface systems, providing for extensive ground water exchange. Wickiup reservoir contains 200,000 acre-feet at full capacity. The surface flow out of the watershed at Wickiup Dam represents only a portion of the precipitation that falls within the basin.

Vegetation

The Browns/Wickiup Watershed is comprised primarily of lodgepole pine, ponderosa pine, and mixed conifer forest communities. At higher elevations, colder forest types dominated by mountain hemlock plant associations provide striking contrast to the common warm and dry plant associations. Remnants of late-successional forest is present within the watershed, but the abundance has been compromised by mountain pine beetle epidemics and harvest fragmentation. Wildfire, insects, and pathogens have all shaped the historic and current conditions of these plant communities.

Fire/Fuels

Fire has been a major disturbance element in the watershed. Large, high intensity fires occurred in the lodgepole and mountain hemlock plant associations within the watershed and the surrounding areas. The combination of weather, beetle-killed trees, and high recreation use contribute to the area's inherent fire-susceptibility. The magnitude of disturbance has changed significantly in some plant communities due in part to the suppression of fire since the turn of the century (Bork, 1984). Where fire was once frequent and light in the ponderosa dry plant association groups (PAGs), the effects were relatively negligible except in understory vegetation and fuels. Contemporary fires are not as expansive due to fire suppression, but the intensity and potency of fires has increased notably. While several fire starts occur annually within the Browns/Wickiup assessment area, only a very small percentage build into large-scale high intensity fires.

Threatened and Endangered Species

Presently, there are no known northern spotted owls within the analysis area. However, potentially suitable habitat does exist, and occupied sites are within approximately 5 miles of these habitats. Other species listed under the Endangered Species Act (ESA) known to occupy the analysis area include: northern bald eagle (Threatened status) and the spotted frog (Candidate status). Seven nesting sites of northern bald eagles are known in the watershed analysis area. An additional four nest sites are located within the portion of the Browns Mountain LSR outside of the watershed boundary. Bull trout, proposed to be listed as "threatened" under the Endangered Species Act are presumed to have been eliminated from the watershed about 40 years ago. The status of the redband trout, currently on the Regional Foresters Sensitive Species list, is unknown. There are naturally-reproducing rainbow trout within Wickiup Reservoir, but it is unclear if they can be considered redband because of the likelihood of interbreeding with stocked rainbow trout. No threatened or endangered plant species are known in the watershed area.

Recreation

Wickiup Reservoir and the adjacent North and South Twin Lakes are high use recreation areas. There are 9 developed campgrounds, providing a total of 235 individual overnight camp sites, and 3 day use sites (not associated with a campground). Use of developed recreation facilities in the Wickiup area has increased dramatically over the last decade. Data collection from 1982 through 1995 indicates a forest-wide increase of 35%. This equates to an increase of 35,000 Recreational Visitor Days (RVDs). Facilities at many developed sites are in need of maintenance and are inadequate for current sizes of recreational vehicles (RVs), and are inaccessible to physically challenged users. Nearly all recreational facilities are in need of maintenance or repair.

Dispersed camping outside of developed campgrounds is very popular in the analysis area, especially at sites near water. Approximately 140 dispersed sites have been inventoried and are occupied 30-45% of summer days. Sites located in the recreation/riparian interface show a loss/degradation of vegetation, soil compaction, sanitation problems, and a change in site character. Approximately 7 miles of trail leading to the Pacific Crest Trail provide access to the backcountry (Figure 3-10, Points of Interest). Other uses in the Browns/Wickiup area include one resort at South Twin Lake and several fishing outfitter-guide services. There is no grazing or mineral extraction occurring at this time.

Recreational fishing is a very popular activity, and a variety of species attract anglers from across the western United States. The game species include: rainbow trout, eastern brook trout, brown trout, kokanee and coho salmon, largemouth bass, brown bullhead, and mountain whitefish.

Fig. 1-1

DESCHUTES NATIONAL FOREST
BROWNS/WICKIUP WATERSHED ANALYSIS AREA

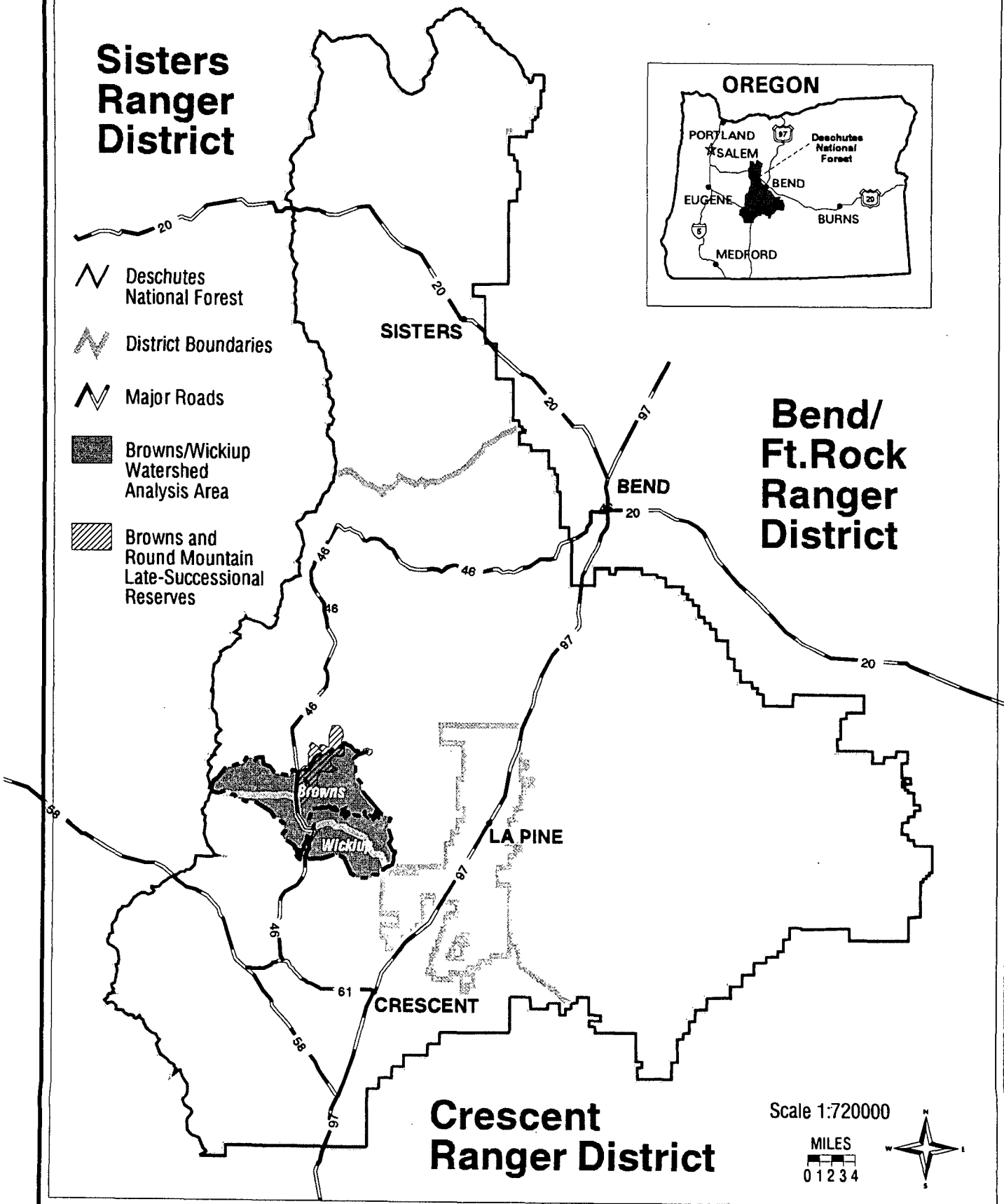


Fig. 1-2

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Topographical View

Deschutes National Forest and District Boundary

Browns/Wickiup Watershed Analysis Area

Late Successional Reserves

Reservoirs, Lakes, and Streams

N W E S

0 1 2

Miles

Scale 1:160000

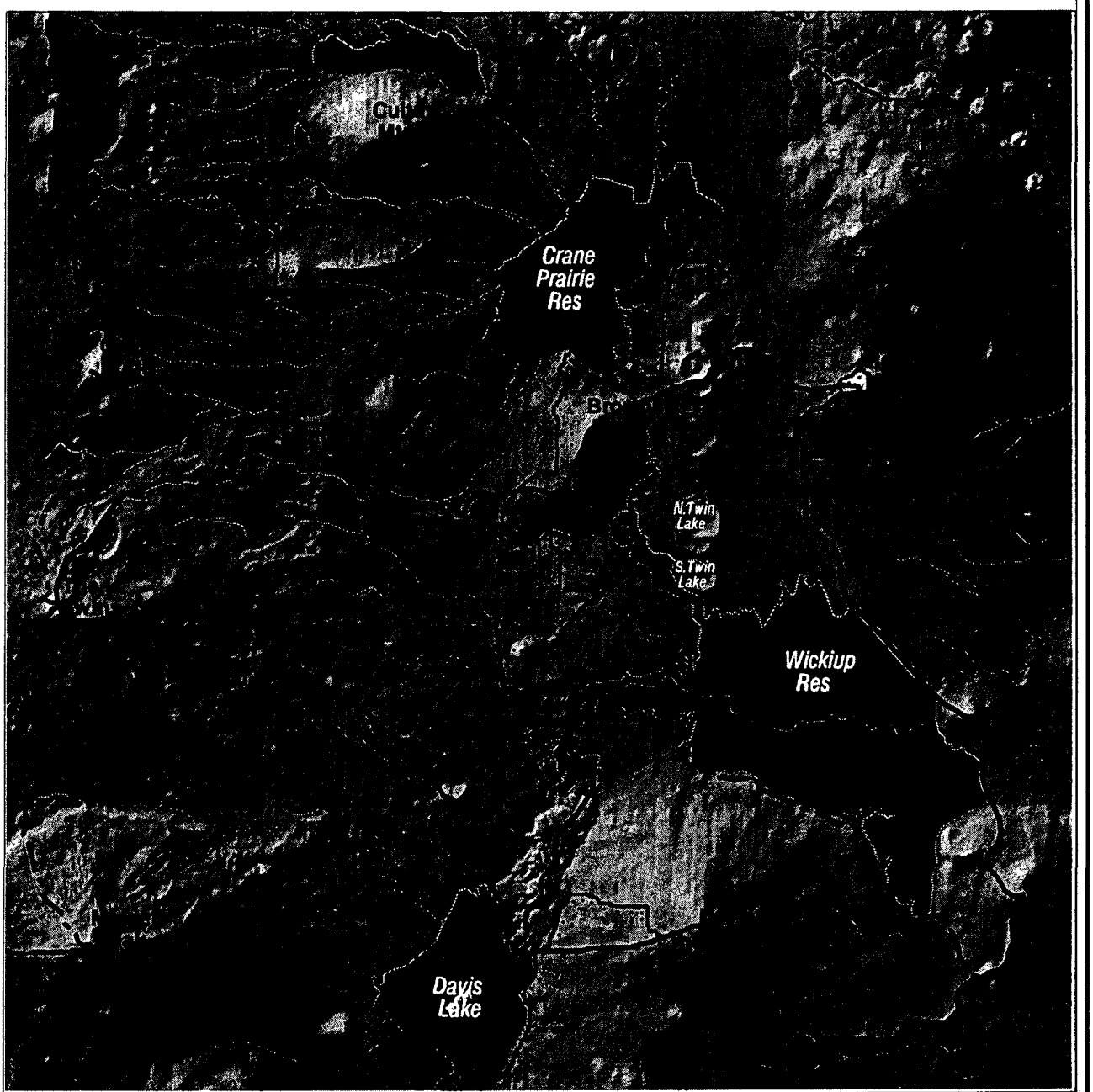


Fig. 1-3

DESCHUTES NATIONAL FOREST
BROWNS/WICKIUP WATERSHED ANALYSIS AREA
Forest Subwatershed Boundaries and Late Successional Reserves

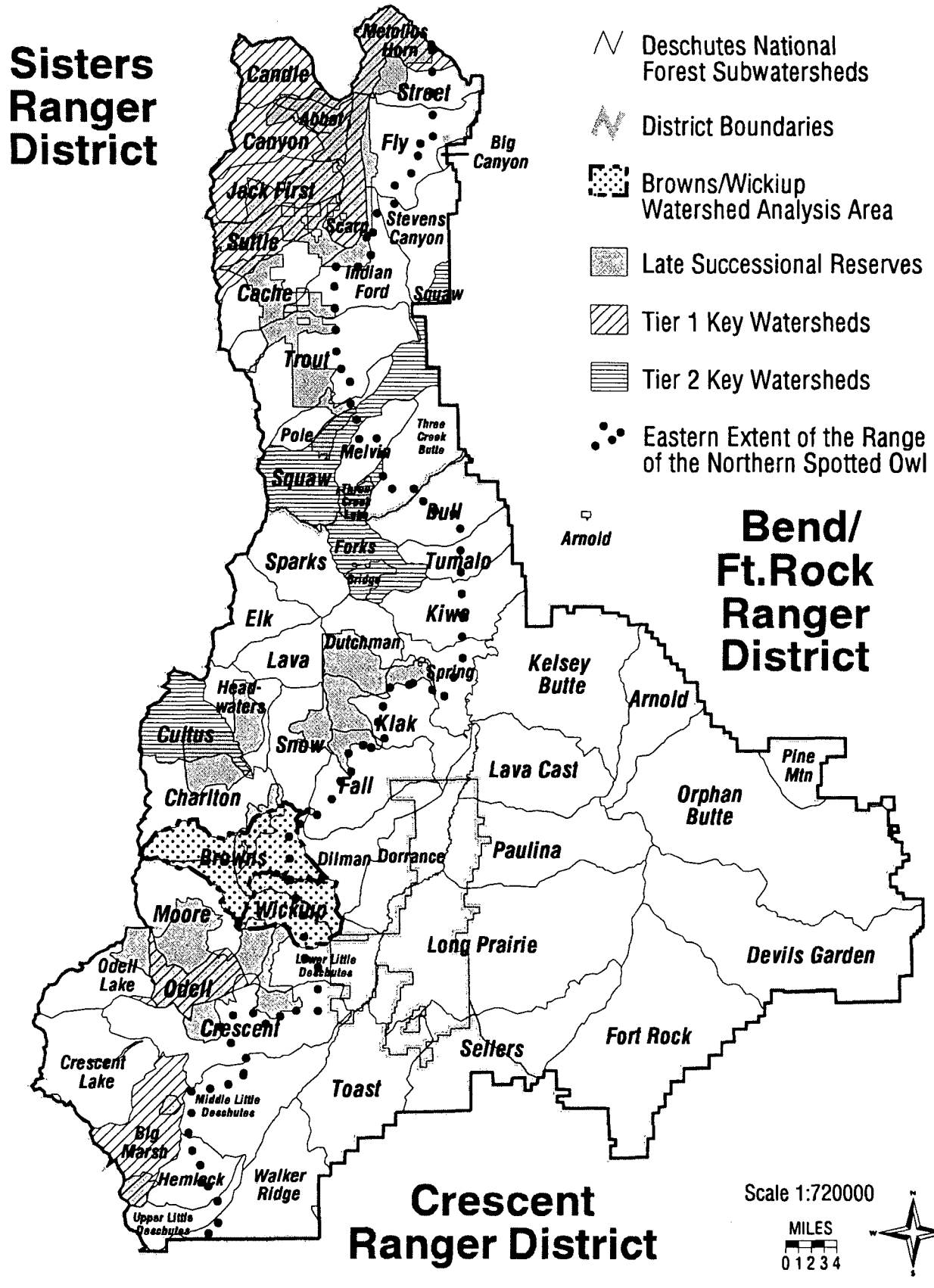


Fig. 1-4

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Subwatersheds and Late-Successional Reserves

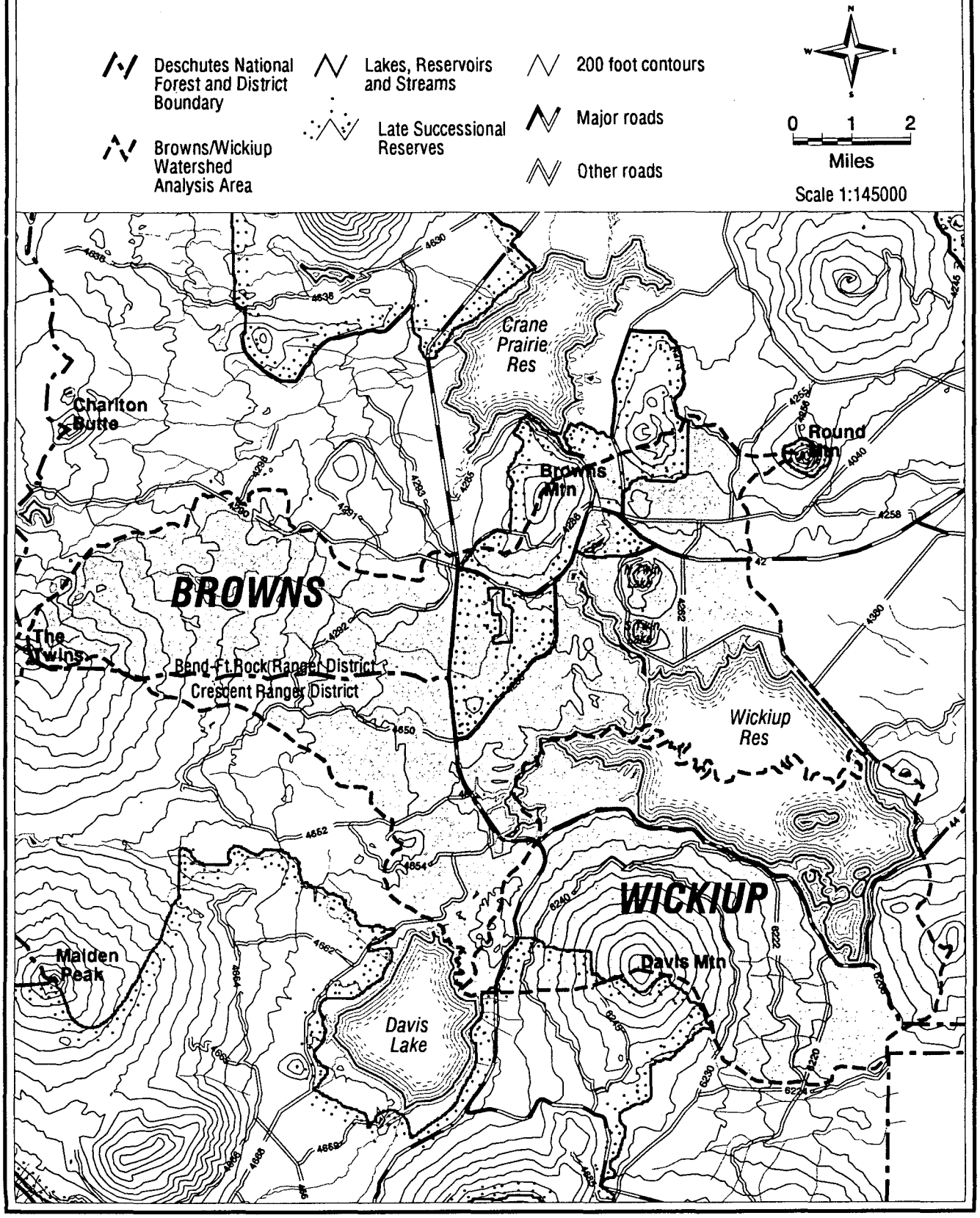


Fig. 1-5

BROWNS/WICKIUP WATERSHED ANALYSIS AREA
Forest Plan Management Areas and NWFP Allocations

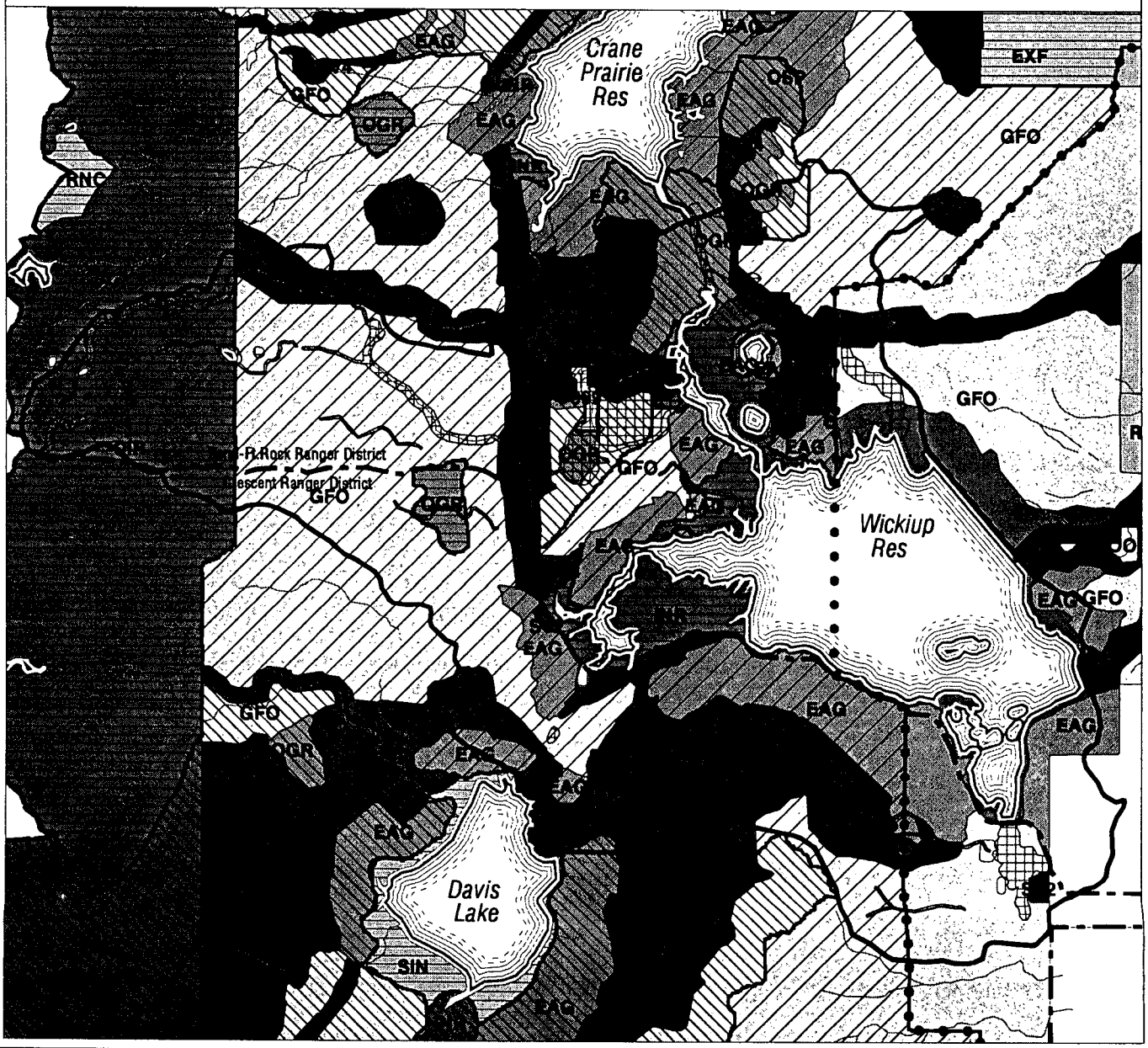
- Deschutes NF and District Boundary
- Browns/Wickiup Watershed Analysis Area
- Eastern Extent of Owl Range
- Reservoirs, Lakes, and Streams
- General Forest
- Scenic Views
- Recreation Areas
- Eagle and Osprey Management Areas, and Old Growth
- Wild, Scenic, and Recreation Rivers
- Experimental Forest, Research Natural Areas, and Special Interest Areas
- Other Ownership
- Adminstrative Withdrawal
- Matrix
- Proposed Riparian Reserves
- Late Successional Reserve

N, W, E, S

Scale 1:145000

0 1 2

Miles



Chapter II:

Issues and Key Questions

Chapter II
Issues and Key Questions

The purpose of this chapter is to focus on the key elements of the ecosystem that are relevant to the management objectives, human values, and resource conditions within the watersheds. See Figure 1-5 for a display of management allocations.

Key issues are incorporated from an adjacent watershed analysis (Cascade Lakes, 1995) with similar dominant physical, biological, and social attributes. After review and analysis, Issues #1, #2, and #3 are refined to reflect the priorities found in the Browns/Wickiup subwatersheds. Priorities were not assigned to the three issues as the team did not weight one domain over another. Key questions were formulated to focus the team analysis. Units of measure are used to interpret key ecosystem elements and are found throughout the analysis.

Key Issue #1:
The desired conditions for riparian health, water quality, fish, and riparian habitat for dependent wildlife may not be attainable with the present amount, duration, and type of dispersed recreational use.

Background: Dispersed camping and other recreational activities are creating loss of vegetation and soil compaction along lakes, reservoirs and streams, which in turn creates shore erosion, affects water quality and diminishes riparian habitat. Water quality is important because it affects fisheries, downstream uses, and the recreational experience. Disposal of human waste is also occurring within 100 feet of the high water line of both Crane Prairie and Wickiup Reservoirs.

Key Questions:
• What level of use and quality of recreational experience can occur in riparian reserves and around Wickiup Reservoir while maintaining the desired biological, physical, and social resources in the long term?

Measure:	Inventory of existing dispersed and developed sites
	Acres of impacted dispersed sites (current and potential)
	Carrying capacity (# of sites/mile of shoreline)
	Recreation experience surveys

•What is the status of water quality within the watershed, and what activities threaten or benefit its quality?

Measure for streams:	Fine sediment volume
	E. Coli bacteria
	Temperature
	Macroinvertebrate communities
Measure for lakes and reservoirs:	E. coli bacteria
	Transparency
	*Nutrient concentrations
	Major ions
	PH
	Conductivity
	*Plankton communities
	*Road density and proximity to water

* Phosphorus is tied to soil erosion; roads are soil conduits

•How are current activities and trends within the riparian reserves and Bald Eagle Management Areas (BEMAs) affecting habitat and populations for dependent fish and wildlife?

Measure:	Current conditions affecting future trends
	Population/breeding numbers

Key Issue #2:
The desired condition of the forest may not be attainable. Social expectations may exceed resource capabilities as illustrated by:

a. **Past harvest practices has limited future management options by creating fragmentation resulting in loss of connectivity for dependent wildlife species;**
b. **Fire exclusion and natural succession have changed the historical fire regime and reduced the ability to suppress wildfire;**
c. **Forest resilience to insects and disease, as a result of fire exclusion, has diminished as stand densities increase and shade tolerant species populate warm/dry sites.**

Background: Large, high intensity fires historically occurred in the lodgepole and mountain hemlock plant associations within the Browns/Wickiup watershed and the surrounding areas. Fire exclusion has resulted in a highly unstable condition in many of the ponderosa pine and dry mixed conifer stands, increasing the potential for more frequent and larger disturbances. Conditions which contribute to these disturbances include encroachment of fir into stands which were once relatively fire tolerant. Over-crowded and weakened trees are competing for limited water and nutrients. Although some level of dead and dying trees are an important component of ecosystem processes, significant acres of dense stands are imminently

susceptible to insect and disease.

The dilemma is to balance both short-term and long-term objectives for a more stable, resilient ecosystem. This system became unbalanced over a long period of time and a quick fix may not be available.

Key Questions:

• What are the natural and human caused disturbances which have shaped the existing landscape and watershed condition?

Measure:	Historical range of variability (HRV) for forest vegetation
	Map layers representing historical harvest, thinning, and fire
	Fuel models by acres
	Acres where fire regime can be restored without pre-treatment
	Percentage of forest stands dominated by shade intolerant species
	Stand densities
	Historical insect and disease disturbance patch sizes
	Acres of high risk stands
	Road densities

• What are the root causes of the current unstable conditions within suitable bald eagle habitat and how can the risk of losing that habitat be reduced?

Measure:	Parameters for loss of large trees with large open limbs used for nesting and roosting
	Map of suitable bald eagle habitat
	Stand densities
	Road densities

• What are the effects of forest fragmentation on interior forested habitat and connectivity between habitats for dependent plants and wildlife?

Measure:	Baseline patch size and number
	Number and width of wildlife corridors connecting desired stands
	Size and condition of interior forest relating to dependent species
	Acres of regeneration
	Acres of Late- and Old-Structured (LOS) habitat
	Road densities

• What is the resilience of large trees in the dry forest type?

Measure:	Stand densities, by plant association group (PAG)
	Species composition

• What is the historic range of variability in the Late-Successional Reserve (LSR) Forest?

Measure: HRV estimates of the structural stages by PAGs
Current and future trends of the structural stages by PAGs

• What animal species related to late-successional and old-growth forest have potential for occupancy within the LSR?

Measure: Listing of potential species
Acres of suitable forest type

• What are the nesting, roosting, and foraging (NRF) habitat requirements for the northern spotted owl in an eastside forest and how much NRF exists within the watershed?

Measure: Acres of suitable nesting, roosting, and foraging habitat
Acres of NRF utilized by owl pairs in adjacent watersheds

• What percentage of the LSR or adjacent stands is in excess of NRF requirements and which can be manipulated to maintain future resiliency?

Measure: Acres in excess of NRF requirements
Acres which are not resilient to disturbance

• What factors determine if large trees with a multi-stratum condition would benefit from stocking level reduction, given signs of decline and mortality within the next 20 years?

Measure: Density related to sustainability per PAG
Departure from HRV (stages 6 and 7)
Average crown ratio per overstory tree
Presence of bark beetles

Key Issue #3:
The desired condition for developed and dispersed recreation, may not be attainable with present and predicted use levels and the deterioration of recreation facilities.

Background: Maintaining a quality recreation program will become increasingly difficult with more recreationists using the same facilities and areas. Current recreation budget allocations have been reduced approximately 40% since 1993, making it more difficult to respond to operation and maintenance needs, as well as user expectations for clean and efficient facilities.

Many of the recreation facilities were constructed 25+ years ago and are now in need of costly repair or replacement. Currently, there is little to no funding allocated for the

replacement of these facilities (water systems, rest rooms, etc.)

Increasing recreation use due to rapid population growth, more leisure time, and technological development has resulted in a changing experience. What once was a quiet, serene setting is now a busier, fast-paced environment which is in direct conflict with some recreationists values.

Key Questions:

- What is the desired condition for recreation, both developed and dispersed?

Measure:	Desired condition per landscape sub-area
	Amount of resource impacts present and/or acceptable

- What is the current level of use and quality of recreation and what is the trend over time?

Measure:	density of campsites
	occupancy rate

The following key question was removed as a result of a variety of physical and locational factors:

- How do we maintain water quality and instream flow regimes (peak flow, duration, timing, water yield) as upland timber stands are actively managed?

In the Browns/Wickiup subwatersheds, upland management of timber stands appears to have a minimal effect on water quality and instream flow regimes due to the combination of porous soils, moderate slopes and the presence of a small number of perennial and ephemeral stream channels. The porous soils and moderate slopes contribute to a rapid movement of precipitation to the subsurface system, providing extensive ground water exchange. While slopes are slightly more extensive along the reach of the Deschutes River between Crane Prairie and Wickiup Reservoirs, increases in instream flow as a result of past harvest activities have been minimized by existing vegetation buffers in this area.

Browns Creek is also buffered by a reasonably wide vegetation barrier and low to moderate slopes. The most likely increases in overland flows within the subwatersheds are associated with roads and harvest areas adjacent to an ephemeral stream channel in the central portion of the watershed, one which currently empties seasonal and storm event flows into two borrow pits located along road 46. Therefore, the interrelationship of upland timber stand conditions, water quality and instream flow regimes was removed as a key question, although the issues and concerns involved with these areas are still addressed.

Summary of Analysis Results

The following statements are some of the key findings of the watershed analysis. These findings are grouped into four headings including: 1) Matrix/General Forest lands, 2) Recreation Waterbodies, 3) Wildlife, and 4) Late-Successional Reserves.

Matrix/General Forest

- Most mountain hemlock stands are currently within historic fire regimes and appear to be stable for both the short- and long-term. The native fire return interval is approximately 250 years. Other plant association groups have a shorter fire return interval and thus are more affected by fire exclusion since the turn of the century.

- Most mixed conifer dry PAGs are currently in a high density condition as a result of fire exclusion and forest succession, and are not stable nor sustainable, thus carrying an element of risk associated with long-term ecological function.

- Most lodgepole pine stands have been harvested as a result of salvage/fiber recovery activities following mountain pine beetle epidemics to reduce the risk of an uncontrollable wildfire. These treatments have compacted and displaced the soil to a point where long-term productivity on certain sites may be decreased.

- Most ponderosa pine stands, especially those located on forested lavas, have high levels of dwarf mistletoe inoculum.

- Late-structural, single story stands, which once dominated the dry plant associations are now a minor component of these subwatersheds.

Wildlife

- Stand densification due to lack of natural fire has increased the probability of insect/disease epidemics and stand replacement wildfire. LOS habitats are at risk in local areas.

- Competition between trees is causing stress on desirable overstory species such as ponderosa pine and Douglas-fir, reducing the regeneration of these species.

- Connectivity between LSRs and other LOS habitats has been compromised as a result of insect and disease, salvage and other prescriptive harvest activities.

- Most large trees within the Bald Eagle Management Areas (BEMAs) are stressed from competition with understory vegetation. Eagle nesting habitats are at risk.

- Disturbance to some individual sensitive species such as bald eagles is widespread and due to

dispersed recreation, open roads, and management activities.

Recreation Waterbodies (Wickiup Reservoir, North and South Twin Lakes, and a portion of landscape sub-area 6 which includes Crane Prairie Reservoir and the Deschutes River)

- Dispersed campers at Wickiup have created impacts to the character setting, primarily from overuse (vegetation degradation, garbage, etc.) and over crowding to a point where some feel their recreation experience has diminished. Others do not seem to mind over crowding and the loss of seclusion.

- Dispersed recreation use continues to increase, including extended camping stays along the reservoir shores and the use of pit toilets for disposal of human waste.

- Resource damage as a result of dispersed use appears to be mostly limited to existing sites. Areas for parking, campfires and access to shoreline are compacted and denuded of vegetation. Based on sites inventoried in 1993, increases in the size or number of sites is not readily apparent. Only a few sites (less than six) were added to the inventory around Wickiup Reservoir. Some of the higher use sites around Fat Man's Point have expanded in size. Shoreline instability is not extensive, primarily as a result of the gradual slope transition from upland to reservoir shoreline conditions.

- Although data is very limited, water quality within Wickiup Reservoir meets standards and has not changed significantly since the early 1980s.

- Noxious weed populations are present along some shoreline sections of Wickiup Reservoir and appear to be expanding.

- Localized impacts have occurred to riparian vegetation and snag habitat from dispersed campers.

- Recreation/riparian restoration projects implemented in 1991 at dispersed areas around Crane Prairie and Wickiup Reservoirs are not successful due to a segment of the public which disregards signs and barriers.

- The current condition of shoreline habitat and the physical integrity of shoreline banks at all lakes and streams are in reasonable shape considering the amount of recreational use. Increasing use or expansion to new sites could exacerbate disturbance to sensitive species (Aquatic Conservation Strategy Objective #1). Establishment of noxious weed populations, and the reduction of late-structural vegetative structure stages surrounding Wickiup Reservoir (Aquatic Conservation Strategy Objectives #8, #9) may place this area at risk to non-consistency with the Aquatic Conservation Strategy (ROD, NWFP, page B-11).

Late-Successional Reserves

- Roughly 90% of stands are currently classified as either moderate or high density and contain a large element of management risk in their current condition.

- Approximately 90% of the LSR contains fuel models 6 or 10, considered to be high hazard due to fuel loadings and arrangements..

- High density stands which exhibit long-term instability, are present throughout the LSRs.

- Reduction of stand densities in some Management Strategy Areas (Chapter VII) could still provide habitat for representative species.

- Habitat for the northern spotted owl exists on the north side of Browns Mountain, although a 1997 survey not find any owls present. Timber harvest and road activities in areas adjacent to the LSR have significantly reduced or eliminated dispersal habitat for spotted owls attempting to move from established nest sites in LSRs to the north and south.

- Stands in forested lavas contain dwarf mistletoe at or above endemic levels.

- Human use within and adjacent to the LSR is increasing, but appears to be at levels which are not adversely affecting LOS species populations. Bald eagle populations along the south shore of Crane Prairie appear to be at the greatest risk from disturbance.

- Unique habitats are found adjacent to Browns Creek.

- The current condition of riparian habitat adjacent to perennial streams appear to be meeting the objectives of the Aquatic Conservation Strategy, excluding objective #4 (water quality) and objective #6 (instream flow). Water quality and instream flow objectives are not always met in the Deschutes River as a result of water storage practices for irrigation within Crane Prairie Reservoir. Pooling of water increases temperature and turbidity. The need for irrigation determines the release of water from Crane Prairie Reservoir. Changes to water release strategies are outside the scope of this analysis.

Chapters III and IV:

Reference and Current Conditions

Chapters III and IV
Reference and Current Conditions

The existing vegetative condition was mapped and summarized by utilizing data from the 1988 Pacific Meridian Resources (PMR) Integrated Satellite Imagery (ISAT) as a starting point for assigning structural and seral stages. The structural and seral stage assignments were then updated using a forest-wide large tree mapping effort, aerial photography interpretation, recent activities and recent stand exams. ISAT imagery (Figure A-2) was useful for landscape level and coarse scale comparisons. For more details and rulesets, reference the Vegetative Appendix under the heading "GIS-assigned Structure Stage to Charlie-Brown-Wickiup outside of Stand Exams". Note: this satellite data did not go through the rigorous classification and ground-truthing process that PMR performed on the 1988 satellite data. It is used for display purposes only.

Landscape Sub-Areas

The landscape was divided into 19 sub-areas based upon the following criteria: key issues and questions, resource conditions within the watershed, and the social, physical, and biological domains. The sub-areas are shown on Figure 3-1. This division allowed focus on relevant issues. A brief description of each sub-area is provided in Chapter V, Trends and Interpretation.

To further stratify analysis, vegetation was grouped into dry, moist and cold categories (Table 3-1):

Table 3-1

Forestland Vegetation Classification

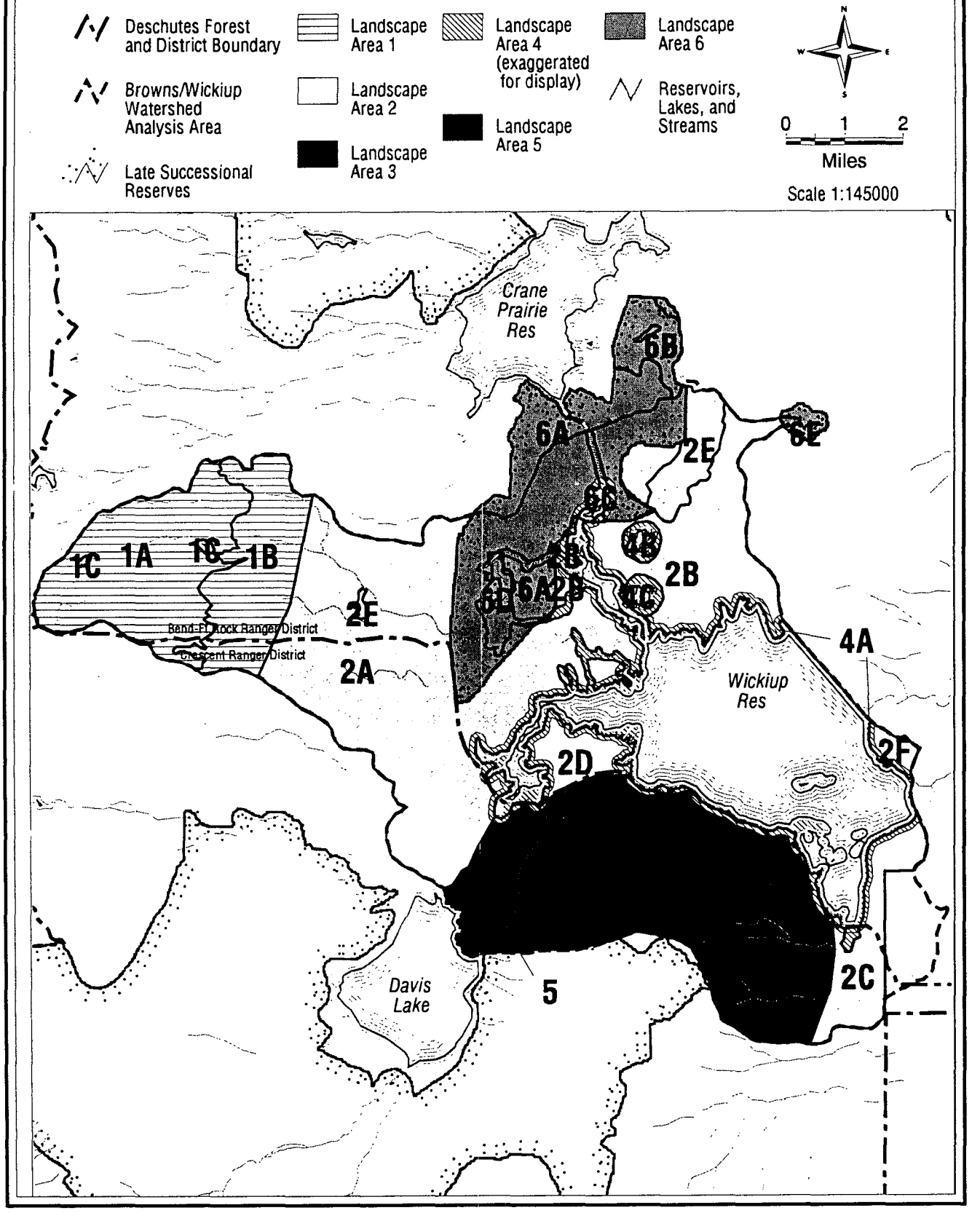
Potential Vegetation Group	Plant Association Group	Potential Vegetation Types
Dry Forest	Mixed conifer dry Ponderosa pine dry/wet Lodgepole pine dry	Dry grand fir/white fir Interior ponderosa pine Lodgepole pine-Oregon
Moist Forest	Mixed conifer wet Lodgepole pine wet	Grand fir/white fir - East Cascades Spruce-fir wet
Cold Forest	Mountain hemlock	Mountain hemlock-East Cascades

Modified from Hann et al. (1996) as described in ICBEMP DEIS (1997)

Fig. 3-1

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Landscape Areas and Sub-Areas



Soils

Reference Conditions For Soils

Soils are classified into seven broad soil type groups (Table 3-2). These groupings reflect differences in soil characteristics that affect their response to management, and the amount and type of vegetation they support.

Table 3-2 Characteristics of Soil Type Groups

Soil Type Groups	SRI* Mapping Units	General Characteristics
Wet/Riparian	2, 5, 8, 43, WE, WF, and WH	• High seasonal or year round water table • Primarily drainage bottoms and wet meadows • Support diverse types of vegetation (forbs/grasses, trees, shrubs) • Variable textures and rock fragment amounts
Upland: Moderate Elevation	17, 19, 21, 25, 41, 44, 45, 46, 67, 70, 73, 81, 82, 96, 97, 98, 6B, 9C, GK, MN, MP, PJ, PM, and XH	• Moderate depths of coarse textured Mazama tephra and/or residual soils over glacial till, glacial outwash and/or basaltic lavas) • Elevation below 6,000 foot/cryic soil temperatures
Forested Lava	14, 65, LL, LM and MR	• Thin layers of Mazama tephra and/or thin residual soils on lava. • Matrix of soil accumulations that support vegetative growth, and rock outcrops • High productivity with limitations on reforestation.
Alpine Uplands	16, 85, HG, HM, HN and MX	• Low to moderate depths of Mazama pumice and ash • Elevation above 6,000 ft/cryic soil temperatures • Marginal site productivity • Deep seasonal snowpack
Coarse Soil Tephra	7, 9, 12, 13, 57 and 83	• Coarse material present on the surface or within the rooting zone • Porous soils • Marginally low site productivity • Generally above 6,000 ft./cryic soil temperatures • Deep seasonal snowpack
Barren Lava	1, 11	• Rough lava flows of recent origin • Little or no surface soil • Supports little or no vegetation
Upland Slopes >30%	68, 69 and 9Z	• Surface material susceptible to displacement • Productivity varies by aspect and soil depth • Harvest system design and mitigation necessary

*Unique codes found in the Soil Resource Inventory

Inherent Productivity

The inherent productivity of the soil resource is the primary reference condition used to assess the level of change or impacts incurred by management activities. Inherent productivity is based on site class and growth rate measurements collected by ecologists and silviculturalists during the development of plant association guides and soil mapping, both of which assume low levels of disturbance or "natural" conditions.

The inherent productivity of the soils within the watershed were stratified using the site class designated for each soil type in the SRI. Site classes (defined as soil potential for vegetation) on the Deschutes National Forest range from 4 to 7, with high =4, moderate =5 or 6, and low =7. Table 3-3 summarizes the inherent productivity for the landscape sub-areas.

Table 3-3

Inherent Productivity by Landscape Area

Landscape Area	Total Acres	% High	% Moderate	% Low
1	7,490	16%	42%	42%
2	20,680	55%	45%	<1%
3	10,120	90%	10%	-
4	1,740	9%	91%	-
5	1,410	3%	1%	15% (81% Lava)
6	7,460	70%	29%	1%

The majority of the soil resource within the watershed is inherently high or moderate productivity, indicating that these soils have some resiliency to disturbance. The soil characteristics that contribute to the higher inherent levels of productivity include unimpeded rooting depths, textural classes that allow for water infiltration and percolation, and soil particle composition that allows for moderate water holding capacities. Landscape areas 2, 3 and 6 have a large percentage in the moderate and high productivity classes, indicating they contain the most productive forests within the watershed.

Reference Conditions by Vegetation Class

Reference conditions of the soil resource can also be stratified within the three primary potential vegetation groups identified in the watershed. The historic ecological condition of the soil resource was one of low physical disturbance, moderate to low nutrient content and varying amounts of litter and duff. Historic physical conditions are represented by undisturbed

areas of soil on the existing landscape and generally occur on all soil types within the watershed. Soils naturally exhibited low soil strengths and bulk densities within the rooting zone, as well as distinct stratification of organic and mineral horizons. Nutrient analysis conducted after fertilizer application on pumice and ash soils has shown them to be limited in nitrogen, phosphorus, and sulfur in both natural and disturbed settings (person communication with Cochran, 1996). Fire was the primary disturbance affecting nutrient, organic matter, and litter and duff levels. These conditions varied based upon the fire return interval for the dry, moist, and cold forest types.

Dry Forest Type

Soil conditions and productivity in the dry forest types were influenced by regular fire intervals estimated to average ten years. Litter and duff levels were limited by the regular fires that occurred primarily as cool underburns. Because decomposition rates on these sites are low, the periodic fires are thought to have accelerated litter decomposition and provided a regular flush of available nutrients to vegetation surviving or regenerating after a fire. Stand replacement fires may have caused some physical soil damage and nutrient volatilization beneath down logs where higher temperatures occurred for a longer duration. Long-term effects of fire induced soil damage are not apparent on the landscape today, indicating it was not extensive in these forest types.

The relatively low amounts of litter and duff in dry forest types most likely enabled wind erosion processes. Loss of surface material probably occurred on a regular basis and likely increased during the first few years following a fire event. While water erosion was not extensive, it could occur on a rill or gully basis during peak thunderstorm events, due to the coarse texture and high detachability of the ash and pumice particles.

Moist Forest type

Soils in the moist forest types were less influenced by fire disturbance than in dry forest types, although when fire did occur it was more often a stand replacement event. Litter and duff levels were historically allowed to accumulate to a few inches in depth, covering the majority of the soil surface within a stand. Decomposition rates in moist forest types were slightly higher than in the dry forest types, reducing the reliance of these soils on fire disturbance for nutrient flushes in order to maintain productivity.

In moist forest types, coarse wood is a greater component on the forest floor than on drier sites, most likely supporting greater amounts of microbial and invertebrate populations. Although the coarse wood component may have contributed to higher surface temperatures for longer durations during fire events, the overall soil damage was still relatively low, as evidenced by the current levels of vegetative growth on these sites and the lack of apparent burn damage within the mineral soil.

Cold Forest type

Soils in the cold forest types were least influenced by fire disturbance within the watershed, although when fire did occur, the intensity was generally moderate to high. Fire return intervals were in excess of 200 years in the mountain hemlock stands and around 100 years in the higher elevation lodgepole pine stands. Relatively long fire return intervals in combination with low decomposition rates allow for significant accumulation of litter, duff and coarse wood on the soil surface.

Two fire events, the Airstrip fire on Santiam pass in 1967 and the Moolack/Charlton Complex in 1996 occurred in the cold forest types and likely represent historic conditions as a result of fire events. Fire behavior in these two events was relatively extreme, although damage to the soil was limited by the quick movement of the fire front that shortened the duration of excessive temperatures. As a result of these fires, the mineral soil exhibited hydrophobic characteristics in some areas.

Productivity of soils in the cold forest types is limited by cold soil temperatures that reduces biological activity within the rooting zone to a few short months. This is slightly offset by precipitation levels that approach 50 inches annually.

Current Condition For Soils

The current condition of the soil resource is determined by assessing the level of detrimental disturbance incurred from past management activities. Activities that have impacted the soil resource include timber harvest activities, road building and the recreational use associated with waterbodies such as Wickiup Reservoir and North and South Twin Lakes. The degree to which the soil resource has been affected by these activities varies within the landscape sub-areas according to the type, number and intensity of harvest entries, the density of roads, and the proximity of recreation sites to water.

Four existing condition classes for the soil resource are determined based on the extent of detrimental compaction, displacement, puddling, erosion and burn damage present. Condition Class A is equivalent to 0 to 10% detrimental disturbance, Class B 11% to 20%, Class C 21% to 40% and Class D > 40%. The latter two classes do not meet Region 6 Soil Quality Guidelines for detrimental disturbance and are considered to have altered productivity.

Stratification of areas into the four condition classes is done using activity code records and photo interpretation. The following harvest prescriptions are used to classify areas with records of activity: Class D (Prescriptions = HCC, HOR or HFR), Class C (Prescriptions = HCP, HCR, HSH, HSV or HTH), and Class B (Prescriptions = HPL, HPR, HSA, HSC or HSL). See Appendix Table A-7, Activity Codes Since 1988.

Table 3-4 summarizes the current level of impact by landscape area. These figures do not yet reflect the acres rehabilitated through subsoiling within the landscape sub-areas. Units that have been subsoiled will have their Condition Class upgraded to Classes A or B.

Table 3-4

Soil Condition Class

Landscape Area	Total Acres	% Class A	% Class B	% Class C	% Class D
1	7,490	62%	29%	6%	3%
2	20,680	8%	26%	40%	26%
3	10,120	17%	28%	40%	15%
4	1,740	37%	15%	40%	8%
5	1,410	98%	2%	-	-
6	7,460	32%	44%	14%	11%

Activity code records and management allocation are the best indicators of the type and extent of disturbance within a given landscape area. Landscape areas 2 and 3 are both comprised primarily of Deschutes Land and Resource Management Plan (LRMP) General Forest allocations and have the greatest extent of ground-based mechanized harvest activity codes. Each of these landscape areas has over 50% of their soil resource in a Condition Class which does not meet regional standards for detrimental disturbance, specifically Classes C and D (FSM 2500, Watershed and Air Management, 1996). Landscape area 4 has the greatest disturbance from recreational uses such as dispersed camping and daily shoreline use. Shoreline vehicle camping has occurred for many years around Wickiup reservoir, primarily in areas accessible from existing roads. The extent of damage to the soil resource varies according to the density of campsites and the vegetation present on site. Trees are the primary component limiting the enlargement of existing sites, or access to new sites.

Landscape area 6, has a comparatively low amount of soil impact. This is a result of fewer commercial entries and selective harvest prescriptions on Browns and Round Mountains, as well as Wuksi Butte.

Effects of Management Impacts

The ecological condition of the soil resource has changed primarily due to mechanized harvest activities (Table 3-5), recreational traffic, and fire exclusion. Mechanized harvest activities and recreational traffic affect the physical component of the soil through compaction and displacement, fire exclusion has allowed litter and duff layers to accumulate in various plant associations. Fire exclusion has also reduced the number of cooler underburns that were

historically prevalent and which provided a regular nutrient flush into these systems.

The primary physical soil disturbances are compaction of the soil profile from compressional and vibrational forces of mechanized machinery, and the loss of natural horizon stratification from the displacement and mixing of the mineral soil A horizon. These disturbances can alter normal soil/water and plant/soil relationships depending on the size of the disturbance across the landscape.

Soil monitoring on the forest shows that a 20% or greater increase in bulk density is often reached in ash and pumice soils from vibrational and compressional forces incurred by ground-based machinery. This level represents an exponential increase in soil strength and is capable of restricting the growth and natural function of plant roots. The productivity of sites on the forest can be compromised under these conditions, especially when combined with an altered soil/water regime as a result of a change in infiltration rates.

The rehabilitation of compaction in the soil profile is possible by subsoiling areas of excessive impact. While subsoiling does not address the loss of surface horizons and the mixing of organic matter as a result of previous management activities, it does relieve compaction to a level favorable to natural soil/water and plant/soil processes. Mineral soil horizonation, including the replenishment of a natural mineral A horizon, is the slowest component of these disturbed systems to return.

Fire exclusion within the watershed has allowed litter and duff levels to increase in some areas above those that would be found under regular fire return intervals. The lodgepole and mixed conifer dry plant associations appear to have the greatest amount of accumulation as a result of this exclusion. The mountain hemlock association has a thick layer of litter and duff but appears to be within the outer extent of normal fire return intervals, while the drier ponderosa pine sites have accumulated some additional surface organics, although rarely in a uniform mat across a given stand. Site productivity and response to fire are the primary soil components affected by these accumulations.

Assessing the quantitative effects of physical soil disturbance on site productivity is still ongoing, although research indicates that the alteration of physical soil properties can reduce vegetative growth. Some regeneration stands of lodgepole pine in landscape area 2 appear to have slower establishment and growth of seedlings on highly disturbed landings and skid trails when compared to the rest of the unit area.

Table 3-5

Harvest Summaries

Type of Activity[1]		Acres by Decade			
		1970s	1980s	1990s	Unknown Date
Activities That Change Forest Structure	Regeneration	2320	6090	3890	-
	Overstory Removal	2750	2160	200	-
Activities That Do Not Change Forest Structure (Thinning)		5110	4370	6360	3510
Activities That Initiate New Forest Structures (Reforestation)		350	50	5040	3110

1. Acres will overlap between these categories.

Water

The Browns/Wickiup Watershed water resources are dominated by Wickiup Reservoir at over 10,000 surface acres and 200,000 acre-feet when at full capacity. Four natural lakes are located within the watershed (Table 3-6): Johnny (17 acres), Found (6 acres), North Twin (103 acres), and South Twin (101 acres). Johnny and Found Lakes were formed by glacial action. North and South Twin Lakes were formed by explosive blasts when groundwater came in contact with rising lava. The trophic status of the lakes range from ultra-oligotrophic Johnny to mesotrophic Wickiup Reservoir.

There are few streams, perennial or intermittent (Table 3-7, Figure 6-3). The porous surface soils, composed of ash and pumice overlain on glacial till, glacial outwash, and basaltic lava, absorb and transfer precipitation subsurface (snow melt and rainwater) providing for extensive ground water exchange. The surface flow out of the watershed at Wickiup Dam represents only a portion of the precipitation that falls within the basin because of high infiltration. Evidence for high infiltration rates and limited surface run-off can be found by comparing precipitation levels of a storm event and the resulting streamflow. As an example, a storm event of 2.87" over a three day period in January of 1996 measured at Wickiup dam, did not result in an immediate release in the flow of Browns Creek. The flow was 30 cubic feet/second (cfs) at the start of the storm and fluctuated between 28 and 30 cfs for the next two weeks (reference Figure A-3, Browns Creek Stream Flow, in the Water Appendix).

Table 3-6

Lakes Within the Watershed

Lake	Legal Description	Elevation (ft.)	Acres	Depth (ft.)	Game Fish Species	Landscape Sub-Area
Found	T21S, R6E, Sec 25	5900	6	11	brook trout	1c
Johnny	T21S, R7E, Sec 29	5400	17	21	brook trout	1c
North Twin	T21S, R8E, Sec 28	4300	103	60	rainbow trout, brown bullhead	4b
South Twin	T21S, R8E, Sec 33	4300	101	55	rainbow trout	4c
Wickiup*	T21S, R9E, Sec 7	4350	10,153	60	rainbow trout, brown trout, whitefish, kokanee, brook trout, coho salmon	4a

* A very small number of largemouth bass escape through screening at Crane Prairie Reservoir and end up at Wickiup Reservoir

Table 3-7

Perennial Streams Within the Watershed

Stream	Landscape Sub-Area	Gaging Station Location	All-Time Minimum Flow (cfs)	All-Time Maximum Flow (cfs)	Average Flow (cfs)	Period of Record
Browns Creek	6d, 4a	T21S, R8E, Sec 29	16	104	38.8	65 years
Deschutes River	6c, 4a	T21S, R8E, Sec 16 (Crane Prairie Dam)	0	1170	214	69 years
Deschutes River	_	T22S, R9E, Sec 7 (Wickiup Dam)	1.1	2280	743	49 years
North Davis and Davis Creek	4a	-	-	-	180	-
Awbrey Springs	4a	-	-	-	25	-
Sheep Springs	4a	-	-	-	120 - 500	-

Reference Water Quantity

The spring-driven tributaries to the Deschutes River were Browns Creek, Davis Creek, North Davis Creek, Sheep Springs, and Awbrey Springs. The Deschutes River had one of the most stable flow regimes for river of its size in the western United States. The mean flow of the Deschutes River was approximately 750 cfs where the outlet of Wickiup dam now exists.

The soil types allow rapid drainage of precipitation into the subterranean, resulting in the reduction of surface overland flow in stream channels. Prior to construction of Wickiup Dam, there were approximately 30 river miles of perennial channels and less than 24 miles of intermittent channels within the watershed.

The water quantity within the natural lakes were similar to present conditions, although the presence of dead and standing trees near the shorelines of South Twin Lake indicates fluctuating water levels. There appears to be a correlation between water levels in South Twin and Wickiup Reservoir, suggesting seepage between the two waterbodies (ODF&W Basin Plan, 1996).

Current Water Quantity

The construction of Wickiup Reservoir added nearly 10,000 acres of surface water to the watershed. The reservoir has a volume of 200,000 acre-feet at full capacity. The North Unit Irrigation District owns the shared water rights. Releases of water into the Deschutes River are coordinated with the Oregon Water Resources Department. There is seepage loss through the reservoir bottom, averaging 70 cfs. The reservoir receives seepage from Davis Lake, and likely Crane Prairie Reservoir as well. The average seepage loss in Crane Prairie Reservoir amounts to 82 cfs, well above the pre-reservoir level of 10 cfs (Upper Deschutes Wild and Scenic River, FEIS, 1996). Because of the impoundment of water in Wickiup and Crane Prairie Reservoirs and the associated evaporation and percolation, there is likely a net loss of water quantity under current conditions when compared to historic conditions.

When Wickiup Reservoir is at capacity, there are approximately 6 miles of perennial stream channel and 24 miles of intermittent channel.

Browns Creek has a drainage basin estimated to be 13,400 acres, and the Deschutes River at Crane Prairie Dam drains 254 square miles. Any influences to streamflow, yield, or timing of the Deschutes River at the dam is the result of factors occurring in upstream watersheds, and is not within the scope of this analysis.

The flow regime of Browns Creek has been altered by the diversion of an intermittent tributary channel by two rock quarries constructed decades ago. Flow is currently diverted into the quarries where the water either seeps through the bottom or evaporates. The volume of water lost by the diversions is not known at this time, but is estimated to be less than 1% of the total yield of Browns Creek.

Past research studies have demonstrated that timber harvest in watersheds can alter the quantity and timing of streamflow due to the following factors: (1) spatial distribution of water and snow on the ground; (2) amount of precipitation intercepted or evaporated by foliage; (3) rate of snowmelt or evaporation from snow; (4) amount of water that can be stored in the soil or transpired from the soil by vegetation; and (5) the physical structure of soil that dictates the rate and means by which water moves to the stream channel.

Harvest activities within the Browns/Wickiup watershed have not resulted in significant increases in overland flow into streams, particularly into Browns Creek and the Deschutes River. The porous soils within the watershed limit overland flow and significant changes in stream flow, yield, and timing.

Over 9,000 acres (approximately 30%) within the Browns subwatershed have been harvested in the past (GIS records dating back to 1972). These harvest units reflect a varying intensity of harvest and are currently in various stages of regeneration.

From a review of historic streamflow and climatic data, there is evidence that yearly fluctuations in peak and mean flows in Browns Creek are dependent upon precipitation levels, and are not correlated to timber harvest or road building activities.

Reference Water Quality

The Deschutes River and its tributaries, being predominantly spring-fed systems, were of excellent water quality. Temperatures were cool (estimated at 40 to 55 degrees Fahrenheit) and high in clarity. The flow regime entering the watershed has been altered due to the construction of Crane Prairie Reservoir.

The water quality of other lakes within the watershed were probably similar to present conditions, although accurate historic data is lacking.

Current Water Quality

The Deschutes River from the outlet at Wickiup Dam downstream to the urban growth boundary of Bend is referred to as the Upper Deschutes and is federally designated Wild and Scenic River and State Scenic Waterway status. The Deschutes River below Crane Prairie Dam is on the Oregon Department of Environmental Quality 303(d) list for water quality impaired streams because of high summer water temperatures, which often exceed 70°F. in recent drought years. During years of abundant flow, this section may remain within the state standards for temperature. Water quality within the Browns/Wickiup watershed partly determines the water quality within the Upper Deschutes River (Appendix Tables A-1, A-2). The river below has shown increases in turbidity when algae blooms form in Wickiup Reservoir. The river has also recently tested positive for E. coli by the Forest Service (June, 1997). Although the watershed is not considered a municipal watershed, some residences in the Bend and Madras area use irrigation water from the river as a drinking water source, resulting in potential ingestion of E. coli, giardia lamblia, and other pathogens. Deschutes County reported an increase in giardia cases early in 1997, and it was speculated that drinking untreated water from the Deschutes River was the cause in many cases.

Erosion along the other stream courses is not prevalent. There is no mass wasting, and the potential for landslides is very low. Since the streams are either spring-fed or regulated, they may lack the flushing flows necessary to clean gravels of fine sediments, which generally originate from native surface roads.

At Wickiup Reservoir, dispersed campsites and failing pit or vault toilets in developed campgrounds are potential sources of nutrient input. Although nutrients are likely entering the reservoir, the volume and effect on water quality is not well understood. Camping was restricted to above the high water mark several years ago in an attempt to address this issue. Untreated sewage can also be the source of E. coli and other pathogens. Comparison of

limited water quality data taken in 1982, 1984, and 1991 has not demonstrated a change in the trophic status of the reservoir. Fecal coliforms were detected in small numbers in 1984 and 1991 (Appendix Table A-1, "Selected Water Quality Parameters and Concentrations from Synoptic Surveys of Wickiup Reservoir"). A single sample was taken in August, 1997, which tested negative for E. coli.

A documented pattern exists between increased human activity around a lake and an increase in the production of phytoplankton and zooplankton. This is referred to as "cultural eutrophication", and can lead to excessive plant growth and degraded water transparency and water quality. Within a lake, phosphorus and nitrogen are the two most important nutrients that effect aquatic plant growth, especially phytoplankton. An increase in either of these two nutrients typically results in an increase in the growth of phytoplankton and on up the food chain. Nutrient enrichment from human activity, especially sewage, is of particular concern to lakes with very porous soils in their drainage basins, which is typical of lakes in this watershed.

The water quality of Wickiup Reservoir and the Deschutes River is also influenced by the condition of the waters received from Crane Prairie Reservoir (i.e. elevated water temperatures, phytoplankton, and nutrient inputs).

Factors that are preventing eutrophication of the reservoir are the short retention time (approximately 5 months) that provides a rapid exchange of the water volume, and the high elevation that limits the growing season for phytoplankton.

Mercury was detected in the reservoir in both 1984 and 1991 at levels that exceeded the chronic aquatic life level of concern criteria. An analysis of fish tissue from the reservoir in 1996 concluded very low concentrations of mercury that are far below the Oregon State Health Division advisory standard.

In some areas, overland flow is delivering sediments to water bodies, however, this does not appear to be a widespread problem within the watershed. The shoreline of Wickiup Reservoir is eroding in some areas from a combination of wind action and recreational use, adding sediments to the reservoir. In other areas, spur roads without proper water-barring are promoting overland flow with the potential to carry sediments to the reservoir. The most significant erosion and the improperly functioning spur roads are occurring on less than 1% of the 50.5 miles of shoreline surrounding the reservoir. When the reservoir level drops, recreationists often drive below the high water line, which promotes erosion of the lake bottom. Wind and rain action on the exposed soils can be significant sources of erosion.

North and South Twin Lakes have no surface inlets or outlets so retention times are great, 19 and 22 years respectively. Recreation facilities and dispersed camping have the potential to add nutrients that could alter the water chemistry of these lakes. The lakes are relatively high in major ion concentrations. Springs near the lake bottoms are speculated to be the source of

minerals (Appendix Table A-2, "Water Quality of Lakes").

Johnny Lake is considered ultra-oligotrophic, and Found Lake is considered oligotrophic. Lakes of these trophic status are especially vulnerable to "cultural eutrophication". The lakes currently receive light recreational use (Appendix Table A-2, "Water Quality of Lakes").

Some of the lakes have a low buffering capacity to acid deposition, the potential source being acid rain. The Deschutes National Forest is in the initial stages of lake water quality monitoring, in part to track changes that may be attributable to acid rain.

Within the LSR, the shoreline area of Crane Prairie Reservoir receives intense recreational use. There is potential for nutrient input into the reservoir from untreated sewage. There is also potential for sediment delivery to the reservoir from spur roads, although this is occurring on less than 1% of the shoreline.

Browns Creek has excellent water quality, with summer water temperatures remaining below 60° F. near the mouth. There is light dispersed camping use along the creek. Recreational use is limited by the year-long closure of fishing on the stream.

Vegetation

Vegetative composition is an important feature in understanding and evaluating the physical, biological, social, and economic processes occurring in the analysis watersheds. Interactions among processes of climate, geomorphology, succession, and disturbance events yield changes in vegetative composition (structure, species, density). Climate, soils, and topography remain generally constant over time. Succession and disturbance continually work in concert to change the landscape conditions, both in terms of distribution and structure, as well as processes and ecological function. For a more detailed account of biophysical environments, see Jensen et al., 1996.

Vegetation in the watersheds consists of plant associations (similar vegetative species found within similar climate regimes) that can be summed to 8 groups or PAGs: lodgepole pine dry, ponderosa pine dry, mixed conifer dry, lodgepole pine wet, ponderosa pine wet, mixed conifer wet, mountain hemlock, and "miscellaneous" including meadow, and riparian communities (see Table 3-9 and Figure 3-2 for more PAG information). Wildfire, insects, and pathogens have all shaped the historic and current conditions of these plant communities (Table 3-10).

Over the last several decades, there has been a pronounced shift in forest structure, density, and species composition for a large proportion of the watershed analysis area (see Appendix Table A-4, "Structural Stages Used to Describe Forest Vegetation Structure Over Time" and Figure 3-3, "Forest Succession" from ICBEMP). This is particularly true within the dry forest plant association groups (dry mixed conifer and ponderosa pine; in Volland, 1985), where frequent, low-intensity fire played an active role in shaping species and structural composition. Within the last century, these once relatively stable and fire resistant forest communities have been replaced by dense, multi-storied stands of fire susceptible species (Hann et al., 1996). Landscapes once dominated by open stands of large trees have been replaced by crowded stands of all sizes.

Additionally, species composition of these forest types has shifted from the fire resistant species such a ponderosa pine, to the more ephemeral lodgepole pine and true firs (Table 3-8, "Common Shade-Tolerant/Intolerant Tree Species In Browns/Wickiup Watersheds"). To aggravate the shift from shade intolerant species (e.g., ponderosa pine) to shade tolerant species (e.g., white fir), selective harvests typically removed the intolerant species, allowing the more tolerant species to flourish. Shifts in composition, for both structure and density, as well as in species, has largely been the result of an active fire exclusion program, in addition to the selective harvesting pattern spanning over the last 80 years.

Table 3-8

Common Shade-Tolerant/Intolerant Tree Species within Browns/Wickiup Watersheds

Shade-tolerant Tree Species	Shade-intolerant Tree Species
white fir - WF Douglas-fir (sometimes) - DF mountain hemlock - MH Engelmann spruce - ES	interior ponderosa pine - PP lodgepole pine - LP Douglas-fir (sometimes) - DF

Modified from ICBEMP DEIS (1997)

Table 3-9

Acres and Proportion of Landscape by Plant Association Group (PAG)

PAG	Watershed		Browns Mtn. LSR		Round Mtn. LSR	
	acres	%	acres	%	acres	%
Mixed Conifer Dry/Wet	14,960	26%	3,930	54%	220	100%
Lodgepole Pine Dry	11,290	20%	1,250	17%	-	-
Ponderosa Pine Dry	6,050	11%	1,340	19%	-	-
Ponderosa Pine Wet	4,300	8%	40	1%	-	-
Mountain Hemlock	4,310	8%	-	-	-	-
Lodgepole Pine Wet	3,690	6%	520	7%	-	-
Misc. types [1]	11,960	21%	160	2%	-	-
Totals	46,170	100%	7,240	100%	220	100%

1. Includes meadows, cinder, riparian, water, and other non-forested areas.

Fig. 3-2

BROWNS/WICKIUP WATERSHED ANALYSIS AREA
Plant Association Groups

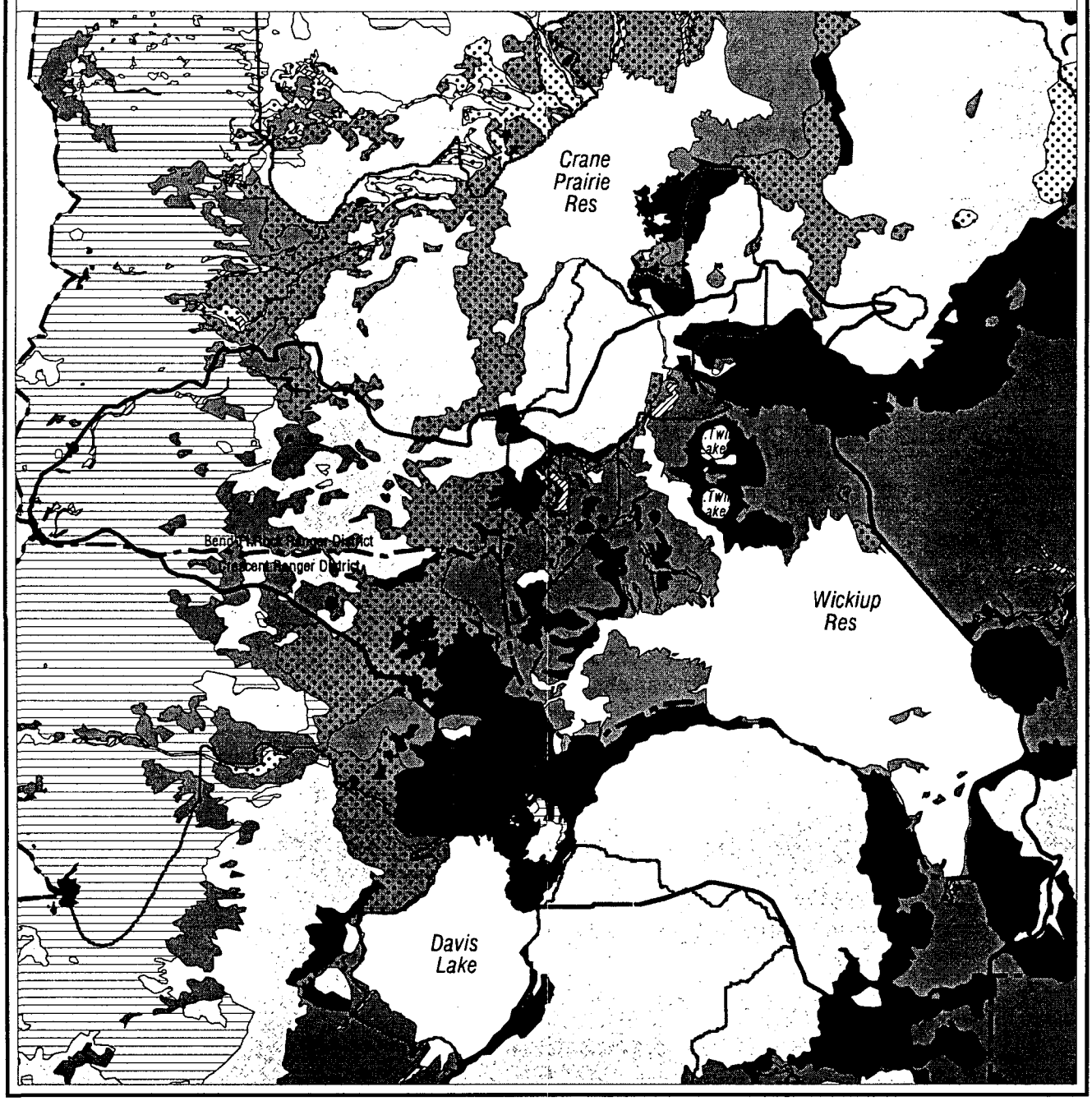
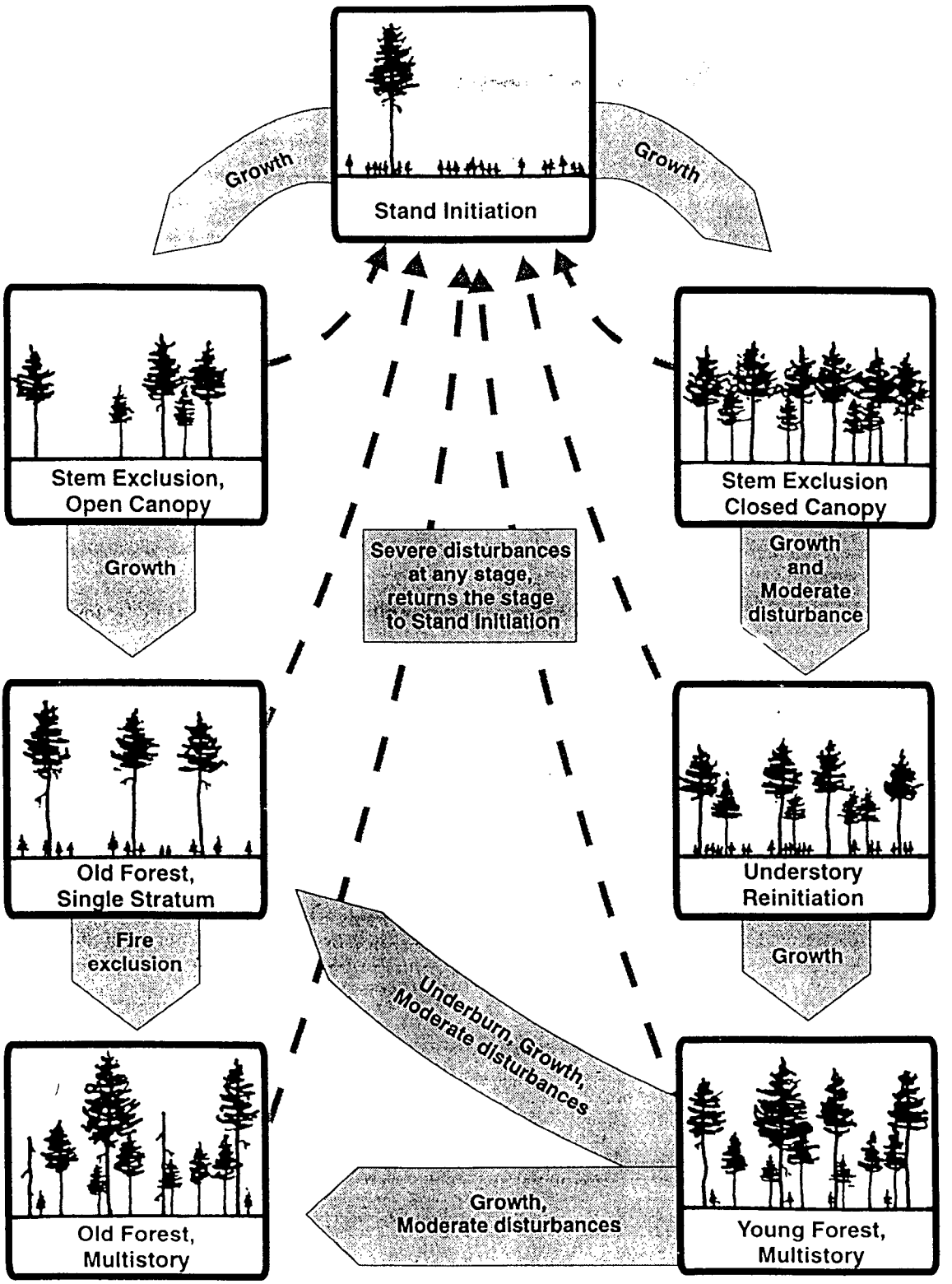


FIGURE 3-4 FOREST SUCCESSION



Forest Successional Stages - Potential forest succession stages are predictable changes in vegetation that can be described by stand structure, growth patterns, and disturbance patterns. Conditions of one successional stage create conditions that are favorable for the establishment of the next stage.

Table 3-10

Dominant Historic Disturbances by PAG [1]

Potential Vegetation (PAG)	Disturbance Factor	Disturbance Regime (intensity)	Patch Size (acres)	Landform or Geomorphic Sub-Area	Elevation (range in feet)	Aspect
Ponderosa pine dry/wet	Fire	Low	< 5	Upland Tephra	4200'-4600'	All
	Insects & Disease	Low	< 5			
Mixed conifer dry	Fire	Moderate	< 300	Morainal & Browns Mtn Wuksi Bu. Davis Mtn	4400'-6600'	All
	Insects & Disease	Low	< 5			
Lodgepole pine dry	Fire	High	< 1000	Morainal & Outwash	4400'-6000'	All
	Insects & Disease	Moderate	< 1000			
Lodgepole pine wet	Fire	Moderate	< 500	Morainal & Outwash	4600'-5200'	All
	Insects & Disease	Moderate	< 1000			
Mixed conifer wet (Engelmann Spruce)	Fire	High	< 500	Spruce Bottomlands	<4400'	All
	Insects & Disease	Moderate	< 500			
Mountain hemlock	Fire	High	< 150	Tephra & Crest	4800'-7000'	All
	Insects & Disease	Moderate	< 200			

1. Modified from Cascade Lakes Watershed Analysis (1995); after Ochoco NF Viable Ecosystem Management Guide (N.D.)

A shift in stand densities and species drift has led to an overall reduction in health and vigor of forested stands, with an attendant increase in susceptibility to a multitude of insect and disease agents (Hessburg et al., 1996). By way of example, the dry mixed conifer plant association group, once dominated by frequent, low-intensity fires, has become increasingly susceptible to high-intensity, stand-replacement fire events (Agee, 1993; Hann et al, 1996; Ottmar et al., 1996). Table 7-2 in Chapter VII shows the current dominant species by plant association group (PAG).

Insects and Disease Agents

Insects have the potential to cause substantial vegetative changes, causing landscape patches and patterns to emerge. Currently, mixed conifer stands are imminently susceptible to defoliator insect attacks, as well as to those by bark beetles. Although there is no certainty of these events occurring, there is a greater predisposition for outbreaks to occur, relative to other forest vegetative composition, structure, and density. If an outbreak of defoliator or bark beetle species occurs at an epidemic level, then large patches may be created across the landscape, as the mixed conifer vegetative zone is a dominant plant association group within both watersheds.

Root pathogens, in addition to insects, have also contributed to landscape patterns and patches. As a root disease center expands, trees on the edges of openings become susceptible to infection and ultimate mortality. Over time, these openings are colonized by species more resistant to the root disease, thus regenerating a new stand of different composition. Lodgepole pine and western white pine are shade intolerant species typically more resistant to root pathogens than the shade tolerant firs, thus allowing a mechanism that promotes species diversity over successional advance. Root disease pockets are easily observed in aerial photography within the mountain hemlock zone.

Fire patterns currently will differ greatly from historic patches and patterns, simply as a result of chronically increasing stand densities and fuel loadings as a product of insect and disease patterns/cycles. Managing insect and disease at endemic levels will provide forest defect needed by dependent wildlife.

Mountain Pine Beetle

Mountain pine beetles have been the most significant agent of mortality in recent years (Eglitis, 1996). Large expanses of lodgepole pine stands have succumbed to these insect attacks, from the 1980s to present, with shifting "hot spots" occurring each year. Lodgepole pine dry and wet plant association groups have been hardest hit, and interspersed mortality has shown up in the ponderosa pine dry, mixed conifer dry, and some high-density mountain hemlock PAGs as well.

Widespread individual tree mortality resulting from outbreaks of several years' duration can influence the ecosystem. Often, large expanses of trees are killed and short-term habitat is created for cavity nesting species that would not otherwise exist. With this comes increased fire hazard and greater risk of large, uncontrollable wildfire. A further complication is with the negative visual and change in recreational setting of the recent dead and dying trees.

Cultural stand treatments can reduce the risk of epidemic beetle attacks before they occur. This necessitates the reduction of density levels to ensure that individual tree health and vigor is maintained. Stand regeneration to a new forest structure can also reduce the potential for

beetle attack, and is most appropriate in lodgepole pine stands nearing the end of their natural life cycles, whether from pathogens or high density stress. Salvaging dead lodgepole pine resulting from such beetle outbreaks can reduce the larger increase in fire hazard, but will not stop the outbreak, as stand conditions that favored the outbreak have not been altered elsewhere (Eglitis, 1996).

Western Pine Beetle

Large diameter ponderosa pine are particularly vulnerable to epidemic attacks by the western pine beetle, especially within mixed conifer dry PAGs. These trees are stressed by a variety of factors, yet this can be tied to competition for scarce resources. The vulnerability of loss from epidemic levels of bark beetles is correlated to growth rates and life cycles of ponderosa pine trees. Older trees with thin crowns and slow growth rates are most likely to be attacked and killed by the western pine beetle, and are typically found in highly dense stands.

Management treatments that reduce stand densities in the immediate vicinity of selected trees will help to control epidemic beetle attacks. Typically, some trees less than 21" diameter at breast height (dbh) are removed thus allowing retention of trees greater than 21" dbh.

Fir Engraver

The fir engraver is a bark beetle that attacks most fir species in the western United States. Most susceptible are the true fir species found within the mixed conifer (dry and wet) PAGs. Mass attacks occur coincident with drought conditions, and precipitation zones are key to understanding fir mortality management risk. Annual precipitation of 20 to 25 inches defines an extreme risk of white fir attacks by the fir engraver. These are typically fir trees at the lower end of their elevation range, and generally conform to the mixed conifer dry PAGs. Precipitation in the 25 to 30 inch range poses a high risk of attack, and that from 30 to 40 inches yields a moderate risk of attack. Risk for fir engraver is low for moisture zones above 40 inches.

In typical, non-drought years, most fir engraver attacks occur in conjunction with root disease agents. Silvicultural treatments that maintain trees in a healthy, vigorous state will often minimize stand mortality risk, and manage the fir engraver at endemic population levels.

Douglas-Fir Beetle

The Douglas-fir beetle, a large bark beetle, is similar to the mountain pine and western pine beetles in life cycle. This beetle infests trees damaged by windfall, fire, or other disturbance event, and attacks Douglas-fir trees, particularly those found within the mixed conifer dry PAGs. Outbreaks are typically sporadic and of short duration, yet are likely to kill large numbers of trees. Damage is greatest in dense stands of mature Douglas-fir trees (Eglitis, 1997).

Reducing stand density levels through thinning can help to maintain health and vigor of individual trees and reduce susceptibility to epidemic beetle outbreaks. Endemic levels are often an acceptable mechanism to recruit snags.

Western Spruce Budworm

Douglas-fir and white fir are the tree species most at risk to western spruce budworm infestations. Conditions that favor outbreaks are large expanses of nearly pure host trees, primarily those with multi-layered canopies and host stands on warm, dry sites. Silvicultural practices that maintain trees in a healthy and vigorous condition will tend to reduce the risk to epidemic levels of budworm activity. Stand management techniques that reduce pure host tree composition and move to more seral species also helps in minimizing the risk of epidemic budworm attacks.

Armillaria Root Disease

Armillaria root disease can exist as a saprophyte on dead woody material for decades, or as a lethal tree parasite. Armillaria spreads from colonized stumps or infected trees to nearby healthy trees. Tree species have varying amounts of resistance to the disease due to natural biochemistry. Resistance fades, however, when the tree is under stress, creating pockets of mortality, or in some cases wiping out an entire stand over time. Stress elements include overstocking, drought, and soil compaction.

Effects from Armillaria are mixed. It creates canopy gaps and snags that are representative of a late-successional forest during the early phases of the disease. These conditions are considered ideal for the prey base of the spotted owl. As mortality increases in distribution and abundance, an opening is created that is no longer at a scale suitable for owl foraging. Unless resistant species are established or introduced, the opening is likely to persist for decades.

Silvicultural treatments include density control favoring resistant species to improve the resistance of the residual stand. Soil compaction from mechanical equipment may accelerate tree mortality, so care must be exercised in management practices. Accelerated levels of infection are typically not desired within late-successional reserves, although the smaller, endemic disease centers are often desirable in creating diversity within habitats.

Annosus Root Disease

Annosus root disease spreads from colonized stumps from windborne spores that germinate following disturbance, typically from logging activities. Secondary attacks by bark beetles often follow initial infections. Disease centers usually focus around old infected stumps, but also can be from wounds on live trees. Hosts trees are pines, hemlock and true firs.

Silvicultural treatments include minimizing mechanical damage and stump treatment with Borax, and care must be exercised in management practices. Accelerated levels of infection are typically not desired within late-successional reserves, although the smaller, endemic disease centers are often desirable in creating diversity within habitats.

White Pine Blister Rust

This fungal disease was introduced into North America in the early 1900s from Europe, with host species for white pine blister rust being the five-needled pines (includes western white pine and whitebark pine). *Ribes* species (gooseberry plants) are the alternate hosts for the disease, providing the mechanism for blister rust infections. This blister rust is currently infecting western white pine trees that are a minor component of stands within the mixed conifer and mountain hemlock zones.

Several management options are available to help control the adverse effects of blister rust. Using genetically-improved, rust-resistant trees when starting a new stand is a most effective strategy. If this is not possible, then reducing or removing the *Ribes* component from the stand understory is also effective. Pruning lower branches up to the height of the highest canker reduces the chance of lethal cankers, unless stem cankers, which reduce the life-expectancy of trees, are present.

Dwarf Mistletoes

Dwarf mistletoes of ponderosa pine, lodgepole pine, and white fir are ubiquitous within the watersheds. Native to this region, these parasites have increased in distribution and abundance as a result of fire exclusion and selective harvest practices over the past several decades. In many cases, the severity of mistletoe levels has compromised the long-term survival of many forest stands.

Heavy infections of mistletoe slows tree growth, compounding over time to the point where it may not be possible to grow stands that exhibit characteristics of large, old trees. Silvicultural treatments that are effective in reducing or controlling dwarf mistletoe include thinning, retaining mistletoe-free trees, pruning, mistletoe overstory removals, and species replacement.

Other Agents of Change

Several other disturbance agents of concern exist within the watersheds, including Douglas-fir tussock moth, pandora moth, laminated root rot, and windstorm, but are not discussed in this section. The reader is encouraged to review the Cultus/Sheridan Mtn. LSR Assessment (Deschutes National Forest, 1996) for more detailed descriptions.

Historic Range of Variability Analysis --- A Look to the Past

One standard reference point for understanding how landscape vegetation patterns developed is with the concept of "historic range of variability" (HRV; see Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis {Version 2.2, August 1995} for a discussion on this conceptual basis). With HRV, estimates of past landscape conditions and processes are made by looking at the probable landscape composition that existed prior to local settlement conditions (roughly 1850 to 1910) as a reference point.

FIGURE 3-4 Existing vs. HRV for Dry PAGs

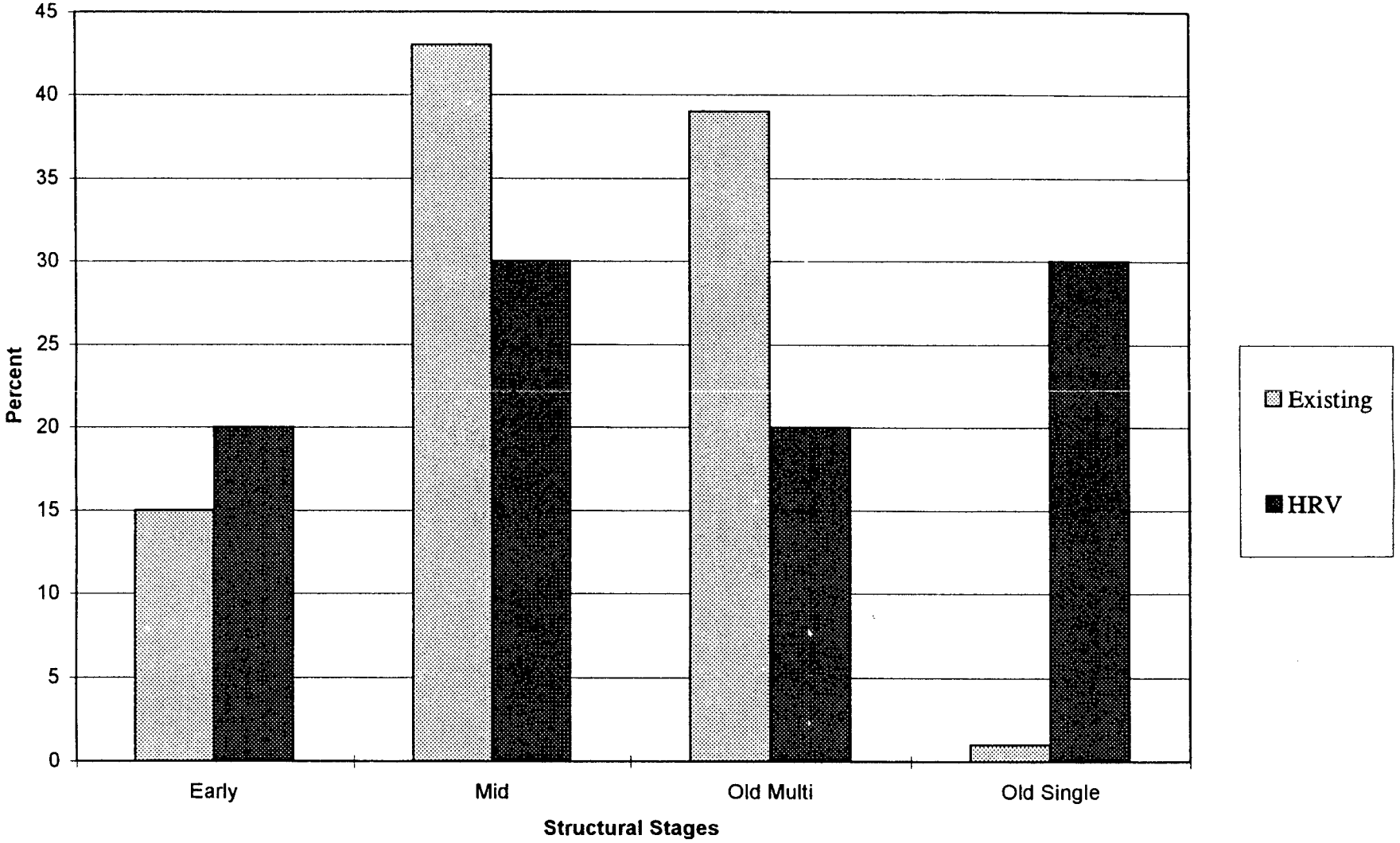


FIGURE 3-5 Existing vs. HRV for Moist PAGs

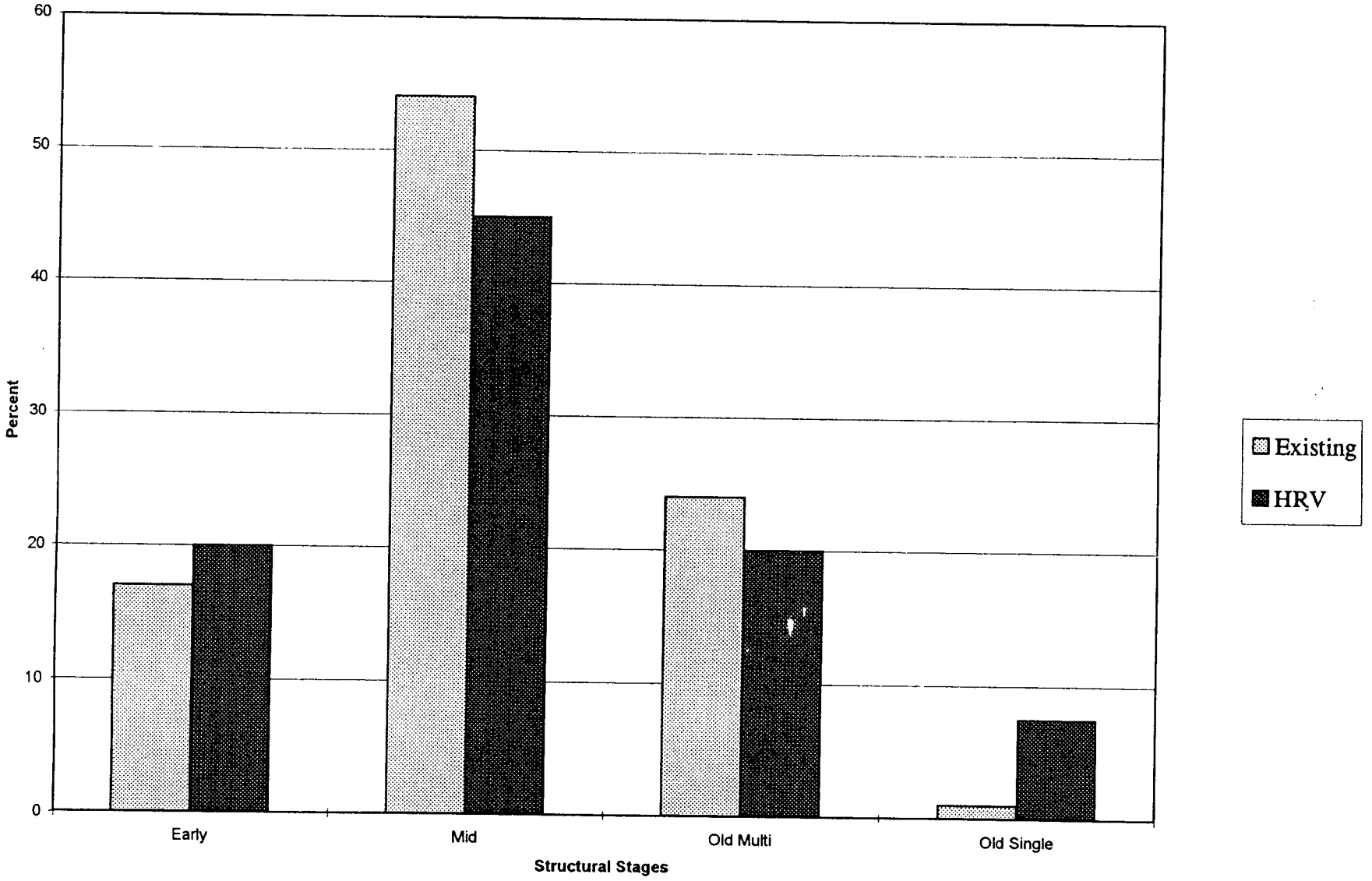
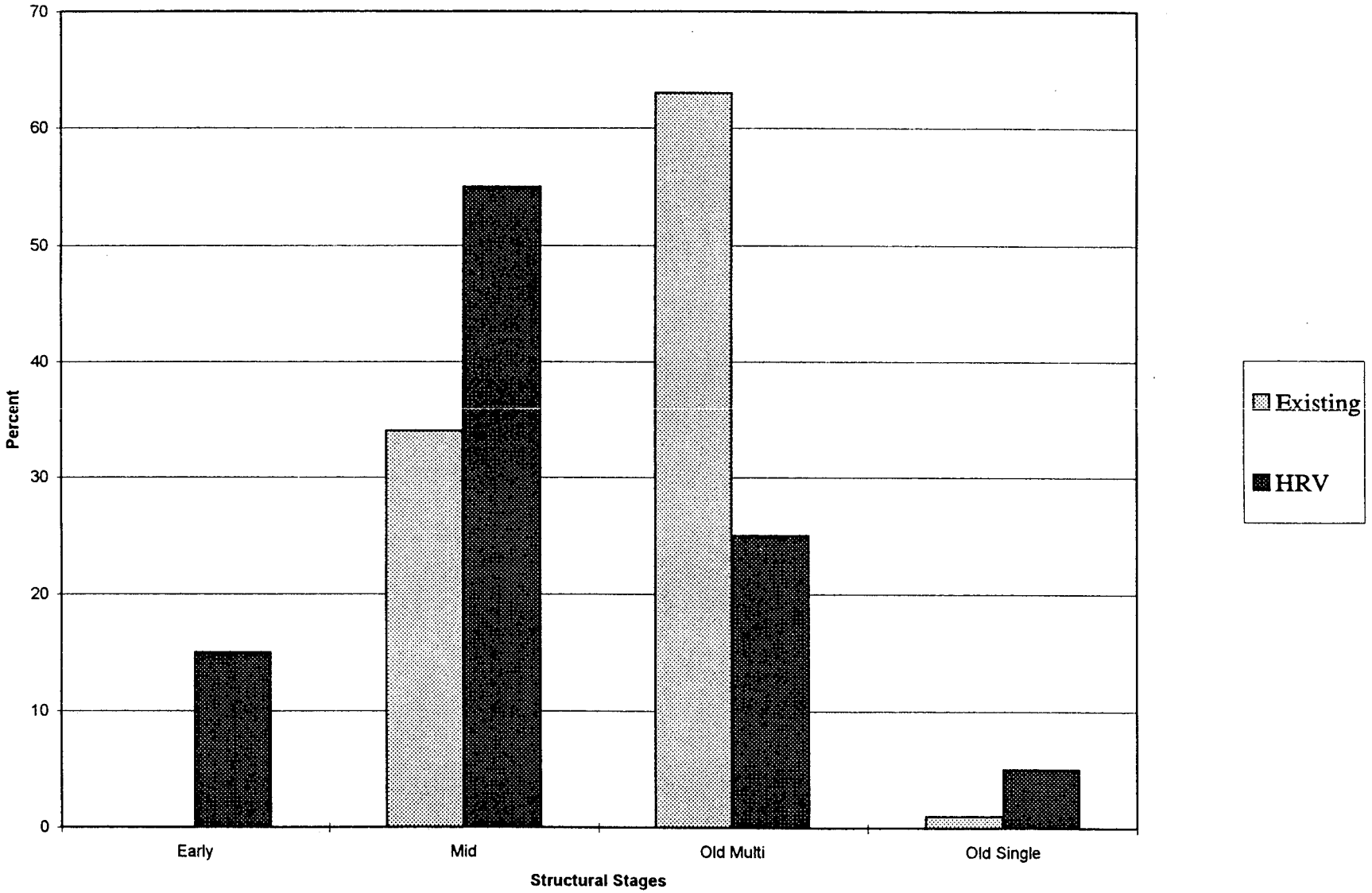


FIGURE 3-6 **Existing vs. HRV for Cold PAGs**



Potential Vegetation, Species Coverage, and Structural Stage

In order to make comparisons of the probable historic landscape conditions to the current state of vegetation, site conditions for potential vegetation are held constant. To establish the probable potential vegetation for each unique list, plant associations (groups) are used. These are considered to remain constant through time, with species composition, structural stage (Figure 3-7) and density the ever-changing factors (Table 7-2, "Current Dominant Species by PAG verses Structure Stage"). For the Browns/Wickiup Watershed, 8 plant association groups were identified, and have been categorized into 3 dominant potential vegetation types.

Dry Forest Types

1) Dry Mixed Conifer:

- PAG is 14,950 acres in size
- Majority of PAG is north slope of Davis Mountain and much of Browns Mountain LSR
- Tree species include ponderosa pine, white fir, lodgepole pine, and Douglas-fir
- Management activities that have occurred since 1930s include fire exclusion and selective harvesting

2) Dry Lodgepole Pine:

- PAG is 11,290 acres in size
- Majority of PAG occurs in well-drained soils on low-lying areas between major water bodies
- Tree species include lodgepole pine, ponderosa pine, and occasionally white fir
- Lodgepole pine is an opportunistic species and quickly dominates following disturbance events
- Stands have been heavily fragmented by management activities

3) Dry Ponderosa Pine:

- PAG is 6,050 acres in size
- Majority of PAG occurs on slight elevation rises above dry lodgepole pine flats and bottoms
- Ponderosa pine dominates, with lodgepole pine resulting from fire exclusion
- Forest composition is typically either in large diameter structures or in "black bark" mid-size structures

Moist Forest Types

4) Wet Mixed Conifer:

- PAG is 10 acres in size
- Majority of PAG lies along Browns Creek
- Species composition is highly diverse, including ponderosa pine, white fir, lodgepole pine, Douglas-fir, western white pine, and occasionally mountain hemlock
- Most stands within this classification are composed of late-seral structures

5) Wet Lodgepole Pine:

- PAG is 3,690 acres in size
- Majority of PAG occurs in poorly-drained, highly productive soils
- Species composition is typically dominated by lodgepole pine, but has a diversity of species, including ponderosa pine, white fir, and Engelmann spruce
- Stand composition is typically highly resilient to vegetation treatments

6) Wet Ponderosa Pine:

- PAG is 4,300 acres in size
- Majority of PAG lies as "islands" within dry ponderosa pine associations, or in interface between dry ponderosa pine and dry mixed conifer associations
- Ponderosa pine dominants, with occasional inclusions of white fir, and rarely some lodgepole pine
- Stand composition is similar to dry ponderosa pine associations, with more latent stability due to higher site quality

7) Meadows:

- PAG is 100 acres in size
- Majority of PAG is located around Browns Creek
- Species composition is highly diverse non-forested types, with occasional invasion by forest species, typically lodgepole pine and Engelmann spruce

8) Riparian:

- PAG is approximately 200 acres
- Location of PAG in and around low-lying areas with seasonal flooding
- Species composition is riparian-dominated vegetation, generally non-forest communities, with occasional forest-dominated (e.g., Engelmann spruce) species

Cold Forest Types

9) Mountain Hemlock:

- PAG is 4,310 acres in size
- Virtually entire PAG is located in western portion of the Browns subwatershed
- Species composition is highly diverse; stands are dominated by lodgepole pine and mountain hemlock, with minor amounts of white fir, western white pine, ponderosa pine, Shasta red fir, whitebark pine, and occasionally sugar pine
- Stand composition is relatively stable, with little previous management disturbances

Fig. 3-7

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Structural Stages

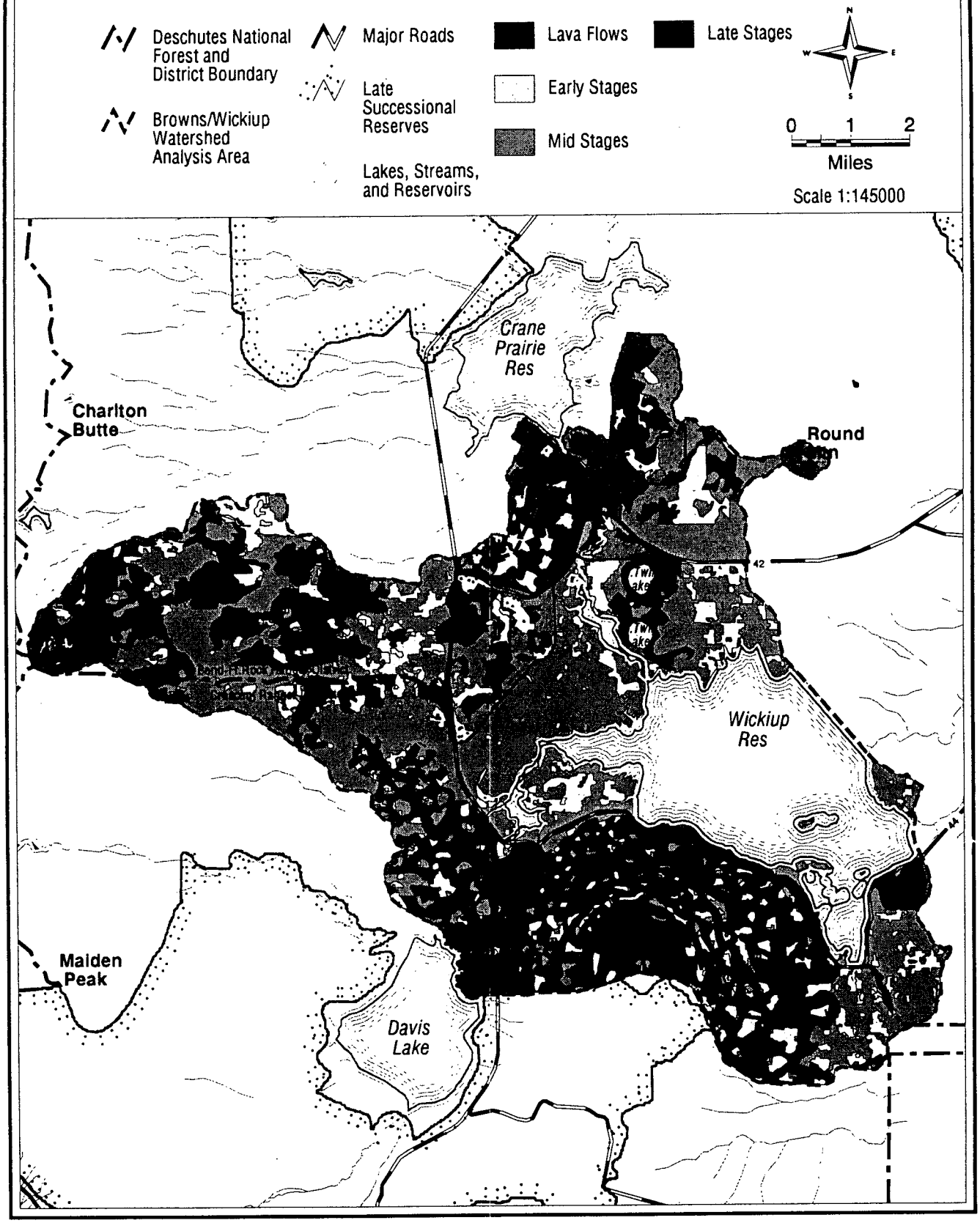


Table 3-11, "Historic Structural/Seral Stages at the Landscape Level" displays the expected landscape composition from HRV analysis. Included are mid-point estimates of expected dominance by shade-intolerant species by structural stages.

Table 3-11

Historic Structural/Seral Stages at the Landscape Level [1]

PAG	Early	Mid	Late/Old Multi	Single	Other [2]
Distribution in percent of PAG					
Dry	15%	35%	15%	25%	10%
Moist	20%	45%	20%	10%	5%
Cold	25%	50%	15%	10%	0%
Shade-intolerant Species (percent of structural stages)					
Dry	75%	70%	65%	90%	-
Moist	70%	65%	65%	70%	-
Cold	65%	55%	50%	80%	-

1. Reference data source: ICBEMP DEIS (1997); Structural/Seral Stages in table are estimated mid-points for illustrative purposes.
2. Refers to understory of grasses, shrubs, and forbs

Table 3-12, "Current Structural/Seral Stages at the Landscape Level" shows the existing condition for the watersheds. Note the dramatic reduction of late-single-storied stands as well as the general reduction of shade-intolerant dominance.

Table 3-12

Current Structural/Seral Stages at the Landscape Level [1]

PAG	Early	Mid	Late/Old Multi	Single	Other [2]
Distribution in percent of PAG					
Dry	15%	43%	39%	0%	3%
Moist	17%	54%	24%	0%	5%
Cold	0%	34%	63%	0%	3%
Shade-intolerant Species (percent of structural stages)					
Dry	93%	68%	60%	100%	-
Moist	0%	95%	100%	-	-
Cold	0%	0%	0%	-	-

1. Reference data source: ICBEMP DEIS (1997); Structural/Seral Stages in table are estimated mid-points for illustrative purposes.
2. Refers to understory of grasses, shrubs, and forbs

Riparian Vegetation

Historically, river channels, that traversed the area now covered by Wickiup Reservoir, had small riparian areas; 497 acres were recorded during surveys early this century. Narrow strips of riparian vegetation likely existed along Davis Creek, Browns Creek and the Deschutes River. Two drainages, one at the south end of Wickiup Reservoir and the other to the northwest of Wickiup Dam probably also hosted some riparian vegetation.

Currently, about 1450 acres of riparian vegetation grow around the reservoir in areas varying in size from 2 to 700 acres. This increase in acreage was probably the result of the reservoir construction, where areas now inundated part of the year, and a reduction in the rate of water flow, have allowed riparian vegetation to spread. Vegetation grows at lakeside in narrow strips or in meadows that host many plant species. Willows, Baltic rush, sedges and grasses such as mat muchly are most prevalent, although there are also many attractive forbs such as meadow arnica, showy downingia and evening primrose. Not all the shores of Wickiup Reservoir have riparian vegetation. Currently, there are large stretches of bare soil, where no native plants have spread. Noxious weeds have invaded some of these areas. Approximately 27 acres of noxious weeds grow around Wickiup Reservoir, along the Deschutes River

between the two reservoirs and along the shore of Crane Prairie Reservoir within the LSR. Above the reservoir, the upper Browns Creek and springs areas appear nearly natural. These special places host a wide range of plants and show little to no disturbances, whereas the lower end of Browns Creek has fewer plant species and the vegetation has been trampled by recreationists. Neither Johnny nor Found Lakes have been surveyed for TES plants. Some sections of the streams between Johnny and Found lakes and Wickiup Reservoir have been surveyed, but there is little riparian vegetation alongside them. No surveys for aquatic plants have been conducted.

Threatened, Endangered, and Sensitive Plants

The Deschutes National Forest has no threatened or endangered plant species known at this time. Sensitive plant species are those that appear on the Regional Forester's Sensitive Plant List (revised, 1991). They may also have Federal or State status. Watch List species are identified on the Oregon Natural Heritage Data Base only; they are considered rare but have no official sensitive, State, or Federal status. Survey and Manage species are identified in the Northwest Forest Plan (USFS et al. revised 1994) as associated with late-successional or old growth forest, and are discussed on the next page.

Existing Distribution for Sensitive Species

Portions of the Browns/Wickiup watershed have been surveyed for threatened, endangered, and sensitive plants (TES Plants). Project surveys have covered approximately 20% of the land area of the watershed. The following sensitive species is known to occur within the watershed boundary:

Jepson's Monkeyflower - *Mimulus jepsonii*

Status: Regional Forester's Sensitive Species List. State List 2, taxa threatened or endangered in Oregon, but more common or stable elsewhere.

In Central Oregon, the range of Jepson's monkeyflower extends linearly from the Cultus Lake area on the Bend-Fort Rock District south to Diamond Lake with the center of distribution being on the Crescent District. Five sites are known to occur in the Cascades Lakes Watershed that is to the north of the Browns/Wickiup Watershed. One very large site is in the southwest portion of the Browns/Wickiup Watershed in landscape sub-area 2a. Three small disjunct populations have been found in landscape area 2, in the area that is between the large site and the sites within the Cascade Lakes Watershed.

Jepson's monkeyflower is an early seral species which evidently benefits from disturbance. Natural disturbances include frequent fire to maintain openings and reduce organic litter, and overland flow events that create bare soil. Many populations have been observed at the base

of slopes where colluvial soil movement has provided available habitat in full sun and partial sun environments. Plants are also found in or along roads, landings, and skid trails. Seeds appear to move downslope with overland flow. These ephemeral annuals are visible for only a few weeks during the season, existing for most of the year in seed bank form.

For a prefield review of potential habitat for TES plant species, see Table A-14 in the Vegetation Appendix.

Survey and Manage Plants: Known Occurrence

A complete list of Survey and Manage plant species that may be found in Region 6 is given in Appendix J2 on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, USDA Forest Service and USDI Bureau of Land Management, 1994. This includes bryophytes, fungi, lichens, and a few vascular plants. Inventory of "survey and manage" species is far from complete. Most are non-vascular plants not taken into account by the usual survey procedures.

Species descriptions in Appendix J2 include general habitat and location information. Specific locations are given for only a few taxa. The ones known to occur in the Browns/Wickiup Watershed and in the Cascade Lakes Watershed (adjacent and to the north of the Browns/Wickiup Watershed) are listed below. There is a high probability that more "survey and manage" plants exist in the watershed, and more information is needed.

Sugar Stick - *Allotropa virgata*
Approximately, twenty occurrences of this plant have been found in the Browns/Wickiup Watershed. Most are within landscape sub-area 3. One population is also within the Browns Mountain LSR in landscape area 6. The range is along the east slope of the Cascades from British Columbia to California. Habitat is closed canopy, mature- and old-growth Douglas-fir, mountain hemlock, grand fir, silver fir, and lodgepole pine forests in dry soil with abundant woody debris. The Sugar Stick is a plant without chlorophyll, requiring association with both a fungus and a vascular plant to survive, but is intolerant of other plant competition. Threats include fire exclusion, fragmentation of habitat, and reduction in coarse woody material. It is also found in the Cascade Lakes Watershed to the north and in the Odell Watershed to the south (S&M 1,2; Appendix J2-249).

Liverwort - *Tritomaria exsectiformis*
Other management status: The Oregon Natural Heritage Program considers *Tritomaria exsectiformis* to be threatened with extirpation (List 2, 1995).

One occurrence is known within the Browns/Wickiup watershed and in the Browns Mountain LSR in landscape area 6. The range is from Alaska to Oregon, mostly in the Western Cascades. It is found at mid to high elevations, on densely shaded, moist, organic soil, especially around springheads. It is threatened in some areas by heavy trampling from

recreation users (S&M 1,2; Appendix J2-94).

White Chanterelle - *Cantharelles subalbidus*
There is one known occurrence within the Browns Mountain LSR. The range extends from Washington through Northern California. Chanterelle mushrooms have an ectomycorrhizal associate with a variety of conifer and mixed forests. Harvesting by commercial and personal-use mushroom pickers may have a long term effect on distribution, frequency, reproduction, and productivity as well as genetic viability.

Bolete Mushroom - *Gastroboletus subalpinus*
There is one known occurrence within the adjacent Cascade Lakes Watershed. The range extends from the Oregon Cascades through the northern Sierras, at elevations of 4,500' to timberline. This mushroom probably has mycorrhizal associations with pines, especially lodgepole pine and whitebark pine. Most known locations are within campgrounds. Threats include trampling and soil compaction related to recreation activities (S&M 1,3; Appendix J2-102).

Rare False Truffle - *Rhizopogon evandens* var. *subalpinus*
There is one known occurrence within the adjacent Cascade Lakes Watershed. Its known range is from the vicinity of Mt. Rainier National Park south to Siskiyou County California, first described in Idaho. It is an ectomycorrihizal fungus of mountain hemlock and true firs. Suggested protection is to preserve extensive tracts of mountain hemlock (S&M 1,3; Appendix J2-133).

Aquatic lichen - *Hydrothyria venosa*
There is one known occurrence within the adjacent Cascade Lakes Watershed. The range is from Central British Columbia to montane Central California. Habitat is within streams at low to mid elevations, however the known location is in a Cascade lake. Threats include siltation and fluctuation in water flow. Throughout the general range, much of the suitable habitat has already experienced siltation and other disturbances. Protection can be gained through enlarging riparian reserves, and watershed protection guidelines (S&M 1,3; Appendix J2-241).

Habitat Suitability/Disturbance and Loss of Habitat

The following factors have affected or may affect habitat suitability for sensitive plants in the watershed:

1. Control of naturally-occurring fires
Lack of natural fires over time will reduce the size and number of forest openings. Openings create important islands for plant diversity and habitat for sensitive species. Dense stands of lodgepole pine within the watershed may account for the disjunct populations of Jepson's monkeyflower.

2. Noxious weed encroachment

Noxious weeds are invasive, aggressive non-native plants. They can crowd out native species completely, changing diverse habitat into a monoculture Infestations tend to become profuse in areas of disturbance such as roadsides, and can take over even undisturbed habitats. Open ground in disturbed areas which provides habitat for the annual Jepson's monkeyflower would also provide favorable growing conditions for noxious weeds, many of which are also early-seral species.

Long-term controls of noxious weeds will involve a combination of hand-pulling, for lighter infestations, combined with herbicide on heavier infestations, and biological controls for some species. Herbicide use is not commonly used on the Deschutes National Forest at this time. Noxious weed controls now in place include an annual mapping of populations, with hand-pulling of the smaller, outlying infestations. Introduction of biological controls is done through the Oregon Department of Agriculture (ODA).

Spotted and diffuse knapweeds (*Centaurea maculosa* and *Centaurea diffusa*) are of special concern. Browns/Wickiup Watershed is well-removed from the private lands where knapweed populations are most dense, but these weeds are spreading into landscape areas 2 and 3 along major roads 43 and 46. Future invasion of noxious weeds may threaten sensitive plant habitat and overall native plant diversity.

Wickiup Dam, within landscape area 4, supports a very substantial population of Klamath weed, (St. John's Wort) *Hypericum perforatum*, along with lesser amounts of knapweed. Klamath weed also grows at the southwest end of Wickiup Reservoir along road 46 in landscape area 4, and at the southeast end of Crane Prairie Reservoir in landscape area 6.

Canada thistle, *Cirsium arvense*, grows on the shore of South Twin Lake, and on the south shore of Wickiup Reservoir within landscape area 4.

Bull thistle, *Cirsium vulgare*, has been found in old landings within landscape area 2 and on Browns Mountain.

Reed canary grass, *Phalaris arundinacea*, is a non-native plant that is not classified as a noxious weed by the Oregon Department of Agriculture. It is, however, very invasive and is growing around Crane Prairie Reservoir to the north and Davis Lake to the southwest of the Browns/Wickiup Watershed. It has been observed along the Deschutes River channel between Crane Prairie and Wickiup Reservoirs, and a well-established population grows in a meadow at the south end of Wickiup Reservoir. This plant was once planted extensively throughout the United States for cattle fodder. It is thought it was planted in the Big Marsh and around Davis Lake on the Crescent District.

Noxious weed infestations on the Deschutes National Forest are still fairly recent and are in the process of spreading here from more disturbed, agricultural areas. Weed seed can be

carried on auto or bike tires, on auto bodies, on boats and trailers, or on the coats or in the feed of livestock. Several other noxious weed species have been found elsewhere on the Forest, but are not a threat in the Browns/Wickiup Watershed at this time. A number of other noxious weed species have been reported in adjacent areas, but have not yet reached the Deschutes National Forest. Continued vigilance is needed. Increased noxious weed infestation would seem inevitable, especially without the use of herbicides.

Wildlife

The analysis area includes generally xeric coniferous forest types and a moderate level of species diversity, with approximately 262 species (Bend-Ft. Rock Ranger District, 1995). The majority of the area is within the range of the northern spotted owl and is therefore addressed by the Northwest Forest Plan (NWFP; USDA Forest Service et al. 1994). Management allocations assigned by the NWFP within the analysis area include Late-Successional Reserves (LSR) and Matrix. There are two reserves within the area including Round Mountain and Browns Mountain. Round Mountain is small at approximately 220 acres and Browns Mountain of moderate size at approximately 7,240 acres. The spotted owl range for the watershed is within the Eastern Oregon Cascades physiographic province as described in the NWFP.

Presently, there are no known spotted owls within the analysis area although several historic sightings have occurred. However, suitable habitat does exist in it (1,958 acres within the LSRs), and occupied sites are within approximately 5 miles of these habitats. Informal surveys for owls were done in late spring 1997 in the Browns Mountain area with no responses. The suitable nesting/roosting/foraging/ (NRF) dispersal owl habitat is displayed in Figure 3-8. There is no designated or proposed Critical Habitat within the watershed.

In addition to the northern spotted owl (Threatened status), other federally listed species under the Endangered Species Act (ESA) that are known to occupy the analysis area include: northern bald eagle (Threatened status) and the spotted frog (Candidate status). Other listed species that are found on the Deschutes National Forest but with no current documentation in the watershed include: American peregrine falcon and bull trout. A complete description of these species may be referenced in the Biological Assessment for 1997 for the Deschutes National Forest (Gerdes et al. 1997). Also, reference other sections of this report for additional information on bull trout.

Fig. 3-8

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Spotted Owl Habitat

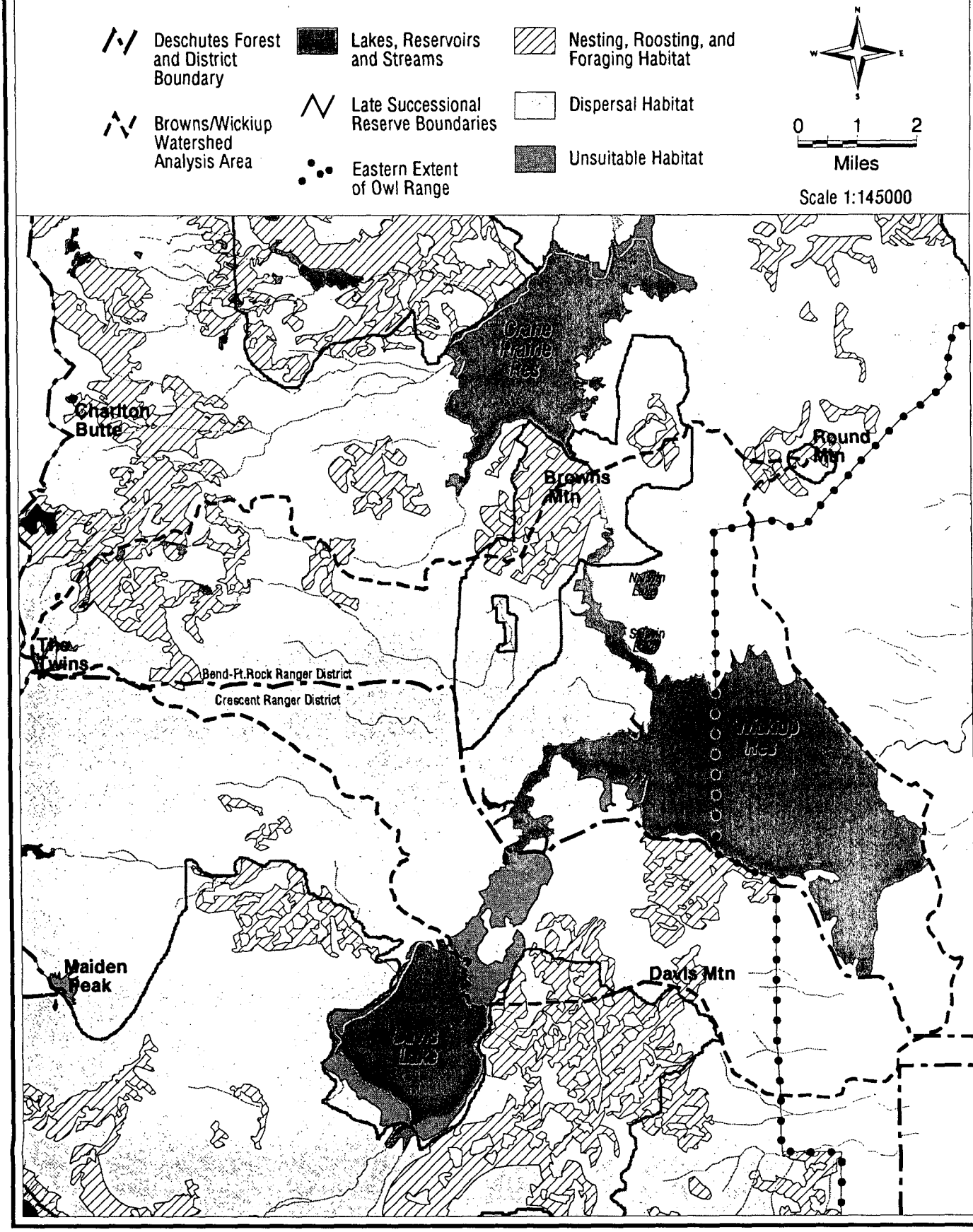
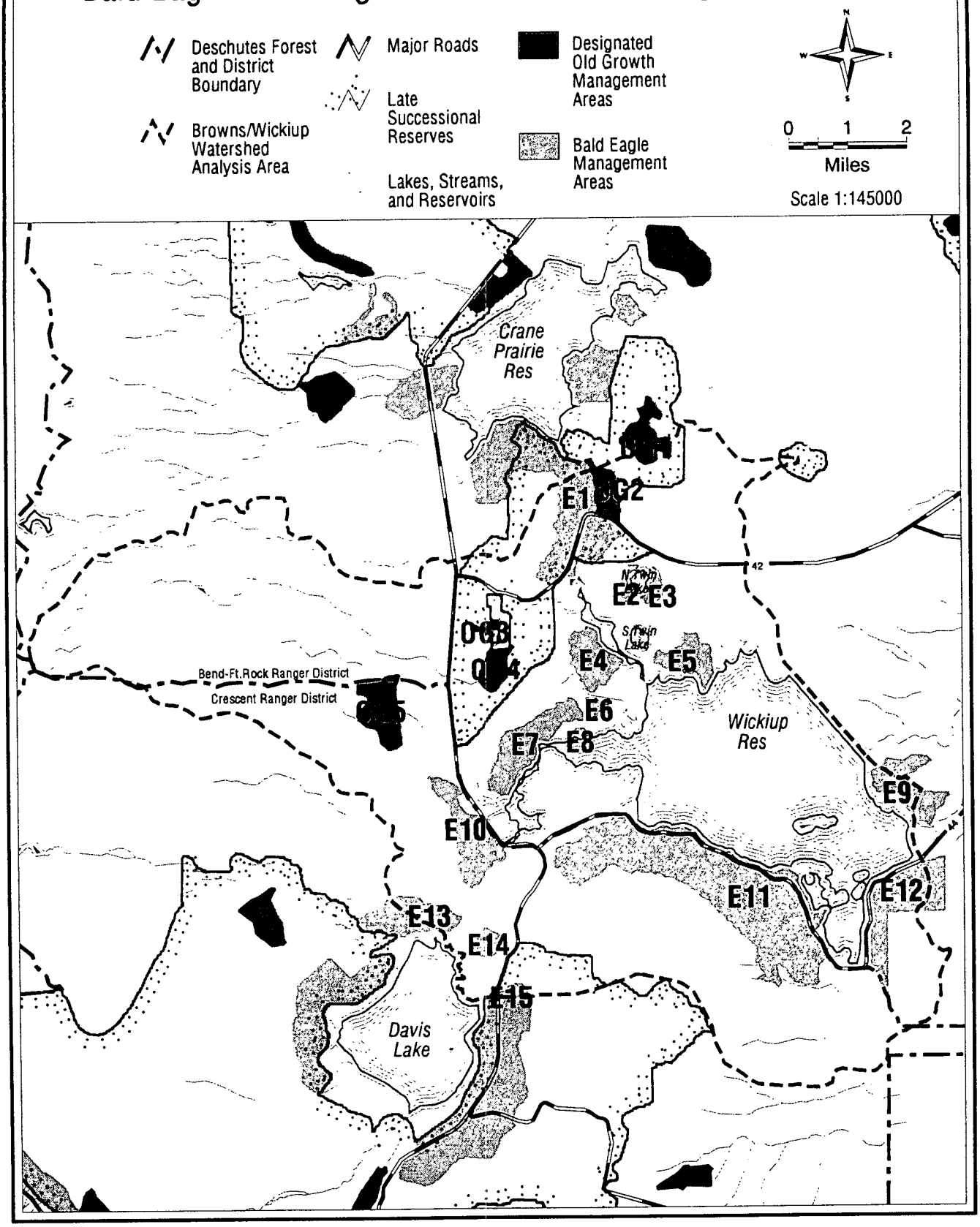


Fig. 3-9

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Bald Eagle and Designated Old Growth Management Areas



There are presently seven known nesting sites of northern bald eagles in the watershed analysis area. An additional three nest sites are located within the portion of the Browns Mountain LSR that is outside of the watershed boundary. There are also portions of two Bald Eagle Management Areas (BEMA; DNF, LRMP 1990) that are within the watershed boundary but the actual nest sites are not. The watershed area is within Recovery Zone 11, High Cascades (Oregon), which was designated by the Pacific Bald Eagle Recovery Plan (USDI, 1986). The nest sites within the watershed make a significant contribution to the goals of the Recovery Zone. Bald eagle nest sites are classified as sensitive data and therefore are not mapped. However, the designated BEMAs are shown on Figure 3-9, Bald Eagle and Old Growth Management Areas. Several of the designated BEMAs have not been recently occupied and serve as alternate/future nesting areas. In total, there are 15 BEMAs (7,946 acres) in the watershed and LSR analysis areas. There are no known eagle roosts in the watershed and comprehensive roost surveys have not been done, however winter use of the area is high.

Spotted frogs have been documented at Davis Lake and at Crane Prairie Reservoir. None of the sites are within the watershed boundary, however portions of Crane Prairie Reservoir are within the northern Browns Mountain LSR boundary. Additional surveys are being conducted, and potential habitat does exist within the watershed. Alarming population declines across large areas of the species' range have increased the importance of local population protection (Leonard et. al. 1993).

A variety of other species that are present or suspected to occur in the watershed have been determined by the US Fish and Wildlife Service (FWS) to be Species of Concern. Included are: California wolverine, Pacific fisher (Oregon Critical; ODFW 1992), Preble's shrew, long-legged myotis, long-eared myotis, small-footed myotis, Yuma myotis, Pacific western big-eared bat, northern goshawk (Oregon Critical), black tern, harlequin duck, and Cascades frog (Oregon Critical). Other sensitive species that have been documented within the watershed include: great gray owl (NWFP Survey and Manage species and Deschutes National Forest Management Indicator Species, MIS), osprey (MIS), American marten (Oregon Sensitive, MIS), pileated woodpecker (Oregon Critical, MIS), white-headed woodpecker (MIS), Black-backed woodpecker (Oregon Critical, MIS), three-toed woodpecker (Oregon Critical), Williamson's sapsucker, pygmy nuthatch (Oregon Vulnerable), western bluebird, neotropical migrant birds (international concern group, total of 87 species excluding waterfowl and shore birds), flammulated owl (Oregon Critical), northern pygmy owl, Greater Sandhill Crane (Oregon Vulnerable), and tailed frog (Oregon Vulnerable). Only those species that have good probability of presence in the watershed have been noted in this section. Past population inventories and/or habitat types/conditions have been used in the determination of concern/sensitivity.

The watershed provides valuable habitats for many common species of economic and/or ecological importance. Mule deer, Rocky Mountain elk, mountain lion and black bear are important big game species in the area. The lakes, reservoirs and rivers in the area provide critical habitat for a variety of waterfowl and shorebird species. Many ducks and geese breed

in these habitats. Approximately 60% of the total species in the watershed utilize riparian habitats significantly (i.e. breeding, feeding, resting). A detailed account of these species is presented in the Cascades Lakes Watershed Analysis (Bend-Ft. Rock Ranger District, 1995), which is adjacent to the Browns/Wickiup Watershed Analysis area and therefore, quite similar in species composition. An array of more common resident species include blue and ruffed grouse, great horned owl, common raven, gray jay, Clark's nutcracker, northern flicker, snowshoe hare, beaver, mink, bobcat, long-tailed weasel, deer mouse, golden-mantled ground squirrel, yellow-pine chipmunk, Douglas squirrel, Pacific chorus frog, etc. to name a few. A complete species list is in the Wildlife Appendix.

Generally, accurate population data on the vast majority of wildlife species is non-existent due to the time and expense involved. However, information from Breeding Bird Surveys, big game harvest statistics, research data sets, local surveys, etc. are often available and may be extrapolated to draw conclusions for individual species or groups of species. Reference or historic data is particularly lacking for most species, so past population levels are best inferred from what is known about past habitat conditions. The following discussion is organized to address individual species that are of concern, e.g. proposed, endangered, threatened, sensitive (PETS). In addition, other selected species will be addressed individually that are Species of Concern (SOC), economically important or ecological significant. In order to reduce the complexity of addressing all of the 262 species potentially within the analysis area, most have been grouped by habitat guilds (see Wildlife Appendix). They are assemblages of similar species that have been grouped into communities with common biological needs.

PETS Species

Northern Spotted Owl

Reference Conditions

- Population levels higher than currently is probable, but numbers unknown
- Habitat fragmentation is less due to having no timber management units, roads, facilities, etc.
- Owls likely occupied sustainable climatic climax forest including MCD on north aspects and MCW types
- Dispersal of young and other movements were less restricted
- Prey base populations were likely higher due to the greater availability of CWM (coarse woody materials)
- Predation was likely lower due to larger more contiguous stands
- Genetic diversity was greater with a larger number of owls and less isolation

Current Conditions

- Federal listing- Threatened
- Unknown population, but two owls have been documented in the high elevation areas near Johnny Lake
- Fragmentation is moderate to high, primarily due to timber harvest units and roads
- Residual potential habitat types remain but are isolated in relatively small areas of the watershed
- Dispersal and movement of owls is potentially limited due to past timber harvest units, roads, wildfires etc.
- Prey base populations are likely lower due to removals of CWM by management activities and wildfires over significant acreage in the watershed
- Predation is potentially significant due to large amount of high contrast edge and small forest interior habitats
- Genetic diversity is potentially constrained due to habitat fragmentation and constrained movements
- Owls are present in the Cultus Mountain LSR and in the Davis Mountain LSR
- Browns Mountain LSR has enough suitable habitat to potentially support one pair of owls, however it is isolated due the effects described above. Some fragmentation has occurred and nest trees may be limiting. Round Mountain LSR has an inadequate amount of suitable habitat to support a pair of owls, however it is adequate to support dispersing owls. Dispersal of owls from other areas is likely a problem due to isolation of the LSR.

Northern Bald Eagle

Reference Conditions

- Historic population levels unknown
- Nesting and roosting habitats were likely more plentiful and of higher quality, i.e. large ponderosa pine and Douglas-fir trees
- Foraging habitat dominated by rivers with some natural lakes, with native trout the primary forage
- No contamination of egg shells by pesticides

Current Conditions

- Federal listing- Threatened
- Present population (summer breeding) is seven pairs with an additional three pairs in the LSR outside the watershed boundary (41% of the Forest's population). Winter population is high, but unquantified due to annual variations. Likely a higher level than historically due to the construction of large reservoirs in the area that have good fish populations, which are critical to successful reproduction.
- Nesting and roosting habitats are presently adequate, but the long-term sustainability of the habitat is uncertain due to risks to insect, disease, wildfire and human disturbance.
- Foraging habitat is excellent because species have shifted from native trout to introduced species (e.g. kokanee, brook trout, brown trout, bass, etc). Bull trout have been extirpated

from the watershed. Disturbance from heavy recreational activities may be adversely affecting the foraging of eagles.
- Egg shell contamination from pesticides has occurred but presently does not appear to be a significant problem affecting reproductive success of eagles.
- Browns Mountain LSR presently supports four known active pairs of bald eagles. Potential for additional nesting habitat exists, however the forage base in nearby reservoirs and rivers may be limiting. Solitude is poor adjacent to Crane Prairie Reservoir but good in the remainder of the LSR due to road closures. Round Mountain LSR has no current nesting eagles, however a sub-adult was observed on Round Mountain in June 1997. Potential nesting habitat presently exists, but the area is about three miles from the nearest foraging area. Solitude is only fair due to open roads and an active fire lookout on the mountain.

Spotted Frog

Reference Conditions
- Historic population unknown but likely higher due to better quality riparian habitats and fewer predators (i.e. introduced non-native fish).
- Riparian habitats were more plentiful prior to the inundation of the Deschutes River by Crane Prairie and Wickiup Reservoirs.
- Predators were limited primarily to garter snakes.

Current Conditions—
- Federal status- Candidate species
- Current populations are low and isolated. However, not all areas have been surveyed. Populations have been documented in the Davis Lake and Crane Prairie Reservoir areas.
- There is less high quality riparian habitat. The fluctuating reservoir levels reduces the amount and quality of non-woody aquatic vegetation along shorelines, which is important to this species (Leonard et al. 1993). The eggs of frogs may also be left on dry ground. Spotted frogs need minimum water temperatures of 70 degrees F. to metamorphose. Warm water temperatures that have been associated with shallow reservoirs may be beneficial to frog egg development.
- Introductions of non-native warm water fishes (e.g. bass) likely have negative impacts on spotted frog populations.
- Browns Creek within Browns Mountain LSR is potential, high quality habitat for spotted frogs, but it has not been surveyed. Adjacent areas of Crane Prairie Reservoir and the Deschutes River between Wickiup and Crane Prairie Reservoirs are also potential habitat. Round Mountain LSR has no habitat.

American Peregrine Falcon

Reference Conditions

- Population level unknown.
- Breeding habitat not present. There is a potential for foraging habitat, particularly along the Deschutes River.

Current Conditions

- Federal status- Endangered
- Population is unknown, but possibility of movement through the area around Crane Prairie Reservoir area in 1993.
- Potential for foraging habitat has likely increased due to more habitat for waterfowl and shorebirds at the reservoirs.
- Population declines due to egg shell thinning from pesticides in the food chain should now be controlled.
- Browns Mountain LSR has no potential nesting habitat. Browns Creek and Crane Prairie Reservoir could provide good foraging. Round Mountain LSR has no potential nesting habitat, and limited foraging habitat.

Habitat Guilds

Reference the Wildlife Appendix for the Habitat Guilds/Management Indicator Species Evaluation for species lists and general information on reference and current conditions. All data is derived from the Deschutes National Forest wildlife habitat relationships database. Individual species may be listed in multiple guilds and may be repeated in the declining population category. All potential habitat users are included, which include those which are rare or on the edge of their range. Importance of potential habitat use is not discussed in this narrative. Reference the Analysis Files at the Bend-Fort Rock Ranger District for the summary data tables on PAGs species lists, riparian species, home range size, use codes, abundance, and other pertinent information.

Fish

The present fish distribution and species make-up is much different than reference conditions. An active stocking program initiated by state agencies early this century, along with illegal introductions, have greatly increased the distribution, species composition, and angling opportunity of the fishery.

Bull trout, proposed to be listed as "threatened" under the Endangered Species Act throughout much of it's range determined by the US Fish and Wildlife Service, are presumed to have been eliminated from the watershed about 40 years ago. The status of the redband trout, currently on the Regional Foresters Sensitive Species list, is unknown. There are naturally-reproducing rainbow trout within Wickiup Reservoir, but it is unclear if they can be considered redband because of the likelihood of interbreeding with stocked rainbow trout.

Fish habitat conditions are much different today than historic conditions, largely due to the formation of Wickiup Reservoir in the 1940s. Several miles of stream channel were converted to reservoir habitat with the completion of the reservoir dam. Crane Prairie Reservoir upstream of the watershed has altered the flow regime and water temperatures of the Deschutes River as it enters the watershed, resulting in adverse effects to fish and other aquatic life. For additional information, refer to Oregon Department of Fish and Wildlife (ODFW) Deschutes River Basin Plan 1996, pages 111-130.

Reference Fish Distribution

Historically, the watershed contained abundant populations of native redband trout, bull trout, and mountain whitefish. Habitat for sculpin exists, but there is no record of documentation. The distribution of the fish was dependent on connection to the Deschutes River. North Twin, South Twin, Johnny, and Found lakes were likely fishless prior to stocking efforts.

The streams within the watershed were some of the most important spawning and rearing areas for bull trout in the Deschutes River upstream of Bend. The last reported catch of a bull trout in the watershed was in Wickiup Reservoir in 1957. The possible reasons for elimination were one or more of the following: 1). Angling mortality; 2). Competition with other fish species for food, space, and spawning habitat; 3). Hybridization with eastern brook trout; 4). Blockage of historic spawning grounds of fluvial (river) populations with the completion of the construction of Wickiup Dam in 1949; and 5). Kokanee salmon superimposing redds on the bull trout redds.

Creation of Wickiup Reservoir changed the population from fluvial to adfluvial. Bull trout are very susceptible to angling, and this likely played a major part in the elimination of the species from Wickiup Reservoir. ODFW will be conducting a feasibility study on the

re-introduction of bull trout to Wickiup Reservoir.

The redband trout are an inland version of the rainbow trout, and are endemic to the western U.S. and Canada. Dr. Robert J. Behnke (fish geneticist) has divided the rainbow into three major evolutionary groups: (1) coastal rainbow trout; (2) redband trout of Sacramento, Kern, and McCloud Rivers in California; and (3) redband trout of the Columbia River Basin (Behnke, 1992). The Deschutes Basin redband belong to the Columbia River basin group.

The watershed has been planted with rainbow trout of various stocks over the years by the ODFW under a Memorandum of Understanding between ODFW and the Forest Service. Interbreeding occurred between the hatchery stocks of rainbow and the native redbands, diluting the genetic purity of the redbands. Genetic testing has been completed on three populations upstream of the watershed. The degree of genetic purity varied with each population.

The mountain whitefish was found in the Deschutes River and the tributary streams.

Although there has been no documentation of presence within the watershed, there is habitat present for two species of aquatic invertebrates currently on the Regional Foresters Sensitive Species list, the Cascades apatanian caddisfly and the Alsea ochrotrichian microcaddisfly.

Current Fish Distribution

ODFW augments or maintains several of the fish populations through stocking efforts of fingerling trout and salmon. Within Wickiup Reservoir, there are naturally reproducing populations of brown trout, kokanee salmon, coho salmon, eastern brook trout, and rainbow trout. The brown trout and coho salmon populations are augmented annually with hatchery stockings. The brown trout within the reservoir represent the only disease-free brown trout population in the state. Since 1990, the sole source of brown trout eggs for ODFW's hatchery program have been taken from Browns Creek.

North Twin and South Twin lakes are stocked with rainbow trout. There is presumed to be no natural reproduction of rainbow trout. Johnny Lake and Found Lake are stocked with eastern brook trout. There is likely no natural reproduction within Johnny Lake, but there is potential at Found Lake because of the presence of the outlet stream.

Other fish species are largemouth bass, three-spined stickleback, and tui chub (within Wickiup Reservoir), and brown bullhead (within North Twin), resulting from illegal introductions. These are either by direct introduction or downstream migration from Crane Prairie Reservoir. Although recent illegal introductions of bluegill and black crappie to Crane Prairie Reservoir have recently occurred, there is no evidence of these species in Wickiup Reservoir, yet the potential exists. Wickiup Reservoir is not considered good habitat for warm water species because of the widely fluctuating water levels that can disrupt spawning.

The Deschutes River has resident populations of eastern brook trout, rainbow trout, mountain whitefish, and brown trout. Browns Creek is primarily rearing grounds, but there are some resident eastern brook trout. Davis and North Davis Creek are primarily spawning and rearing areas and are inundated when Wickiup Reservoir is at full capacity.

Reference Fish Habitat Conditions

Before Wickiup and Crane Prairie Reservoirs existed, the Deschutes River, Browns Creek, Davis Creek, and North Davis Creek were clear, cool, spring-driven streams with stable flow regimes. The streambanks were lined with trees that provided shade and large wood for instream cover. The habitat was sufficient to meet the strict environmental requirements of bull trout for cool temperatures and clean spawning gravels.

Current Fish Habitat Conditions

With the construction of Crane Prairie Reservoir in 1922, the flow regime of the Deschutes River between Crane Prairie and Wickiup Reservoirs was altered and the water temperatures was increased. During low water years, the lack of flow and the elevated summer water temperatures result in degraded habitat for fish and aquatic invertebrates within the river. The dam blocks the natural downstream migration of spawning gravels. Spawning success for the fall spawning brown trout and kokanee salmon may be reduced in the Deschutes River during years that the rising waters within Wickiup Reservoir inundate the redds before the fry emerge, diminishing the oxygen supply to the developing fish.

Recent restoration efforts have been completed by ODFW and the Deschutes National Forest that added 1,200 cubic yards of spawning gravel and 85 whole trees to the Deschutes River channel. Monitoring of the projects indicates a substantial increase in spawning use by rainbow trout, kokanee salmon, and brown trout.

Construction of Wickiup Reservoir inundated approximately 24 miles of stream channel when at capacity, but has added over 10,000 surface acres of water. Most of the standing trees were harvested within the confines of the reservoir prior to filling (unlike Crane Prairie Reservoir). If left, the trees would have provided habitat for fish and aquatic invertebrates. Many of the remaining stumps have eventually become dislodged because of wave action and the widely fluctuating water levels. The stumps float down to the dam where they either become lodged on dry land or are routinely removed and burned. The drawdown of the reservoir in the summer to meet irrigation needs reduces available habitat, desiccates aquatic vegetation and invertebrates, increases competition between fish, decreases foraging opportunity for eagles, ospreys, and other fish-eating birds, and increases the escapement of fish past the unscreened headgates at the dam into the Deschutes River.

ODFW and the Deschutes National Forest have partnered to restore over 230 tree stumps or whole tree bundles to the reservoir since 1990. Monitoring has indicated that fish and invertebrates do use these structures for cover and feeding areas.

Browns Creek is heavily utilized for spawning and rearing of salmonids, primarily brown trout and kokanee salmon. There is abundant instream wood and spawning gravels, but a lack of pool habitat. ODFW added 40 cubic yards of gravel in 1986. Monitoring of the spawning gravels has indicated a high percentage of fine sediments, which is typical of spring-driven systems on the Deschutes National Forest. Analysis in 1997 on six samples found a range of 26-58% fine sediments (sediments < 1/4" diameter), with an average of 42%. Research has indicated fine sediment volumes >20% inhibits salmonid egg development and emergence of fry. The lack of flushing flows in the stable spring systems allows fine sediments to deposit. Coho salmon fingerling were recently discovered near the headwaters, the first evidence that the population within Wickiup Reservoir is reproducing naturally.

Davis and North Davis creeks provide some spawning habitat for kokanee salmon and mountain whitefish in the fall when the reservoir is drawn down. The streams lack instream cover and have high fine sediment volume within the gravels (samples averaged 30%).

North Twin, South Twin, Johnny, and Found lakes are all currently similar in habitat conditions to historic conditions.

For more information, reference stream survey reports on file at the Bend-Ft. Rock Ranger District.

Fire/Fuels

Reference Conditions and Natural Disturbance Regimes
Fire has been a major disturbance regime across these landscapes (Agee, 1993). Fire was once low intensity, high frequency and sometimes very large, and the effects were relatively negligible except in understory vegetation and fuels. The following describes fire regimes by plant association group. See Table 3-13 for fire facts by landscape sub-area.

Ponderosa Pine Forests

Approximately 6,050 acres of Ponderosa Pine Dry forests and 4,300 acres of Ponderosa Pine Wet forests comprise 10,350 acres (18%) of the landbase within the Browns/Wickiup watershed. Ponderosa pine forests have a low severity fire regime. Historic fires were low intensity, rarely scorching the crowns of trees, with a return interval of 1-25 years.

Mixed Conifer (Wet/Dry) Forests

Approximately 14,950 acres of Mixed Conifer Dry forests and 10 acres of Mixed Conifer Wet forests comprise 14,960 acres (26%) of the landbase within the Browns/Wickiup watershed. This plant association group has a moderate to high severity fire regime. Mixed conifer forests have the most frequent fire activity on eastside forests, although cooler, wetter sites (Mixed Conifer Wet, MCW) have longer fire return intervals. Fire return intervals are estimated by Bork (1995) at 9-25 years while Hopkins (WEAVE, 1994) estimates them to be 30-50 years in the lower elevations (1,500 to 4,000 feet) and 50-80 years in the higher elevations (4,000 to 5,000 feet).

Mountain Hemlock Forests

Approximately 4,310 acres of Mountain Hemlock forests comprise 9% of the landbase within the Browns/Wickiup watershed. This plant association group (PAG) falls into a high severity fire regime. Fire is the primary large-scale disturbance in the high elevation forest. Due to the lack of fire resistance of the major tree species in these forests, most fires are stand replacement fires. Fire return intervals are in the 200-300 year range. Typically, a fuel-limited situation for crown fire development exists in these forests, but in unusually dry years, large-scale crown fires will burn regardless of the fuels situation.

Lodgepole Pine (Wet and Dry) Forests

Approximately 11,290 acres of Lodgepole Dry forests and 3,690 acres of Lodgepole Wet forests account for 14,980 acres (32%) of the landbase within the Browns/Wickiup watershed. This plant association group has a moderate severity fire regime. Fire frequency is not well documented for these types of forests. The average fire return interval is in the range of 60-80

years. In areas surrounded by higher productivity forests, the fire return interval is at the lower end of the range. The intensity of fires range from slowly burning logs on the forest floor (also termed "cigarette burns") to crown fires.

Meadows and Riparian Areas

Approximately 310 acres or $<1\%$ of the landbase. Fires were typically of light intensity, less than 1 acre in size, and with a return interval of 50-100 years. During severe droughts, high-intensity fires of 1 to 50 acres may occur with a return interval of 100-200 years. Before Euro-American settlement, Native Americans burned flat grasslands annually to attract foraging game animals.

Fire has less effect in riparian systems than associated up slope forests, because these areas are moist, have more deciduous vegetation, and have higher dead and live fuel moistures. Usually, riparian areas do not burn, or they burn at reduced intensity. Headwater riparian areas sometimes burn with higher than average intensity than surrounding slopes. This is due to the channeling effect of wind in an area of higher biomass than found elsewhere. For example, some of the hottest burn sites in the 1988 Dinkelman fire near Wenatchee occurred in riparian areas. Under normal conditions, riparian areas burn less frequently than fire events on upper slopes, burn under extreme environmental conditions, and may burn hotter (Agee, 1992). The 1996 Tower fire, Umatilla National Forest - NFJD Ranger District, had severe fire in the Hiddaway drainage and it was reported that fish were blistered and died (personal communication with Wilson, 1996). The direct effects of various disturbance types on riparian systems was conceptually modeled by Agee (1988). Fire's direct effects vary, partially based upon the width of the stream. Agee's work does not identify the specific widths of the streams in the size class of small, medium, and large, but the modeled effects are in relative terms.

From a water resources perspective, the effects of fire in forest ecosystems can range from essentially none at all to disastrous. The unpredictability of many fire effects are dependent upon, in part, to the wide range of topographic conditions, site differences in soil characteristics and moisture content, variations in fuel moisture and fuel loads, density of vegetation, microclimates associated with a given slope, aspect and topographic position, and variability in weather patterns before, during, and after the occurrence of a fire. The result is a mosaic of fire severity and effects across a hillside or landscape, even from the 'same' fire (Beschta, 1990).

Riparian

Fire generally has two types of impacts on riparian zones: 1) direct impacts associated with burning within the riparian zone; and 2) indirect impacts associated with burning at another location on the landscape. Indirect impacts affect sediment transport, biomass creation or removal, or water quality and quantity as it moves through the riparian zone.

Fire usually has less effect in riparian systems than associated upslope forests, due to moist riparian areas with more deciduous vegetation. Usuallv, riparian areas do not burn, or they burn at reduced intensity. Headwater riparian areas sometimes burn with higher than average intensity than surrounding slopes due to the channeling effect of wind in an area of higher biomass.

Current Conditions

The magnitude of fire disturbance has changed significantly in some plant communities due to the exclusion of fire for almost 90 years (Bork, 1984). Contemporary fires are not as expansive due to fire exclusion, but the intensity and potency of fires has increased notably. A rapid accumulation of fuels has occurred due to insect and disease infestations, the general absence of fire, and recent drought conditions. This increases the risk of a major disturbance. Recreational use in the watershed is high and expected to increase. Fire occurrence figures have shown increased human-caused ignitions over the last several years. Record-keeping since 1908 indicates approximately 142 fires recorded since 1908 which account for approximately 11% of the total number of fires that have occurred on the Bend portion of the Bend-Ft. Rock Ranger District. Of those, 21 fires have occurred in the Browns LSR and none in the Round Mountain LSR. The Browns/Wickiup analysis area averages 8.4 fires per year. The ratio of human ignitions to lightning ignitions are 3:1.

Table 3-13

Fire Facts by Landscape Sub-Area

Landscape Sub-Area	Elevation Range (feet)	Fuel Models * Model # Acres	Crownfire Susceptibility (Acres)	Special Features	Fire Access	Land Mgmt. Planning Allocation
#1a - High Elevation Unroaded	5400 - 6100	FM 2 = 50 acres 6 = 50 8 = 1,890 9 = 10 10 = 2,030 11 = 10 998 = 30 999 = <10	Water, Rock, Lava and other = 100 Low = 650 Mod. = 1,330 High = 1,010 Ext. = 830	Round Meadow Long Meadow Main hiking trails into Johnny & Found Lakes	Walk-in by engine crews or use of smokejumpers Aerial attack w/ helicopters & retardant planes.	Dispersed Recreation, Admin. Withdrawn, Matrix
#1b - Roaded Lodgepole Pine & Mixed Conifer	4500 - 5200	FM 2 = 10 6 = 390 8 = 850 9 = 10 10 = 1,060 11 = 40 998 = 10 999 = 0	Water, Rock, Lava and other = 20 Low = 1,280 Mod. = 280 High = 820 Ext. = 40	Special Use Pit - located on T21S, R 7E, sec 34 Another pit T21S, R 7E, sec. 36	Drive-to attack, walk in by engine crews. Many roads in the area exist with a variable maint. level and closure status.	Matrix, General Forest
#1c - Johnny & Found Lakes	Johnny Lake 5351 ft Found Lake 5862 ft	FM 8 = 10 10 = 10 11 = 40 999 = 20	Water, Rock, Lava and other = 20 Low = 10 Mod. = 130 High = <10 Ext. = <10	Hiking trails into both of these lake bodies.	No roads Walk in by engine crews or use of smokejumpers	Dispersed Recreation, Admin. Withdrawn, Matrix, Riparian Reserves
#2a - HWY 46 Corridor	4500 - 4600	FM 2 = 90 6 = 2,340 8 = 3,710 9 = 190 10 = 2,580 11 = 200 998 = 30 999 = 0	Water, Rock, Lava and other = 190 Low = 7,000 Mod. = 800 High = 2,010 Ext. = 70	Scenic corridor HWY 46 Pine Butte N. Davis Campground	Drive to attack, walk-in by engine crews, aerial attack via airtankers & helicopters.	Matrix, General Forest, BEMA, Old Growth

Landscape Sub-Area	Elevation Range (feet)	Fuel Models * Model # Acres	Crownfire Susceptibility (Acres)	Special Features	Fire Access	Land Mgmt. Planning Allocation
#2b - North Wickiup Area	4300 - 4500	FM 2 = 70 6 = 760 8 = 1,350 9 = 190 10 = 750 11 = 10 998 = < 10 999 = 0	Water, Rock, Lava and other = 60 Low = 2,520 Mod. = 340 High = 480 Ext. = 70	Headwaters from Browns Creek enter Wickiup Res. Twin Lakes Resort & Campgrounds Sheep Bridge Campground	Drive-to attack, walk-in by engine crews	General Forest, BEMA Matrix
#2c - Eaton Butte	4300 - 4500	FM 2 = 20 6 = 540 8 = 290 9 = 90 10 = 390 11 = < 10 998 = 30 999 = 0	Water, Rock, Lava and other = 70 Low = 920 Mod. = 120 High = 300 Ext. = 60	Special use pit - 4260 rd Adjacent to private land (Crown Pacific)	Drive-to attack Walk-in by engine crews	BEMA
#2d - Davis Arm Area	4300 - 4400	FM 2 = 10 6 = 170 8 = 540 9 = < 10 10 = 210 11 = 0 998 = < 10 999 = 0	Water, Rock, Lava and other = 20 Low = 750 Mod. = 50 High = 160 Ext. = < 10	Reservoir Campground N. Davis Creek Campground	Drive-to attack, some gated roads in area. Many harvest activity roads which dead-end	Intensive Recreation, Admin. Withdrawn, Matrix, Riparian Reserves
#2e - Forested Lava	4500 - 5200	FM 2 = 20 6 = 270 8 = 290 9 = 10 10 = 150 11 = < 10 998 = 0 999 = 0	Water, Rock, Lava and other = < 10 Low = 720 Mod. = 60 High = 90 Ext. = < 10	Special Use Pit T21S, R 07E, Sec 26 off the 4290 Road	Drive-to attack, walk-in by engine crews or hand crews Dozer accessible	Matrix, General Forest, Old Growth

Landscape Sub-Area	Elevation Range (feet)	Fuel Models * Model # Acres	Crownfire Susceptibility (Acres)	Special Features	Fire Access	Land Mgmt. Planning Allocation
#2f - Wickiup Butte	4400 - 4900	FM 2 = 10 6 = 130 8 = 50 9 = 10 10 = <10 11 = <10 998 = <10 999 = 0	Water, Rock, Lava and other = 20 Low = 210 Mod. = 10 High = <10 Ext. = <10	Wickiup Butte Campg. Gauging station off the 4370 Road	Gated roads in areas. Drive-to attack possible. Walk-in by engine crews and hand crews Dozer accessible slopes ranging 20 -40 %	BEMA, Intensive Recreation
#3 - Davis Mtn. Area	4400 - 6200	FM 2 = 100 6 = 1,370 8 = 3,030 9 = 610 10 = 2,690 11 = 20 998 = 20 999 = 0	Water, Rock, Lava and other = 190 Low = 4,360 Mod. = 1,510 High = 1,580 Ext. = 770	Bald Eagle habitat area Heavy fuels on the north slopes where no treatment has taken place.	Drive to attack. Some roads are being closed in the area. Walk-in w/engine and hand crews Dozer accessible but limited by transport access.	BEMA, Scenic Views, Matrix
#4a - Reservoir Shorelines	4300 - 4400	FM 2 = 3,530 6 = 670 8 = 430 9 = 20 10 = 230 11 = 20 998 = 3,310 999 = 2,400	Water, Rock, Lava and other = 9,940 Low = 1,030 Mod. = 80 High = 150 Ext. = <10	Reduction of fuels should occur where there are opportunities to reduce Fuels models 2, 6, 8, & 9 by 30% Dispersed campsites along Wickiup Reservoir	Drive-to attack by engines, walk-in w/ handcrews and engine crews. Retardant not advisable along the shorelines	Intensive Recreation, BEMA, Riparian Reserve, Matrix
#4b - North Twin Lake **This is a public safety and population/ wildland interface zone.**	4350 - 4500	FM 2 = 0 6 = 10 8 = 10 9 = 40 10 = 40 11 = 0 998 = <10 999 = 110	Water, Rock, Lava and other = 110 Low = 30 Mod. = 20 High = 30 Ext. = 10	N. Twin Lake Campground 1 main road (040) in & out of area Area has a great deal of grass/brush in the understory combined w/ dense middlestory, contributing to crown fire development.	Drive-to attack by engines. Walk-in w/ handcrews and engine crews Retardant not advisable along the shorelines	Intensive Recreation, BEMA, Matrix, Admin. Withdrawn, Riparian Reserve

Landscape Sub-Area	Elevation Range (feet)	Fuel Models * Model # Acres	Crownfire Susceptibility (Acres)	Special Features	Fire Access	Land Mgmt. Planning Allocation
#4c - S. Twin Lake **This is a public safety and population/ wildland interface zone.**	4350 - 4500	FM 2 = <10 6 = <108 8 = 10 9 = 30 10 = 30 11 = 0 998 = <10 999 = 100	Water, Rock, Lava and other = 110 Low = 30 Mod. = 20 High = 20 Ext. = 20	S. Twin Lake Campground Area has a great deal of grass/brush in the understory combined w/dense middlestory, contributing to crown fire development.	Drive-to attack by engines. Walk-in w/handcrews and engine crews Retardant not advisable along the shorelines	Intensive Recreation, Matrix, Scenic Views, Riparian Reserve
#5 - Davis Lava Flow	4500 - 4700	FM 2 = <10 6 = 30 8 = 40 9 = <10 10 = 130 11 = 10 998 = 1,050 999 = 0	Water, Rock, Lava and other = 1,060 Low = 110 Mod. = 20 High = 110 Ext. = <10	Consider a confinement strategy if a prescribed, natural fire plan has not yet been developed. Prioritize Davis Mountain as the highest value natural resource to protect.	Walk-in w/ handcrews and engine crews Helicopter water drops would be advised over retardant	Scenic Views, BEMA, Matrix, Riparian Reserves
#6 - Browns/ Round Mtn. LSRs	4300 - 5800	FM 2 = 100 6 = 960 8 = 1,780 9 = 250 10 = 2,680 11 = 30 998 = 20 999 = <10	Water, Rock, Lava and other = 230 Low = 3,210 Mod. = 650 High = 1,560 Ext. = 510	LSR areas - potential habitat for late-successional species Browns Creek is unique riparian habitat Meadows in Sokol land exchange provide for opportunity to use fire & other treatments to prevent encroachment	Walk-in w/handcrews and engine crews Helicopter water drops would be advised over retardant	LSR, BEMA, Scenic Views, Old Growth, Proposed Wild and Scenic River, Riparian Reserve, Osprey, General Forest

* Reference fuel model descriptions in the Appendix for Fire/Fuels.

Recreation

Reference Conditions

During the last half of the nineteenth century, and into the early part of the twentieth century, recreation and leisure in the Wickiup area was likely limited to short family outings. Neither time nor income allowed for extensive recreation pursuits during this settlement era. During the first half of this century, access into the Wickiup area was limited to primarily non-motorized users until road construction projects allowed motorized vehicles. Main access roads were constructed from the 1920s through the 1950s (Roads 40, 42, 46). Limited access in the 1960s provided the opportunity for experiencing solitude, closeness to nature, with a higher degree of self-reliance in a predominantly natural-appearing landscape. Some of the activities which occurred in the area were fishing, trapping, hunting, and camping. Use of the Wickiup area was less due to the lower population levels and less available time to pursue outdoor recreation. Actual use figures are not known for the first half of this century.

Prior to the construction of Crane Prairie and Wickiup Reservoirs, there were few developed recreation opportunities available to the public. With the construction of the reservoirs and roads, came more opportunities for a variety of new recreational activities (Figure 3-10, Points of Interest). Lakes and reservoirs were stocked by the State, attracting anglers and boaters. Private resorts were developed at several lakes along the Cascade Lakes Highway, including South Twin Lake. Formalized Forest Service campgrounds, day use areas, and boat ramps were constructed in the 1950s and 1960s, which helped increase the popularity and use patterns. Personal communication with long-time angler Scott Odgers, indicates there were only a few dispersed camps and an abundance of large fish along the south shore of Wickiup Reservoir during the 1950s. Fishing access was primarily by foot along most areas of the reservoir. However, with salvage logging and road construction, access to the shore was increased. This access allowed dispersed camping to increase, with a corresponding decrease in angling success for large fish as more pressure was exerted on the fishery.

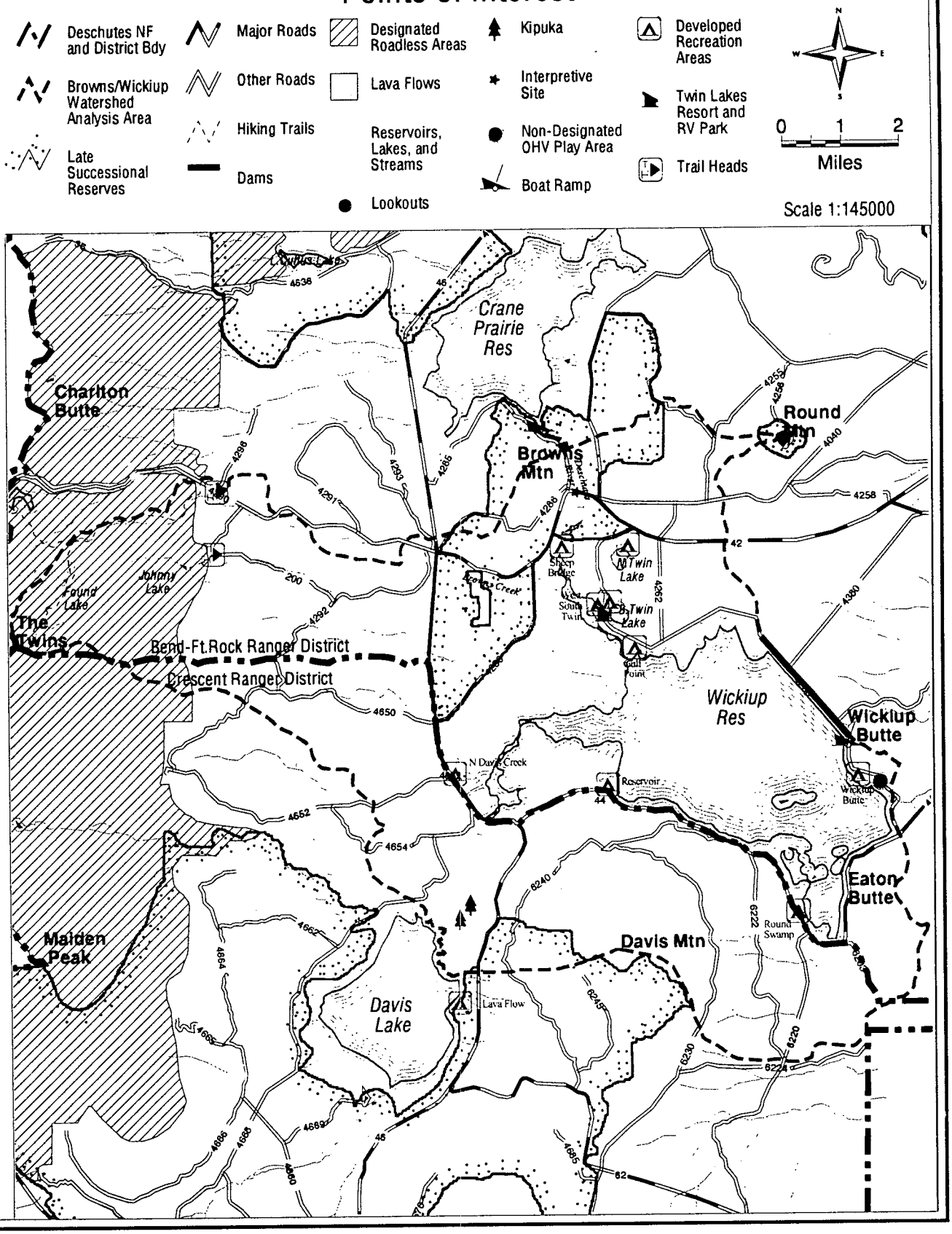
Current Conditions

Harvest activities which provided access to water, an increase in demand for recreational opportunities, and an increase in the population of Central Oregon, has dramatically changed the character of the recreation landscape around Wickiup Reservoir since the early 1960s. Impacts include vegetation trampling/denuding, user conflicts, wildlife disturbance, increased noise and litter, soil compaction, and vandalism.

An increase in demand for recreational opportunities can be attributed to advancements in technology which enable recreationists to access and partake in a larger variety of activities. Two examples of these activities are mountain biking and use of personal watercraft. More leisure time and variable work schedules has also played a role in use patterns and changes.

Fig. 3-10

BROWNS/WICKIUP WATERSHED ANALYSIS AREA
Points of Interest



The impacts of increased use, technology advancements, more leisure time, and the popularity of Central Oregon diminishes the available land base that can be recreated on at one time. The Forest Service recreation budget annually continues to shrink, and has done so since the early 1990s, which limits the amount and type of management that can occur at recreation sites.

Below is a discussion regarding the current condition of the recreation facilities and character within the analysis area. See Table 6-6, "Recreation Restoration by Sub-Areas", for further breakdown of Scenic Quality, Dispersed Recreation, Developed Recreation and Recreation Opportunity Spectrum by landscape sub-area.

Dispersed Recreation

The opportunities for dispersed recreation are primarily hiking, camping, boating (motorized and non-motorized), driving for pleasure, fishing, and hunting. Heaviest use occurs during the summer camping season. Other uses are mushroom picking, horse riding, off-highway vehicle (OHV) riding, and wildlife viewing. Scenic viewing is quite popular from various points along the Cascade Scenic Byway and around Wickiup Reservoir. These activities are likely to increase as the population of Central Oregon increases, and the area is promoted as a vacation destination through the local media and tourism industry.

Overnight dispersed camping is very popular in the project area, especially at sites that are related to water. Many of the dispersed camp sites and areas have been adversely impacted from increased recreation use. Sites located in the recreation/riparian interface have shown impacts through a loss/degradation of vegetation, soil compaction, sanitation problems, and a change in site character. Reduction of an already inadequate maintenance budget will allow the deterioration of recreation facilities and associated natural resource amenities to continue.

Camping in the past was primarily in a relaxed environment with less people, with activities including fishing, and sitting around the campfire. Few administrative restrictions existed. However, within the last 10-20 years, use has increased to the point that it is common to have numerous camps around Wickiup Reservoir throughout the summer months. Use of motorized recreation is popular (i.e. personal watercrafts/jet skis and all terrain vehicles). Also, larger recreational vehicles and larger camp parties have increased the amount and size of impacts to areas and resources associated with water, especially around Wickiup Reservoir. This use has changed the overall dispersed character of several areas from a quiet, serene setting to a more active, crowded, motorized recreational setting.

Many of the accessible upland roads within the project boundary have dispersed camp sites Upland dispersed camp sites have not been inventoried to date.

There are a few trails that provide hiking, biking, and horse riding opportunities. Roads and trails offer the opportunity for other types of recreation such as viewing scenery, gathering forest products, and dispersed camping. These activities are utilized by recreationists

throughout the year, with concentrated use occurring during the summer camping season.

Eight areas of dispersed camping have been delineated (Figures 3-11 through 3-15). For this analysis, scenic integrity is defined as representing the current status of the landscape determined on the basis of visual changes that detract from the scenic quality. See the Recreation Appendix for more information on the following dispersed sites. Occupancy rates are determined by the camping season between Memorial Day (May 30th) through Labor Day (early September):

1) Deschutes Arm (Figure 3-11): This is the most heavily used area, in terms of the number of sites, amount of people, and length of stay. It includes both sides of the Deschutes arm; from the boat ramp at West South Twin Campground, north past Sheep Bridge Campground, south down the west side of the arm to the small peninsula at the end of the arm. Many of the sites on the west side are accessed by both motor vehicles and by boat. In many cases there is little screening between sites, with impacts to vegetation evident at every site. Harvest activities have created an open stand, with thick, young lodgepole and ponderosa pine starting to create more screening. Previous Recreation/Riparian restoration projects (1996) attempted to close many user roads and illegal camp sites (those below the high water mark). However, much of this effort has been disrupted by campers breaching road closures and re-establishing camp sites. The sites located at the small peninsula on the southwest part of this area are very popular and heavily impacted from overuse. There are several groups/families (25+ people), who use the site throughout most of the summer camping season. The integrity of the sites are low to moderate. Surveys of this area show an occupancy rate of approximately 34%.

There are approximately 10 miles of shoreline, six miles on the west and four on the east. There are approximately 55 sites on this stretch, more than six sites per mile along the west shore, and four sites per mile on the east shore. Each of these sites are visible from the water. Where there are solitary or only a few sites together, there is minimal impact to foreground and middleground scenic integrity. Where there are more than five or the site is large to accommodate groups, evidence of soil compaction and denuded vegetation is greater (i.e. southwest corner, south of Sheep Bridge Campground, and on the Browns Creek point).

2) Davis Arm (Figure 3-12): This area stretches from the junctions of roads 44 and 46, around the reservoir north to the south end of the Deschutes Arm. Access is mainly through an extensive network of roads created by salvage activity following pine bark beetle infestation, and the users. This area consists of sites that are more densely concentrated, but not as much as on the Deschutes Arm. Sites along the north shore of this area are large; those closer to N. Davis Creek Campground are smaller and less conspicuous. As with the Deschutes Arm, camps often consist of large groups that can stay for long stretches during the summer camping season. Some sites are on

the waters edge, and all have reduced and trampled vegetative conditions. The integrity of these sites are moderate to low. There are approximately 35 inventoried sites along this stretch. Representative sampling of this area was not accomplished.

There are approximately seven miles of shoreline with approximately 35 sites along this stretch, at five sites per mile. Virtually all sites are visible from the water. In the narrow channel and arms on the west half of this area, the scenic integrity is moderate given the nearness of the shore.

3) Fat Man's Point (Figure 3-12): This area is located on the peninsula at the southwest corner of the Reservoir, north of road 44 and Reservoir Campground. Evidence of salvage activity following the mountain pine beetle occurrence (i.e. skid roads, landings, and stumps) is apparent to most visitors. Access is mainly through an extensive network of roads created by salvage activity and the users. Regeneration of young lodgepole pine is very dense. According to informal surveys of campers, the setting is not very attractive; yet the sites in this area receive moderate to high use. Most of these sites are away from the water line. The camp area just north of Reservoir Campground is very large and is occupied most of the summer (June through August) by a large group of several families. This group is not from the local area and have been coming as a large unit for 20+ years. The integrity of these sites is low. Surveys of this area show an occupancy rate of approximately 55%.

Along the peninsula, there are approximately six miles of shoreline with approximately 13 sites at more than two sites per mile. These sites are somewhat secluded from vehicles accessing other sites but virtually all are visible from boaters in the water. For sites along the narrow Davis Arm channel and arms on the west half of the peninsula, the impact to scenic integrity is moderate given the nearness of the shore. The conglomeration of sites north of Reservoir Campground, designated for scenic views (middleground, foreground) have moderate to high impacts to the scenic integrity.

4) South Shore (Figure 3-13): This area starts at the south end of Wickiup Dam and travels south and west to Reservoir Campground. Except for the sites just north of Wickiup Butte Campground, this area is less impacted from dispersed camping due in part because of the drop in water level later in the summer camping season. This makes these sites less attractive for camping, and makes boat access of the reservoir more difficult. Though several of the camps are large, or are comprised of 1-3 sites, they are relatively isolated from one another (again, except for those directly north of Wickiup Butte Campground). Most sites are well away from the water line (50'+). Vegetation is mostly intact with the mixed conifer setting providing good screening. The integrity of the sites are moderate to high. Surveys of this area show an occupancy rate of approximately 10%.

There are approximately eight miles of shoreline with approximately 33 sites along this stretch, at four sites per mile. Most sites are visible from the water, however, those along the south shore (as opposed to those in the Wickiup Butte area) are inconspicuous due to their location amongst the pine. The impact to scenic integrity is low to moderate (low on the south shore, moderate near Wickiup Butte).

5) Gull Point (Figure 3-11): This area is exclusive of the developed facilities, stretching from the north end of Wickiup Dam, north to West South Twin Campground. The area north of Gull Point campground is accessed off the 4260 road and is used primarily for day use fishing. The area east of the boat ramp to the dam is not accessible by car, though the gate closures have been breached. There are several fire rings located here, but there are no signs of overnight camping. It's likely that the fire rings are the result of warming fires made by boat anglers. This area primarily consists of ponderosa pine, with some lodgepole. The integrity of the area is moderate to high. There are approximately six miles of shoreline with no inventoried overnight sites.

6) The Lakes (Figure 3-14): Johnny Lake has six dispersed sites and Found Lakes has three, which are all accessible by hiking. The hike into Johnny Lake is approximately one-half mile and Found Lake is three miles. There are also two sites not associated with either lake: one at the Johnny Lake trailhead, and one east of Round Meadow (approximately one-third mile) along the Round Mountain Trail. Use at these sites is low. These lakes are characterized by a semi-primitive, unroaded, in a quiet and serene setting. The riparian vegetation around the lakes is intact. The integrity of the lakes is high. Representative sampling of this area was not accomplished.

Two areas on the south half of Crane Prairie Reservoir also receive high use and associated impacts. Both are outside the watershed boundary, though the western area is within the Browns LSR. Any recommendations proposed in this analysis could potentially affect how this area is used by recreationists.

7) Crane East (Figure 3-15): This area starts just south of Crane Prairie Campground and resort and runs south to the north end of the Deschutes outlet. Use of the area is mainly by campers with recreational vehicles, trucks, and tents. Access is provided by roads 4270-470 and 4270-200. Other roads in this area have been gated to protect osprey habitat. Many of these sites provide boat access to the reservoir. When the water level of the reservoir drops, users drive out to other sites to camp, boat, and fish (road 4270-475). In many cases there is little screening between sites, with impacts to vegetation evident at virtually every site. The area is made up of a mixed conifer stand, primarily of ponderosa pine and lodgepole. The lodgepole has been heavily impacted by the mountain pine beetle. This has resulted in a dead stand of lodgepole and subsequent blowdown. With limited access, this area is a high fire risk. The sites located along the 200 road are very popular and are heavily impacted from overuse.

Campers are located here through most of the summer camping season. The integrity of the sites is low to moderate. Surveys of this area show an occupancy rate of approximately 45%.

There are approximately two miles of shoreline with approximately 11 of the 26 sites along the water, at six sites per mile. Most of the 11 sites are inconspicuous due to their location and topography of the area. The impact to scenic integrity is low given these conditions.

8) Crane West (Figure 3-15): This area starts just north of the Browns Mountain boat ramp day use area. Sites continue along the shoreline around to south of Rock Creek Campground. Only dispersed sites within the Browns Mountain LSR were analyzed. A Recreation/Riparian restoration project in 1996 closed the road that accessed many sites in the northern half of this area. The road closure (pole gate) is holding, but the slash that was placed in the road for camouflage has been removed for firewood by campers. It is likely that once the road is more visible from the south that the closure may be breached. When the water is low, this area can be accessed from user roads to the west. The forest is dense, which poses a risk to Browns Mountain from a human-caused wildfire. Campers are here through the summer months. The integrity of the site is moderate to low. Surveys of this area show an occupancy rate of approximately 77%.

There are approximately two miles of shoreline with approximately seven sites that are still accessible from the boat ramp side; another 13 sites are along the closed road at five sites per mile. Sites are not readily visible from the water due to their location within the trees. The impact to scenic integrity is low given these conditions.

Fig. 3-11

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Dispersed Recreation Sites - Deschutes Arm and Gull Point

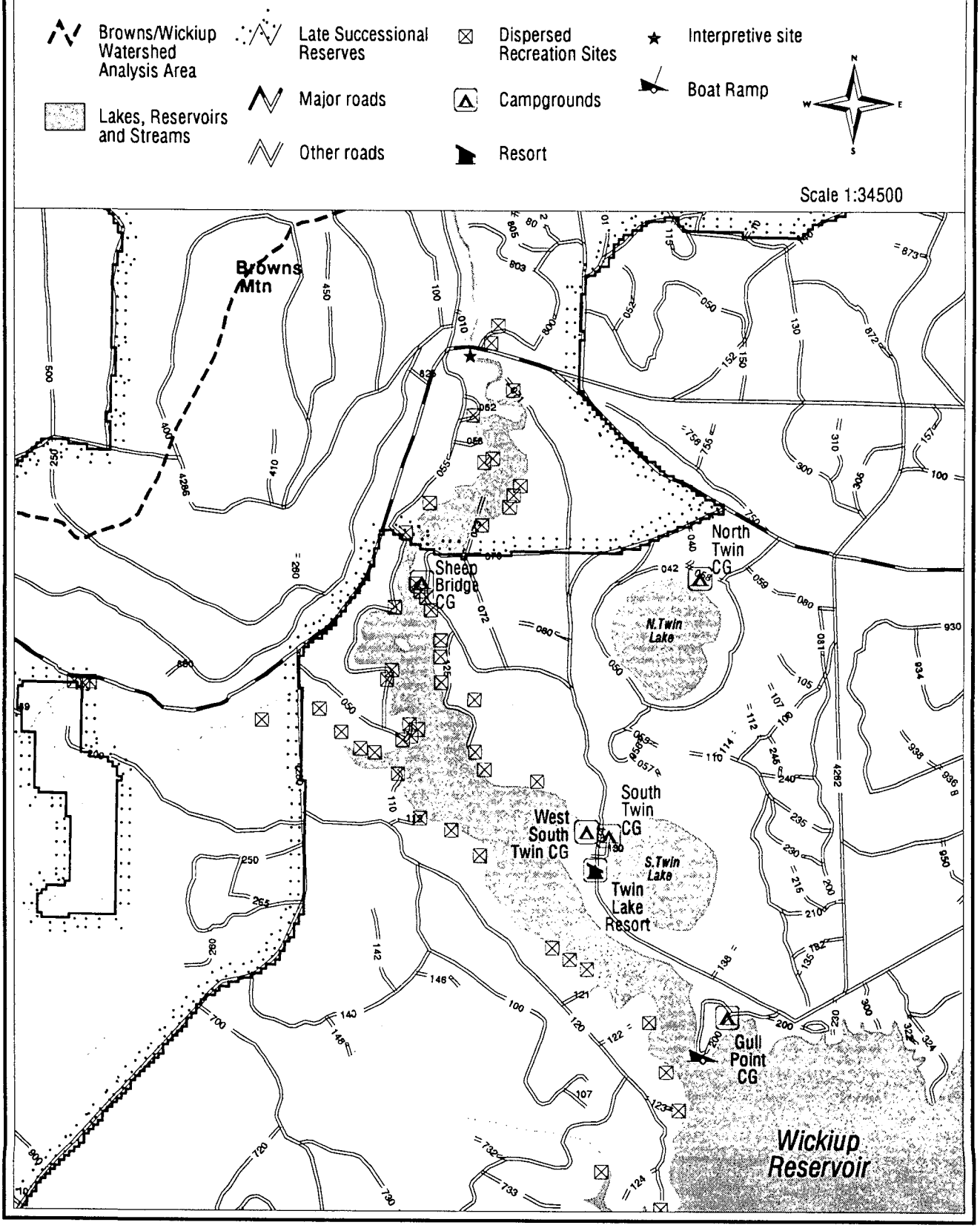


Fig. 3-12

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Dispersed Recreation Sites - Davis Arm and Fat Man's Point

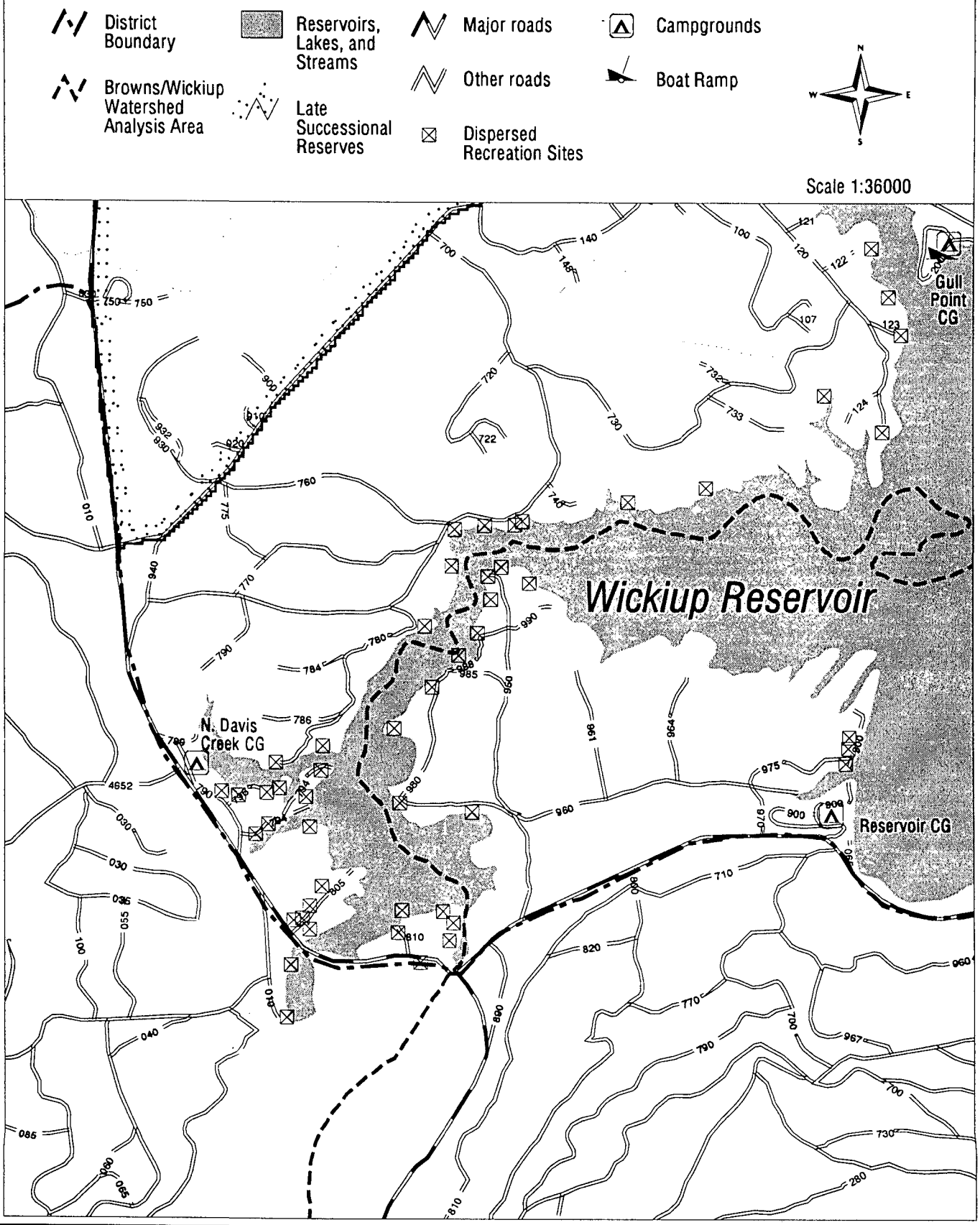


Fig. 3-13

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Dispersed Recreation Sites - South Shore

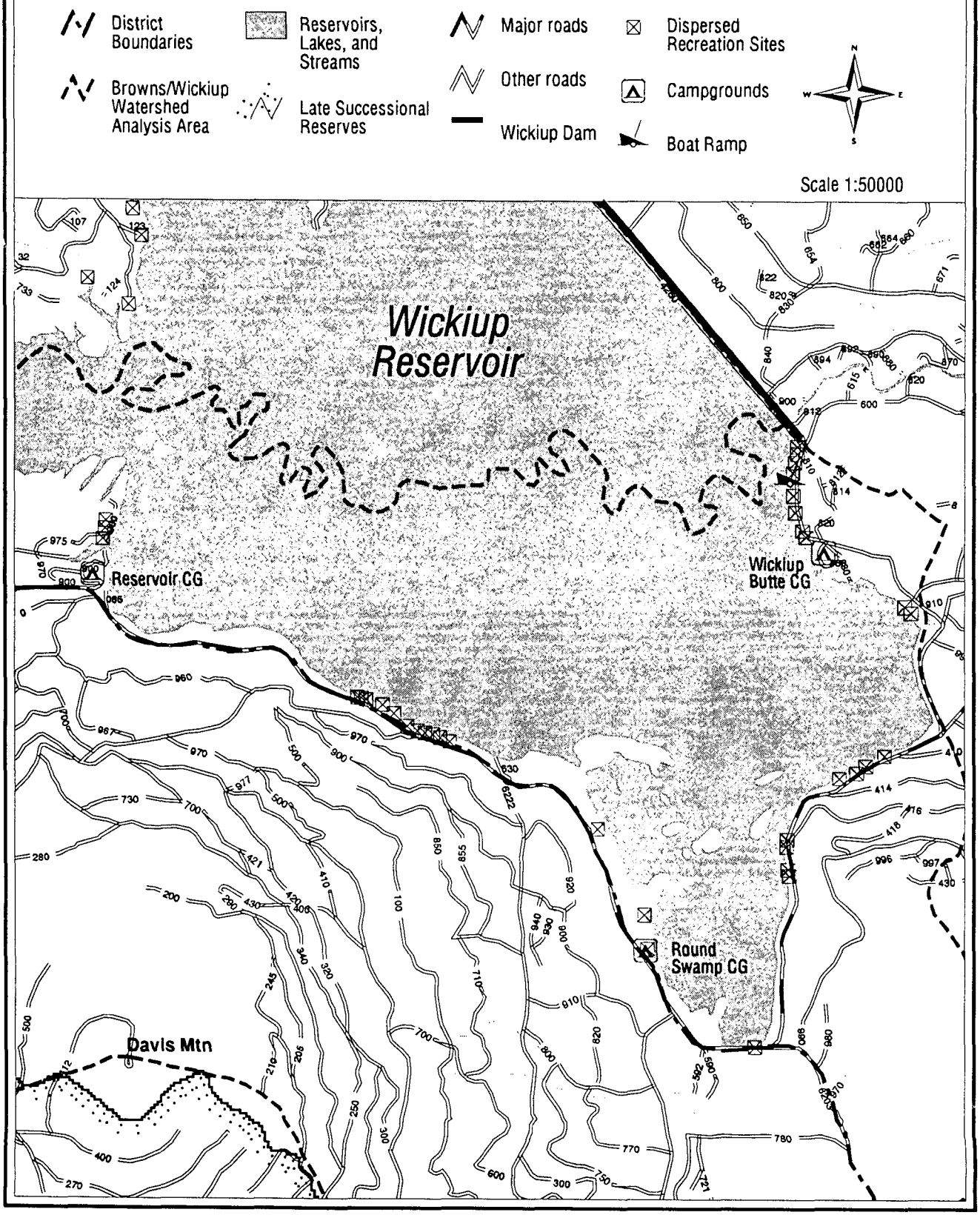


Fig. 3-14

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Dispersed Recreation Sites - Johnny and Found Lakes

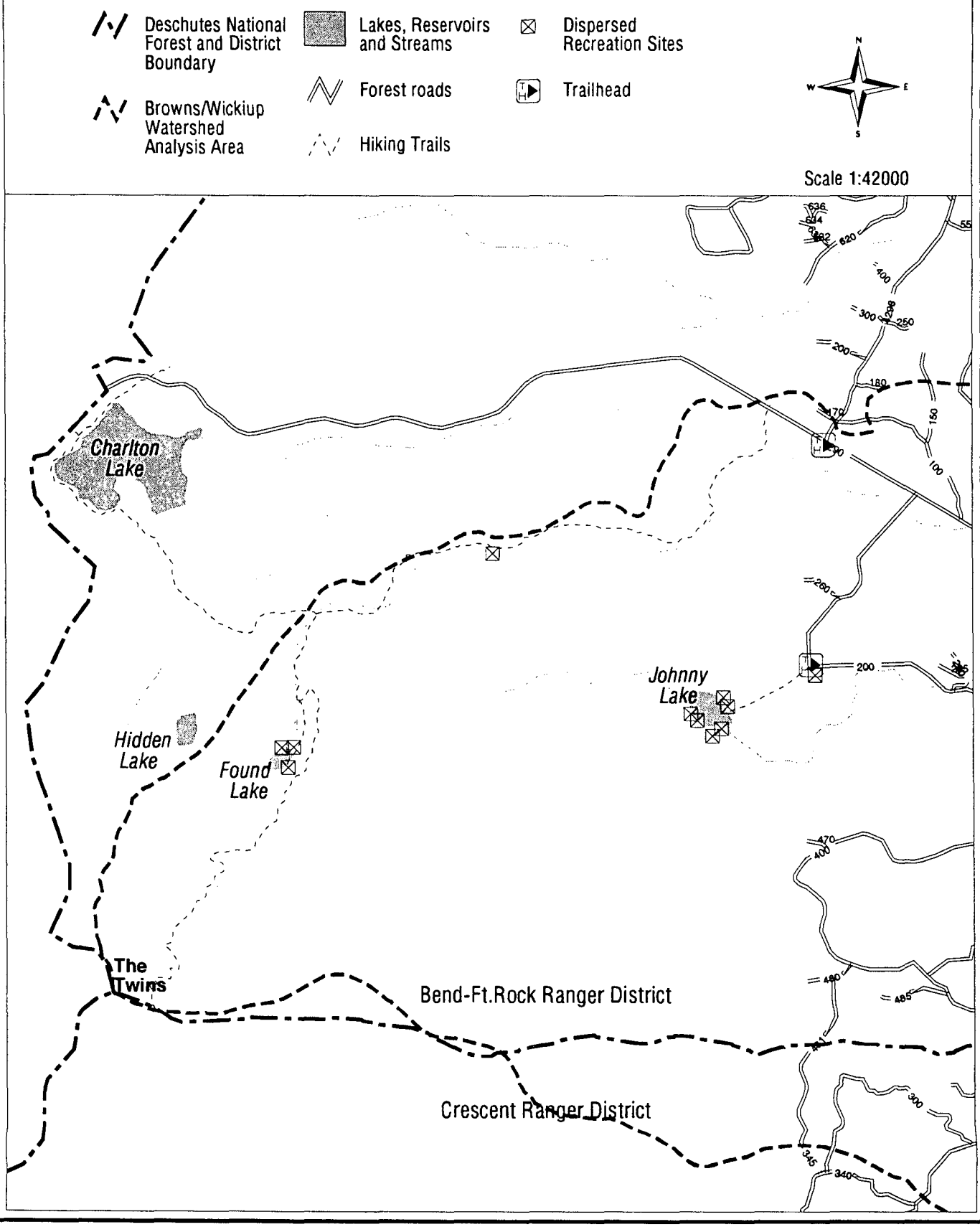
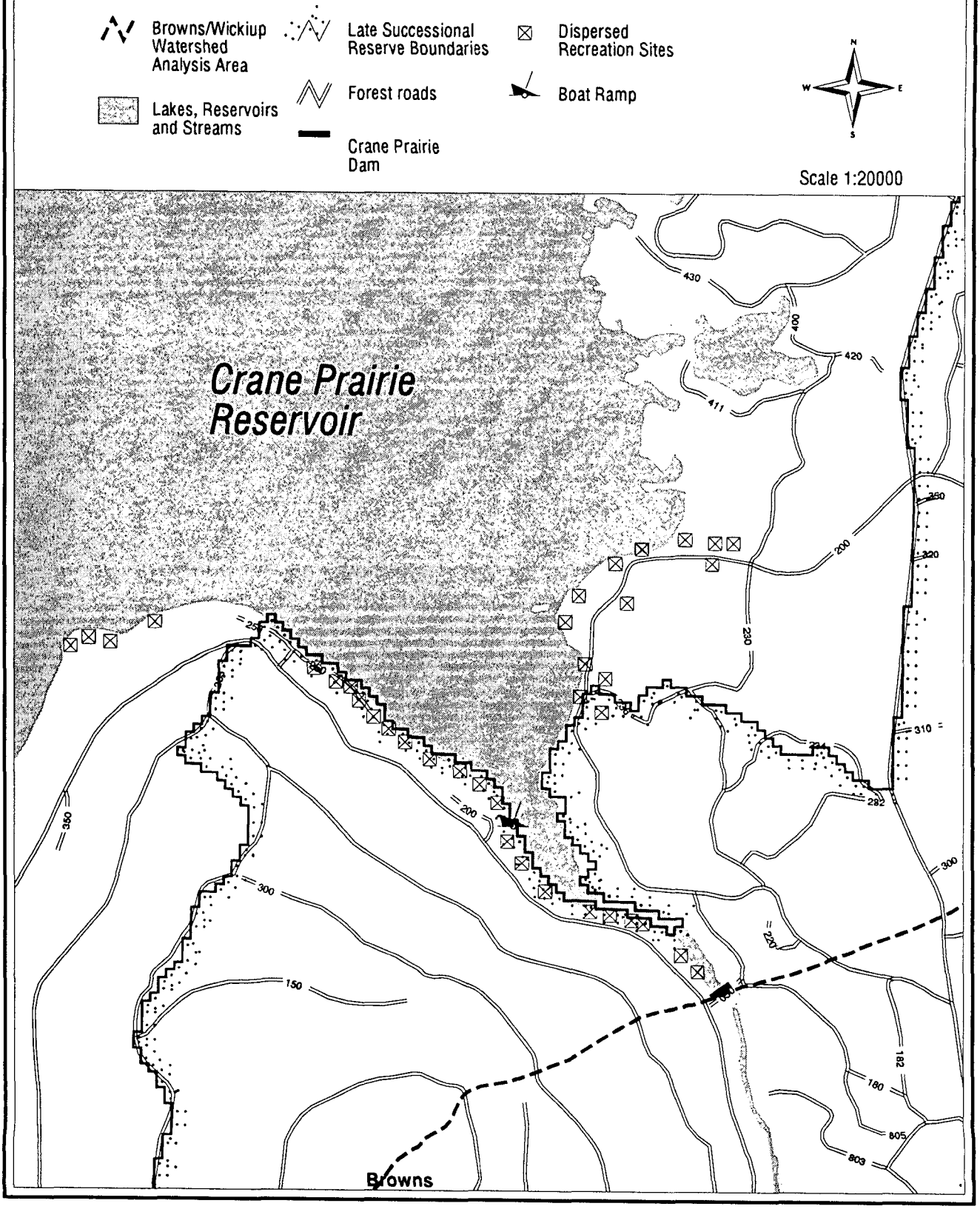


Fig. 3-15

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Dispersed Recreation Sites - Crane East and West



Developed Recreation

There are nine campgrounds, one resort, and three trailheads within the area. All campgrounds charge a fee for use, except Round Swamp. Use of developed recreation facilities in the Wickiup area has increased dramatically over the last decade. For example, data compiled from 1982-1995 shows that camping, picnicking, and motorized travel have each increased approximately 35%. This roughly equates to an increase of 30,000 and 22,000 Recreation Visitor Days (RVDs*) respectively. With the increasing popularity of Central Oregon, this trend is predicted to continue into the future.

> *RVDs are defined as use of national forest sites or areas, and aggregates of 12 visitor hours. They may consist of one person for 12 hours, 12 persons for one hour, or any equivalent combination of use by individuals or groups.

The increased use levels of the developed areas have changed the character of many of the campgrounds over the years. Campgrounds have become more crowded, changing the character of the smaller, slower paced campgrounds, such as North Twin, to a more crowded condition. Also, because of increased use and lack of maintenance/capital improvement funds, many facilities (toilets, picnic tables, etc.) have deteriorated and are in poor condition. Most of the campgrounds do not meet the needs of todays users or size of vehicles. The facilities are in need of upgrades and maintenance. Furthermore, the increased use has also had an impact on the vegetation in the developed recreation areas. Ground cover has been trampled and beaten back. Access to water areas has denuded riparian vegetation. Some trees have been damaged to provide kindling and hanging areas for tarps and other camping equipment. This has changed the overall character of the campgrounds.

The current facility conditions are listed below for the nine developed campgrounds, the resort, and the three day use sites (not associated with a campground). These provide a total of 235 individual overnight camp sites and cabins for a capacity of 1,267 people at one time.

> Browns Mountain Boat Ramp: This facility offers picnicking and boat access to the south end of Crane Prairie Reservoir. The adjacent shoreline area is very popular with dispersed campers. A Recreation/Riparian project in 1996 closed access to a user road north of the boat ramp that had numerous camp sites in the riparian. This area is heavily forested. The high use of the area increases risk for a human-caused wildfire. Both the toilet vaults and buildings are in poor condition.
>
> Browns Crossing Fish Viewing Platform: This is a new accessible facility constructed in 1992 that provides viewing and fishing opportunities on the Deschutes River, just below Crane Prairie Dam. Several interpretive signs are posted displaying information of fish and riparian habitat.

Sheep Bridge Campground: This facility was never completed. The original design specified 34 sites. An access road, signs, and toilet facilities were constructed. Since camp spurs and sites were not constructed, campers park their vehicles wherever it suits their needs or desires. Picnic tables and fire rings move from place to place, which has denuded the vegetation and character of the area. Posted signs have spared the riparian vegetation along the upper end of Wickiup Reservoir. Toilets installed with cement vaults are currently in good condition. The toilet building is in fair condition. The integrity of the site is low. Surveys of this area show an occupancy rate of approximately 30%. This was down from 31% for the 1995 season.

North Twin Campground: This 23 site facility was recently improved in 1996 through site definition, vegetation enhancement, and camp road and spur installation. This improved both the aesthetic integrity and character of the site. It is located adjacent to North Twin Lake, and two Bald Eagle Management Areas. The toilet installed with a cement vault is currently in good condition. The toilet building is in fair condition. The existing landscape integrity is moderate, and deviation from the landscape character is evident but not dominate. Over time, the noted improvements should raise the integrity level to high. Occupancy rate for this campground for the 1996 season was 41%. This was down from 48% for the 1995 season, which is likely due to the change in character from a dispersed type setting, to a more site-defined, administratively regulated type setting.

South Twin Campground: This is a 24 site facility that is nearly full throughout the summer. The facility is perched 30-40 feet above the west shore of South Twin Lake. At least three pedestrian trails provide access to the shoreline. Visitors enjoy the lake as well as other day use facilities and activities (i.e. boat ramp, swimming). The toilets installed with cement vaults are currently in good condition. The toilet buildings are in fair condition. The density of the camp sites is high with much of the sub-canopy vegetation serving as screening for privacy and scenic diversity is missing. Conifer planting in the early 1990s should help provide diversity in the future. Generally, the landscape condition is moderate to high. Surveys of this area show an occupancy rate of approximately 84%. This was down from 85% for the 1995 season.

West South Twin Campground: This is a 23 unit facility that is full most of the summer season. It is located west of South Twin Lake Campground, with views of Wickiup Reservoir. There is boat access, and semi-private camp sites set in a mixed conifer setting. Toilets installed with cement vaults are currently in good condition. The toilet buildings are in fair condition. The vegetation and scenery is similar as described for South Twin Campground. Surveys of this area show an occupancy rate of approximately 63%. This was up from 62% for the 1995 season.

Twin Lakes Resort: The resort is open April through October. Accommodations include 12 cabins equipped with modern conveniences, a grocery store, tackle shop, and a restaurant. The resort offers boat rentals (motorized and non-motorized). Use is high due in part to the early season fishing use. Cabin capacity is 92 people at full occupancy.

Gull Point Campground: This 81 unit site provides boat access to the north end of Wickiup Reservoir. It is a popular, high use site throughout the fishing and camping seasons. The vault toilets with cement vaults are currently in good condition. The one metal vault toilet has failed. All of the buildings, except for the new facility, are in fair condition. The landscape integrity is moderate to high. Occupancy rate for this campground for the 1996 season was 82%. This was up from 77% for the 1995 season.

North Wickiup Boat Ramp: The boat ramp provides boat access to the north end of Wickiup. It is adjacent to Gull Point Campground. The integrity of the landscape is medium to high.

Wickiup Butte Campground: This 11 unit facility is located just south of Wickiup Dam. It is very popular for both overnight use, and day use activities (i.e., boating and fishing). Currently, the adjacent boat ramp area has no defined edges, parking pattern, circulation, or boat loading zone. The two metal vault toilets have failed, and the buildings are in poor condition. The integrity of the landscape is moderate to low. Occupancy rates for this campground are not available.

Reservoir Campground: This 27 unit facility receives little to moderate use, except on the opening of fishing season. It is located adjacent to a past harvest unit which has removed the large tree component. This has created an open, sparsely vegetated setting that is not aesthetically pleasing. The campground was likely developed from existing use patterns. Many of the camp spurs are not used by campers since they provide no views or access to the reservoir. Many of these sites are also lacking camp facilities (fire ring, table, barriers, etc.). The two metal vault toilets have failed, and the buildings are in poor condition. The integrity of the site is moderate to low. Occupancy rates for this campground are not available.

Round Swamp Campground: This facility receives little use, except on the opening of fishing season. It is adjacent to the reservoir and provides boat access to the water only when water levels are high on Wickiup Reservoir. It receives greater use as a dispersed camp area than a developed campground. The one toilet facility is in poor condition. This site has no definition and was likely developed from existing use patterns. The integrity of the site is low to moderate. Occupancy rates for this campground are not available.

North Davis Creek Campground: This 17 unit facility receives moderate use, except on the opening of fishing season. It is located in a mixed conifer setting. Adjacent areas have been recently harvested during the last 15 years, reducing aesthetic quality. The regenerating trees are beginning to fill provide screening between the camps. One of the toilets was recently replaced. The replacement vault has failed and the building is in poor condition. The integrity of the site is moderate. Occupancy rates for this campground are not available.

Scenic Quality

Visual quality objectives (VQO) have been delineated to maintain long-term scenic quality across the landscape. VQOs for this analysis area range from Retention (no evidence of human management activities) to Modification (management activities may be visually dominate but borrow from the "natural" surrounding area). Retention is used to designate sensitive views along the Scenic Byway (road 46). Partial Retention (management activities visually subordinate to the characteristic landscape) is used to designate less sensitive secondary travel corridors (roads 4290, 42, 44), Wickiup Reservoir, North and Twin Lakes. Modification is used for less sensitive general forest areas.

Except for landscape sub-areas 1a, 1c, 5, and 6d, the remaining landscape sub-areas have been impacted by past and present harvest activities, road building, recreation facility construction, utility lines, and insect and disease agents. Mixed conifers cover the slopes and upper ridges while some hardwoods can be found in the larger drainages. Natural and created openings can be seen from roads within the project area, including the Scenic Byway. Some of these openings create views to peaks or buttes of the area, while others open up views of former harvest units.

Scenic integrity of the Wickiup area does not meet the expectations and preferences of some of the users in many places due to the effects of overcrowding, forest health conditions, timber harvest activities, outdated facility design, and a backlog of recreation facility maintenance. Based on user surveys and professional knowledge, the public has a very strong attachment and reverence for this landscape and its settings.

Roadless Areas

Portions of two roadless areas (RA) are within the watershed analysis area boundary: Charlton No. 6107 (9,280 acres), and Maiden Peak No. 3108 (29,420 acres). In general, the two Roadless Areas consist of foothills dominated by Charlton Butte, Gerdine Butte, The Twins, and Maiden Peak.

The areas are comprised of a hemlock and mixed conifer forest with fairly lush understory vegetation, and wet meadows. The forest conditions within the roadless areas are intact except where larger lodgepole have been killed by the mountain pine beetle. This has created large

areas where defoliated trees are weathering and turning the color grey. Much of the vegetative conditions outside of the roadless areas to the east includes large areas where late-structured lodgepole pine has been salvaged after the pine beetle epidemic in the early 1980s.

Trails provide access to several lakes, with Charlton Lake the most road accessible and popular. Both RAs provide a semi-primitive non-motorized experience, with dispersed camping sites occurring around the popular lakes including Charlton, Johnny, Found, and Bobby.

Off Highway Vehicle (OHV) Recreation

South of Wickiup Butte Campground is a user-created OHV play area. This activity started in an old borrow pit (Wickiup Borrow Pit #1089), and has expanded to the adjacent forest and Wickiup Reservoir shoreline. It has developed into a permanent system of trails and loops over the mounds which surround the pit. This has caused loss of ground cover, resulting in erosion and soil compaction/displacement. It is likely OHV trails are expanding into adjacent areas.

Recreation Access

Recreationists have motorized access to most of the analysis area except for the roadless area, and areas closed by gates or berms. There is a area restriction signed as "No Camping" below the high water mark of Wickiup Reservoir. Day use fishing and boat access occurs at a reduced rate during periods when water levels are low.

Timber Harvest Activities

Past and current harvest activities have affected scenic quality (Table 3-5, "Harvest Summaries"; Figure A-1, "Harvest and Reforestation Activities"), and the recreation experience. This condition is especially evident in areas where beetles have impacted lodgepole pine along certain areas of well traveled roads, and in some dispersed and developed camping areas. Public reaction has been mixed in regards to the salvage of these trees. Favorable and unfavorable reactions are dependent on individual values which frame the ongoing debate on how the forest should be managed.

Recreation Opportunity Spectrum (ROS)

ROS activity and experience categories have been delineated for each Deschutes National Forest Land and Resource Management Plan (LRMP) Management Area (MA-1 Special Interest Areas, MA-3 Bald Eagle, MA-5 Osprey, MA-8 General Forest, MA-9 Scenic Views, MA-11 Intensive Recreation, MA-12 Dispersed Recreation). The ROS for the analysis area ranges from Rural at campgrounds and resort facilities, to Roaded Modified in the General Forest, to Roaded Natural for the main travel routes (roads 44, 46), Davis Mountain, and

areas around Wickiup, to Semi-Primitive Motorized (winter only) in the Roadless Areas.

The landscape areas developed for this watershed analysis (in general) meet their ROS class. Landscape sub-area 4, and portions of sub-area 2d, are the most "out of character" from the ROS classification of Roaded Natural. This is due to past management activities (salvage activities), and impacts from the increase in recreation use. The naturally appearing environment has been changed by the loss of late-structured trees, soil disturbance and skid roads. Dispersed use, primarily overnight camping, has changed the setting character with the moderate to high interaction between users. Roaded Natural is characterized as having low to moderate interaction. During most of the summer camping season, there is a low probability for having an isolated or quiet experience due to the close proximity of other users.

Transportation Access System

There are no known significant erosion or structural problems with roads within the Browns/Wickiup Watershed Analysis area.

Due to extensive recreation which includes user-created roads and harvest activities, there is an extensive road network resulting in high mileages and densities (Tables 3-14, 3-15).

Table 3-14

Road Type and Density by Watershed

Watershed	Road Type				Total Miles	Miles Open	Miles Closed	Road Density mi/mi^2
	Paved	Aggregate	Improved	Native				
Browns	21.45	6.67	29.27	143.44	200.83	187.63	13.2	3.8
Wickiup	4.81	0	27.56	97.38	129.75	96.01	33.74	3.7
Total Miles					**330.58**			

Table 3-15

Road Densities by Landscape Sub-Area

Sub-Area	Road Density (mi./sq. mi.)		
	Open Roads	Closed Roads	Total
1	0.96	0.11	1.07
2	4.96	0.07	5.03
3	3.81	2.06	5.87
4	5.62	0	5.62
5	0.10	0	0.10
6	5.21	0.02	5.23
Watershed Average	**4.04**	**0.48**	**4.52**

There are two large transportation related structures in this area. Browns Mountain Crossing Bridge (road 42), built in 1990, is in excellent condition. Road 4280 crosses over Browns Creek using an 8 by 12 foot wide pipe-arch which was installed in 1984. The pipe is in excellent condition. There is a waterfill site at the outlet end, and should be evaluated for continued use.

Placement of debris in the stream for fish habitat improvement upstream of the Browns Creek should consider bridge structure integrity, should the debris become dislodged and float downstream.

Waldo Lake - Charlton Lake Road

This road (4290) weaves in and out of the northern edge of the planning area (Figure 3-10, "Points of Interest"). It connects between Highway 46 at the end of road 42 and the Waldo Lake area of the Willamette NF. This road was laid out, cleared, and excavated to a double lane, but was never surfaced. This resulted in a higher speed standard which subsequently deteriorated the road surface, coupled with high use and exposure to the elements. Currently, this road is maintained as a single lane road above the Clover Meadow area. The Forest Plan identifies this road as a Road of Issue (4-27) and discusses specific steps that would be followed if improvement is deemed desirable. The road is open during the snow free period, typically June through October. 1993 traffic counts showed 30 vehicles per day using this road. The roughness of this road is well known to the public, discouraging higher use.

Material Sources and Debris Disposal

There are a number of cinder and hard rock sources in this area. Only one hardrock source (#1057) West Brown's Creek has been used in recent times. Three of these sources, Crater and Crater Rim Cinder Pits and Wickiup Riprap (probably others) have been used as demolition dumps (debris disposal) as well as material sources. It is common practice by the Forest Service to use these pits as a disposal site for debris disposal associated with projects where vegetation is removed such as road-clearing and construction. Most of the debris is dealt with in a permanent manner and burned or buried. Disposal of accumulated debris from small Forest Service projects, routine maintenance, as well as dumping by the public has become a problem.

Chapter V:

Trends and Interpretation

Chapter V
Trends and Interpretation

LANDSCAPE SUB-AREA TRENDS AND SOCIAL/ECOLOGICAL FUNCTION
(Listed in order of priority rated as medium and high)

The brief descriptions are limited to those conditions which are important to the applicable landscape sub-area. Following this listing are tables of major trends, location, causes and resources affected as well as the supporting analysis for the trends by resource area. The current condition description includes the major land management designations (LRMP and NWFP) within the sub-area (in parenthesis). These definitions will be used for this chapter:

Ecological integrity - A gauge of how well the elements of biodiversity and the functions that link them together are sustaining the entire system.

Social and ecological function - The flow, or "purpose" of each landscape sub-area as identified from functions of the social and ecological realms.

Trend - Expected change from existing and reference conditions rated as either moderate (M) or high (H). These ratings were then used to measure the relative need for restoration and/or management activities.

#1a High Elevation Unroaded (4,550 acres)

Current Condition: (Dispersed Recreation, Matrix, Administratively Withdrawn) Late-structural forest comprises approximately 60% of the sub-area. Risk to a landscape level disturbance from fire is increasing due to continued fire exclusion efforts, although the high elevation hemlock forests have a relatively long fire return interval and are within this time frame. Approximately one-half of the area has been identified as a fuel model 10 (refer to fuel model descriptions in the Fire/Fuels Appendix). The Charlton Fire of 1996 burned adjacent to this landscape sub-area, indicating the potential for stand replacement events in these forest types under current conditions. The high elevation meadows, important habitat for the great grey owl, are being encroached by conifer seedlings. Western white pine is a diminishing component of existing stands. Direct impacts from humans are very low. There are no roads, but constructed trails exist.

Desired Condition: The late-structural forests and unroaded condition remain. Prescribed natural fire is allowed to play a role in the disturbance process, reducing fuel loadings where appropriate. High elevation meadows are maintained. Western white pine is a component of the species diversity. Quality dispersed recreation opportunities are provided in an undeveloped forest environment.

Social and ecological function:

- This sub-area provides an important potential refuge for species that are sensitive to human disturbance that requires large, unfragmented home ranges (e.g. fisher, wolverine, spotted owl, northern goshawk).
- The historical fire regime includes a frequent, low intensity, smoldering, burn. A stand replacement event approximately every 200-300 years.
- Provides important habitat for elk.
- High quality of water in lakes
- Roadless/Dispersed recreation setting

Ecological integrity is rated high as a result of the following:

- Unfragmented late-structural forests
- Majority of stands are currently within upper parameters of fire regime, although they are likely approaching a stand-replacement event. Disturbance agents are still within historical range of variation (HRV) parameters.
- Human use is in accordance with recreation designation.
- Minimal impacts such as roads, facilities, and soil erosion/compaction.

Trend: Trend to late-structural stage in mountain hemlock PAG dominated by historic disturbance regimes including fire (M).

Trend: White pine component is diminishing and at risk to loss (M).

#1b Roaded Lodgepole Pine (2,910 acres)

Current Condition: (General Forest, Matrix) Harvest activities, firewood gathering, and pole cutting have fragmented the area and reduced soil productivity. Lodgepole pine dominates the landscape (approximately one-half), while ponderosa pine and mixed conifer stands comprise the remainder. Regeneration is occurring within the large shelterwood harvest units. Species dependent on large blocks of interior habitat are affected by fragmentation. A high density of roads exacerbate the problem but provide opportunities for motorized recreation, primarily in the fall months. Previous harvest activities have reduced the fuel continuity within the area, although portions of the sub-area is likely at risk to an uncontrollable wildfire where dead and down lodgepole pine occurs in continuous blocks. Approximately 60% of the area is in fuel models 6 or 10.

Desired Condition: Fragmentation has been reduced. Soils are productive throughout the sub-area, especially within plantations and wildlife corridors. Road density is reduced, but still provides opportunities for access and recreation. Risk of an uncontrollable wildfire has been reduced through reduction of continuous blocks of dead and down lodgepole, while providing suitable habitat for dependent species. The goal is to have a resilient forest, where almost one-half of the dry forest is in mid-structural stage and one third in a late-structural condition.

Social and ecological function:

- This area provides a buffer between high density camping at the Wickiup Reservoir and low density human use in sub-areas 1a and 1c.
- Historical fire regime includes a patchy, uneven-aged low intensity fire event with stand replacement every 60-100 years within lodgepole. The fire regime within ponderosa pine includes a frequent, low intensity fire every 7-15 years.
- Provides forage for elk in regeneration and shelterwood harvest units near the edges/interiors of the larger units have low use.

Ecological integrity is rated low as a result of the following:

- Fragmentation
- Significant reduction of late-structural component
- High density of roads

Trend: A continued decrease in soil quality in areas of past activity (M).

Trend: Successional advancement of regeneration. Late-structured stands have been replaced by early-structured stands, often with dwarf mistletoe in remnant understories (M).

Trend: The white pine component is diminishing (M).

#1c Johnny and Found Lakes (30 acres)

Current Condition: (Matrix, Dispersed Recreation, Administratively Withdrawn, Riparian Reserves) This sub-area is somewhat "pristine" including Johnny and Found Lakes where the water quality is oligotrophic. Direct impacts from humans are low, recreational use includes dispersed, slow-paced activities in solitude. Non-native fish introductions are suspected to be reducing native amphibians and other life forms in the food chain.

Desired Condition: The desire is to maintain the oligiotrophic status of the water in Johnny and Found Lakes as well as providing for quality dispersed recreation opportunities in an undeveloped forest environment. Minimal damage occurs to the shoreline and riparian vegetation as a result of day and overnight use. The effects of non-native fish introductions on native amphibian populations is well understood.

Social and ecological function:

- The recreation use of the area includes dispersed slow-paced activities in solitude.
- Aquatic/riparian habitat for dependent species.
- The fire regime includes a very long fire return interval 200-300 years, with stand replacement.

Ecological integrity is rated high as a result of the following:

- Low use and low impacts from humans.
- Aquatic habitats remain accessible to wildlife under relatively low disturbance conditions.
- The sub-area is within fire return cycle parameters.

No trends related to restoration or management opportunities and rated as either moderate or high were identified within this landscape sub-area.

#2a Highway 46 (11,450 acres)

Current Condition: (General Forest, Matrix, BEMA, Old Growth, Scenic Views, Intensive Recreation) Characterized by generally flat terrain, the Cascade Lakes Scenic Byway bisects the sub-area. Large trees are obscured from view from the highway due to thick understory vegetation. Wildlife connectivity, linking the adjacent Davis and Browns LSRs and the roadless areas to the west is currently compromised by a history of 60 years of selective timber harvest practices within the moist lodgepole and ponderosa pine PAGs. Existing stands are fragmented (approximately 80%) which are in early- to mid-structural stages of dense stands. This condition has reduced the distribution of effective connectivity habitat. The designated 456 acre Old Growth Management Area is deficient in late-structural habitat, has low site potential, and generally is in poor condition. The density of the road system is high, especially above desired levels for both the BEMA and the Old Growth area. Road closures in the BEMA located on the north shore of Wickiup Reservoir have been ineffective. Late-structural forest comprises approximately 20% of the sub-area. Reduction of late-structural forest conditions and high road densities has resulted in a moderate to high level of disturbance to dependent species. Over one-half of the sub-area is currently in fuel models 6 or 10 and is at moderate risk to an uncontrollable wildfire due to an extensive high component of dead material, stand densities, and multiple canopy layers. An intermittent stream channel above Browns Creek has been diverted through a closed rock quarry. A pre-identified fire camp sleeping area adjacent to the rock quarry has many hazards such as snags and down logs. Stand conditions are slowly improving as the former harvest units grow replacement trees, however there likely has been soil disturbance in the units that may have compromised long-term site productivity in some areas. Noxious weed populations are increasing.

Desired Condition: Large ponderosa pine are visible from the Scenic Byway. Fragmentation is improving as road densities are reduced and early- and mid-structural stand growth is accelerated through thinning in appropriate places. Approximately one-half of the dry and moist PAGs are in a mid-structure condition, with late-structure comprising approximately one-third. The Old Growth Management Area provides suitable habitat for the designated indicator species. Risk of uncontrollable wildfire is lessened, especially through stand density manipulation and fuel reduction. Long-term site productivity is improved as soil compaction is reduced. The diverted intermittent stream channel is realigned and the quarry has been rehabilitated. The pre-identified fire camp within the rock quarry is ready and safe, should the need occur. Within the BEMA, suitable nesting trees would be provided on a continuing basis and old-growth stands with large trees are emphasized. Road closures are effective. Noxious weed populations are declining.

Social and ecological function:

- This area has historically provided a source for commodities such as wood for logs, fiber, firewood, and post and poles.
- Recreation opportunities such as big game hunting are important in this area.
- This sub-area provides connectivity between Davis and Browns LSRs as well as from the LSR to the roadless sub-area (1a).
- There are three designated BEMAs (two of which are portions of larger BEMAs) at the interface with the reservoir.
- Historical fire regime includes a patchy, uneven-aged low intensity fire event with stand replacement every 60-100 years within lodgepole. The fire regime for ponderosa pine includes a frequent, low intensity fire every 7-15 years.

Ecological integrity is rated low as a result of the following:

- Fragmentation has likely decreased the amount of suitable core areas for dependent species within the remaining late-structural stands.
- Fire exclusion has resulted in the increase of understory stem density in many stands (e.g. mixed conifer dry PAG).
- Snags and coarse woody material levels are variable in harvest units and appear to be below the minimum amounts needed.
- Detrimental soil disturbance as a result of extensive harvest activities throughout the sub-area.
- Several road closures to protect bald eagle nesting areas have been ineffective.

Trend: Fragmentation of the forest matrix causing a decrease in amount and quality habitat for interior dependent species and an increase in edge (H).

Trend: Decline in solitude for species such as bald eagles which are sensitive to disturbance due to roading and dispersed recreation on the shores of Wickiup Reservoir (H).

Trend: Decline of soil quality in timber harvest areas. Approximately 40% of the landscape sub-area is currently in a detrimental condition class for soil (H).

Trend: Susceptibility of landscape to high severity fires is increasing due to fuels buildup with a corresponding potential for human entrapment. Approximately 20% of the area is in a fuel model 6 and 23% in a fuel model 10 (M).

Trend: Increase of susceptibility to insect and disease agents and corresponding loss of large diameter pine resulting in an increase in early- and mid-stand structure (M).

Trend: Loss of connective habitat due to extensive harvest activities and roading between LSRs (M).

Trend: Recreation users continue to access dispersed sites using an extensive network of roads (M).

#2b North Wickiup (4,090 acres)

Current Condition: (General Forest, Matrix, Intensive Recreation, BEMA) Comprised of approximately 60% lodgepole and 40% ponderosa pine, this sub-area serves as access to dispersed camping along the northern shore of Wickiup Reservoir and North/South Twin Lakes. Late-structural forest comprises approximately 15% of the sub-area. The extent of fragmentation from roads and harvest activities is rated as high in this sub-area. Soil productivity is decreased within previously harvested units. Disturbances from insects and diseases are beginning to compensate for the lack of fire since the turn of the century. Approximately one-half of the area is currently in fuel models 6 or 10. Breached and ineffective road closures are evident. Losses of large trees within the BEMA has occurred from windthrow. Fire exclusion has caused stand understories to become more dense, increasing large tree mortality and fuel loadings within the designated BEMA area.

Desired Condition: The ponderosa pine component has increased and trees are free to grow, especially within the BEMA to replace the loss of larger nest trees. Fragmentation and human disturbance to nesting bald eagles is reduced as roads are effectively closed, however adequate access is provided for recreationists. Soils within previously harvested areas are within acceptable levels for productivity. Prescribed fire is used in appropriate places where fuel loadings and understory competition exceeds desired levels.

Social and ecological function:

- Timber harvest is the major human use of the area.
- This sub-area serves as habitat for generalist species which utilize a wider range of habitat types and conditions than the other guilds. In addition, this sub-area serves as corridor movement for interior habitat species such as the northern goshawk and big game.

- Historical fire regime includes a patchy, uneven-aged low intensity fire event with stand replacement every 60-100 years within lodgepole. The fire regime within ponderosa pine includes a frequent, low intensity fire every 7-15 years.

Ecological integrity is rated low as a result of the following:

- Reduction of late-structural stage component relative to HRV
- There are moderate/high effects to species sensitive to fragmentation, roading and disturbance from recreationists using Wickiup Reservoir
- Snag and coarse woody material deficiencies
- Ineffective road closures
- Increasing fuel loadings

Trend: Fragmentation with a corresponding loss of connective habitat between LSRs from roading and past harvest activities of the forest matrix causing a decrease in amount and quality habitat for interior dependent species and an increase in edge (H).

Trend: Susceptibility of the landscape to high severity fires is increasing due to fuels buildup and corresponding potential for human entrapment. Increasing stand densities and stem exclusion has elevated fuel loadings and the crown fire potential (M/H).

Trend: Decline in solitude for species sensitive to human disturbance due to breached and ineffective road closures on the north shore of Wickiup Reservoir (M/H).

Trend: Increase in susceptibility of the stands to insects and disease with corresponding loss of large diameter pine (M).

Trend: Decline in soil quality in timber harvest areas (M).

Trend: Recreation users continue to access dispersed sites using an extensive network of roads (M).

Trend: Mortality resulting from increased competition and stand succession in the LP and MC PAGs (M).

#2c Eaton Butte (1,730 acres)

Current Condition: (BEMA) Eaton Butte is located on the southeastern shore of Wickiup Reservoir, and is readily accessible to the nearby LaPine community. The ownership is comprised of three-quarters National Forest and one-quarter Crown Pacific lands. The privately-owned portion has recently been clear-cut, making the National Forest Lands more valuable for wildlife habitat, especially within the BEMA. Fire exclusion has allowed stem densities to increase and fire intolerant species (white fir) to encroach. Effects to sensitive

species is moderate to high due to the reduction of late-structural habitat. Effects from roads have been mitigated by several closures to protect nesting bald eagles and appear to be effective. Former harvest units on National Forest lands are growing replacement trees, although soil productivity has been reduced in these areas.

Desired Condition: Prescribed fire is used in appropriate places where fuel loadings and understory competition exceeds desired levels. The late-structural forest component is increasing above current levels. Soils are within acceptable levels for productivity. All the desired characteristics for a BEMA are in place and functioning.

Social and ecological function:

- Slightly more than one-third of the area is in a designated BEMA, comprising most of the late-structured forest within the sub-area.
- Provides wildlife connectivity linking Davis LSR and BEMAs
- Historical fire regime includes a patchy, uneven-aged low intensity fire event with stand replacement every 60-100 years within lodgepole. The fire regime within ponderosa pine includes a frequent, low intensity fire every 7-15 years.

Ecological integrity is rated low as a result of:

- Fire exclusion has caused stem densities and tree composition to change within the BEMA.
- Snags and coarse woody materials levels are likely acceptable in the northern portion of this sub-area and deficient elsewhere.
- Decline in the health of late-structural habitat.

Trend: Loss of large diameter pine through harvest, insect, and disease with corresponding increase in early- to mid-structure on Eaton Butte (M).

Trend: Decline in soil quality in timber harvest areas (M).

Trend: Fragmentation of the forest matrix resulting from harvest of private and federal lands causing a decrease in amount and quality habitat for interior dependent species and an increase in edge (M).

#2d Davis Arm (1,110 acres)

Current Condition: (Intensive Recreation, Matrix, Administratively Withdrawn, Riparian Reserves) The Davis Arm sub-area contains a peninsula which locally is called "Fat Man's Point", which is most valued for its access to dispersed camping along the shoreline of Wickiup Reservoir. The extensive salvage of mountain pine beetle-killed lodgepole pine trees occurred around 1985, changing the character of the area. Before the beetle attack, the peninsula was fairly remote and access was limited. After treatment, an extensive road system

remained which allowed access to the previously remote shoreline, contributing to the loss of soil productivity. User-created roads add to the existing high density road system. Ineffective road closures and landings also contribute to the changed recreational experience of the area. Virtually none of the late-structure forest component exists. Snags have been cut down by dispersed campers. Lodgepole pine stands are slowly advancing as regeneration continues to mature. Effects to species sensitive to disturbance are moderate to high. The lack of large trees likely prevents potential bald eagle nesting adjacent to high quality foraging habitat.

Desired Condition: The extensive network of salvage system roads have been effectively closed and existing road density has been reduced. Outside of existing closures and restoration efforts, access to dispersed sites is provided. Dispersed campers have an improved experience as the area continues to grow trees and heal scars from past disturbance events caused by salvage harvest activities, following the mountain pine beetle event. Soil productivity has been improved by the restoration of landings and unneeded roads. The late-structural forest component is increasing above current levels. Snags are present in appropriate places.

Social and ecological function:

- The sub-area is favored by people who use recreational vehicles, sometimes staying in excess of the maximum allowed period on the Forest (30 days).
- Historical fire regime includes a patchy, uneven-aged low intensity fire event with stand replacement every 60-100 years within lodgepole.

Ecological integrity of the area is rated low due to the following:

- The area is highly fragmented from salvage logging and roading. Compacted soils increase the recovery time for vegetation to grow, provided habitat and improved recreational surroundings.
- Late-structural forest component is below historic levels.
- Wildlife disturbance resulting from recreational use on a highly dense user-created and salvage logging system of roads, plus dispersed recreation use within the riparian corridors. Trampled riparian vegetation and cutting snags for camp firewood has resulted in loss of habitat for dependent species.

Trend: Existing loss of vegetation through trampling and roading is recovering at a very slow rate (H).

Trend: Recreation users continue to access dispersed sites into sub-area 4a using an extensive network of roads, diminishing the recreational experience for people who favor solitude, and maintaining soil in a compacted and unproductive state (H).

#2e Forested Lavas (990 acres)

Current Condition: (Matrix, General Forest, Old Growth) This sub-area is characterized as having a thin layer of soil mixed with larger rocks, supporting forest vegetation. Early- to mid-structural ponderosa pine dominates the landscape. Late-structural forests comprises only 15% of the area. Fire exclusion has allowed white fir to encroach into stands once dominated by ponderosa pine. Existing stands have significant levels of mistletoe and are dense.

Desired Condition: Late-structural stands in the dry forest comprise approximately one-quarter of the forest. Prescribed fire is used in appropriate places where fuel loadings and understory competition exceeds desired levels. Healthy and resilient stands are accelerated towards late-structural conditions, especially those functioning as wildlife connectivity corridors.

Social and ecological function:

- Human use is low. Big game hunting and wood gathering are the main activities.
- Serves as a wildlife movement corridor providing connection between three LSRs
- Historical fire regime was a frequent (7-15 years), low intensity event with islands of unburned vegetation which burned at a less frequent interval, creating areas of high biological diversity.

Ecological integrity is rated moderate due to the following:

- Fire exclusion and a corresponding increase in shade tolerant species
- Past timber harvest and roading has impacted the limited amount of soil
- Loss of late-structured stands
- Regenerated stands are slowly recovering

Trend: Encroachment of shade tolerant species, increasing stand densities, and compensation from other disturbance agents has resulted from a changing fire regime (H).

Trend: Decline in soil quality in timber harvest areas (M).

Trend: Fragmentation resulting from roading and harvest activities has decreased amount and quality habitat for interior dependent species and has altered connective habitat between LSRs (M).

#2f Wickiup Butte (280 acres)

Current Condition: (BEMA, Intensive Recreation) This sub-area contains a butte located on the southeast shoreline of Wickiup Reservoir, similar to Eaton Butte (2c). Conditions on the butte are favorable to supporting large ponderosa pine for the BEMA, although large nest trees are deficient. Increasing growth of understory trees has caused stem exclusion and a corresponding encroachment of shrub species. Lack of disturbance has also allowed a large proportion of the brush to become old and decadent, with numerous dead branches. Approximately 93% of this sub-area is in early- to mid-structural stages. Road density is high. Soil productivity has been lowered in harvest activity units. A developed campground is located nearby, which is near an undesignated off-highway vehicle (OHV) play area centered in the borrow pit. Some erosion resulting from uncontrolled hill climbing is occurring. A closed cinder pit is located on the butte.

Desired Condition: Within the BEMA, suitable numbers of nest trees are present with adequate future replacement trees. Prescribed fire is used in appropriate places where fuel loadings and understory competition exceeds desired levels, reducing the shrubs to a healthy, vigorous condition. The late-structural component is above current levels and the road density has been reduced. Soil productivity within activity units is within acceptable levels. Appropriate use of OHVs is occurring.

Social and ecological function:

- Serves as access to developed and dispersed camping, and OHV use.
- Wickiup Butte is within a designated BEMA, however it contains an alternate nest site that has not been occupied.
- Provides linkage for connectivity between BEMAs
- Historical fire regime includes a frequent (7-15 years) low intensity event on the southwest slopes.

Ecological integrity is rated low as a result of the following:

- Increasing risk of an uncontrollable wildfire on the upper southern slopes
- Snags and coarse woody material levels are below the minimum amounts needed.
- Road density is relatively high due to past timber harvest units and an active cinder pit.
- Lack of large ponderosa pine nest trees in the designated BEMA

Trend: Increasing risk of an uncontrollable wildfire from brush and decadent vegetative conditions, allowing crown fires to potentially occur on the southern slope of Wickiup Butte (H).

Trend: Decline in solitude for species sensitive to disturbance (M).

#3 Davis Mountain (10,120 acres)

Current Condition: (BEMA, Scenic Views, Matrix) This sub-area is characterized as a very good site for supporting large trees. Two well-traveled roads intersect within the sub-area, Highway 46 and road 44. Approximately one-half of the area has been classified as having dense stands, many of which have had a significant increase in understory tree density of shade tolerant species such as white fir. The species are out-competing the larger fire tolerant ponderosa pine, causing accelerated rates of mortality. A large scale disturbance from disease, fire, or insects is likely in the near future, due to the mortality, crowded stand conditions, and increasing fuel loadings. The Crescent Ranger District has forest health-related projects (7 Buttes) planned for the area. Approximately one-half of the area has been identified as fuel model 6 or 10. A portion in the southwest corner is in the Davis Mountain LSR (1,000 ac.). Late-structural species dominates the landscape (80%) in the mixed conifer dry PAG. Road density is approximately four miles per square mile, with an additional two miles per square mile blocked but not obliterated. Soil productivity has been lowered in areas of harvest activity. This sub-area is also important for the gathering of Matsutaki mushrooms during the fall season.

Desired Condition: Stands are in a resilient and stable condition (especially the overstory ponderosa pine), and are able to withstand disturbances within endemic levels of insect/disease agents. Late-structural species continue to dominate the landscape. Road densities are reduced and previously closed roads remain intact. The sub-area continues to provide a healthy and viable Matsutaki mushroom crop. The base of Davis mountain within the BEMA is providing a fuel break for the upper slopes. Connectivity between LSRs is provided. Soil productivity is within acceptable levels.

Social and ecological function:

- Matsutaki mushroom habitat
- This sub-area is likely used by nearby northern spotted owls for foraging and dispersal. One large BEMA is within the sub-area adjacent to Wickiup Reservoir and part of another occurs near Davis Lake.
- Provides connectivity between Davis and Browns LSR as well as connectivity between Davis Mountain and BEMA located in 2c.
- Historical fire regime includes frequent (7-15 years), low intensity fires on the lower slopes. The upper slopes had an extended fire return interval (100+ years) which was rarely a stand replacing event.

Ecological integrity is rated moderate as a result of the following:

- Late-structural stands in the mixed conifer dry PAG are the dominant vegetation component.
- Variable snags and coarse woody material levels.

- Moderate fragmentation
- Fire exclusion may cause long-term negative effects on eagles by increasing the probability of future crown fires.

Trend: Susceptibility of landscape to high severity fires is increasing due to fuels buildup, increasing stand densities, and shade tolerant species (H).

Trend: Requests to extract commodities and commercially utilize resources within the sub-area are increasing and diversifying. This includes special forest products, such as Matsutaki mushrooms (H).

Trend: Increasing mortality in MCD PAGs, especially in the overstory ponderosa pine component due to increasing stand densities (H).

Trend: Decline in soil quality in timber harvest areas (M).

Trend: Fragmentation of the forest matrix from roading and previous harvest activities causing a decrease in amount and quality habitat for interior dependent species and an increase in edge (M).

Trend: Increasing scenic and aesthetic quality. Conditions improve as trees grow and lessen the visual contrast from previous harvest activities (M).

#4a Reservoir Shores (1,480 acres)

Current Condition: (Intensive Recreation, Matrix, BEMA, Riparian Reserve) This sub-area is an artificial and highly modified system with fluctuating water levels. People love the close proximity to the water, easy access, scenic views, and great fishing. Recent road closures to dispersed sites (1996) in the Deschutes Arm area was successful in moving impacts away from the lakeshore and protecting riparian vegetation, however, much of this effort has been disrupted from campers breaching road closures and re-establishing camp sites. To some, the carrying capacity has been exceeded and the dispersed camping experience has diminished to some extent. Adjacent to dispersed camping areas, it is common to find a great deal of trash and evidence of human waste after a busy weekend. Developed recreation facilities are getting older and some vault toilets are leaking. User fees are increasing. Some riparian vegetation is being trampled and driven on. The adjacent sub-areas (2b, 2c, 2d, 2f) have a very high density of user-created roads which access dispersed sites on the shoreline. Despite increasing numbers of weekend and long term camping use, reservoir conditions such as bank stability, vegetative health, water quality, and soil compaction remain within acceptable limits. Noxious weeds are beginning to invade the shoreline. Although approximately 90% of this sub-area is in early- to mid-structural stages and direct impacts from humans are moderate to high (primarily from dispersed recreational uses), the sub-area continues to provide suitable habitat

for some wildlife and riparian plant species. Bald eagles have likely been displaced from potential nesting areas along the shoreline due to human disturbance, however they appear to be successfully nesting in adjacent upland areas. In some areas, the shoreline is eroding. Stumps, which provide important habitat for fish, are dislodging and floating away.

Desired Condition: Access management is strengthened through effective road closures. Trash is picked up and disposal of human waste is prohibited within the buffer of riparian reserve surrounding the reservoir. Developed recreation facilities are safe, clean, efficient and barrier-free. Dispersed camping occurs in an undeveloped setting, providing a quality experience for the user. Water quality remains at a high level in the reservoir, within the Designated Wild and Scenic River Corridor, and for downstream users. Soil remains within acceptable productivity levels. Riparian vegetation is protected. The late-structural stand component is increasing. The spread of noxious weeds is controlled and declining. Disturbance is minimal to nesting bald eagles and suitable nest trees are available. The shoreline is stabilized wherever erosion occurs. The fishery remains at a high quality level for recreationists and dependent species.

Social and ecological function:

- This area is most desired as a developed and dispersed recreation area.
- Portions of seven BEMAs are within the sub-area.
- Willows near the Davis Arm section of the reservoir provided important habitat for neotropical migratory birds and other dependent wildlife.
- A diversity of migrating waterfowl and shorebirds utilize the reservoir and adjacent shorelines.

Ecological integrity is rated low/moderate as a result of the following:

- Deterioration of developed recreational facilities
- Dispersed and developed recreation use is at very high levels in the summertime.
- Late-structural habitat has been nearly eliminated, including snags and coarse woody material.
- User-created access has reached the majority of available dispersed sites.
- Disposal of human waste occurs within 100 feet of the high water mark
- current recreation use levels trample vegetation and compact soil
- Noxious weed invasion

Trend: Deterioration of recreational facilities has diminished natural resource conditions and recreational experiences (H).

Trend: Human use and waste disposal, including pit toilets, is likely to increase within the riparian reserve due to increased recreational use, potentially affecting dependent vegetation and water quality (H).

Trend: Decline in woody material (stumps) which provide fish habitat within the reservoir.

As natural decomposition and fluctuating water levels continue to occur, these structures become dislodged and float away to the dam where they become lodged on dry land or are disposed (H).

Trend: Increasing recreational demand for camping, fishing, and motor boating in developed and undeveloped settings (H).

Trend: Increase of undesirable non-native plant species potentially affecting native plant habitat and diminishing the scenic quality (H).

Trend: Decreasing scenic and aesthetic quality as impacts from dispersed camping increases (M/H).

Trend: Displacement of campers which use traditional dispersed areas as restrictions on campsites and access increases popularity of the remaining unrestricted sites (M/H).

Trend: Decline in solitude to bald eagles due to increasing access to dispersed sites during nesting periods (M/H).

Trend: Requests to provide commercial outfitter/guide services within the sub-area will likely increase and diversify (M).

Trend: Increasing user fees (M)

#4b North Twin Lake (103 acres)

Current Condition: (Intensive Recreation, BEMA, Matrix, Administratively Withdrawn, Riparian Reserve) This lake receives a high level of recreational pressure. Facilities lack a barrier-free design. Recent improvements (1996) have been successful in moving impacts away from the lakeshore to protect riparian vegetation and define campground use areas, although willows adjacent to the boat ramp were denuded. Suitable nest trees for bald eagles are available although no nests are present. This condition is probably due to lack of solitude. The effects of heavy recreational use of the lake and its small size may be the reason the birds are not found nesting, since North Twin Lake and surrounding areas provides a good supply of potential forage fish. The entire west shore of the lake lacks solitude due to a developed trail and the proximity of the area to the highway. Understory trees and shrubs have encroached and have raised the risk of an uncontrollable wildfire. Late-structural conditions comprise approximately 97% of the forested sub-area. Water quality is good but has potential for degradation because of long retention time and intensive recreation use. Illegally introduced brown bullhead are adversely affecting the trout fishery.

Desired Condition: Developed recreation facilities are efficient and are designed to be barrier-free. Recent improvements to protect riparian vegetation and define campground use are still in place and working. Suitable nest trees for bald eagles are available, healthy, and occupied within and outside of the current designated BEMA. The historical role of fire has been returned to appropriate ponderosa pine stands, and have lowered the crownfire potential. Insect and disease occurrences are within endemic levels, especially retaining the health and vigor of the late-structured stands. Water quality remains at a fairly high level. Illegally introduced fish are not present and more appropriate species are available for the fishery and foraging raptors.

Social and ecological function:

- Large numbers of people use the developed recreation opportunities of the area.
- Most of the area around the lake is a designated BEMA.
- Foraging habitat for osprey
- Historical fire regime was generally a frequent (7-15 years), low intensity event.

Ecological integrity is rated moderate as a result of the following:

- Lack of fire disturbance is evident and the understory tree component is changing, affecting the remaining overstory trees (including large trees important to the BEMA).
- Dwarf mistletoe infection is spreading and stressing a large percentage of the trees on the eastern edge of the lake.
- Developed campground and parking adjacent to the lake limit wildlife use to some extent.
- Human presence within BEMA may preclude nesting.

Trend: Loss of large diameter pine to insect and disease and corresponding increase in early structure continues to place future nest trees for bald eagles and scenic quality at risk (H).

Trend: Susceptibility of landscape to high severity fires is increasing due to the accumulation of ground fuels and an increase of ladder fuels (understory vegetation and dwarf mistletoe brooms). This condition changes the historical fire regime to an infrequent, stand replacing event which threatens the public and BEMA habitat (H).

Trend: Decline in solitude for bald eagles due to increasing recreational use (M/H depending on season).

Trend: Increasing recreational demand in developed settings while funding to maintain facilities continues to diminish (M).

#4c South Twin Lake (101 acres)

Current Condition: (Intensive Recreation, Matrix, Scenic Views, Riparian Reserve) Conditions are similar to North Twin Lake, only this lake has a resort, cabins, and an RV park. Understory trees and shrubs have encroached and have raised the risk of an uncontrollable wildfire. Trails, pathways, and campsites are not well defined, allowing heavy use to impact vegetation. Late-structural stage forest comprises about 97% of the sub-area. Disturbance to bald eagles from humans is moderate to high, primarily from hiking, boating, and camping at the lake. Blowdown of large ponderosa pine trees is evident here and in adjacent areas where the reservoir has exposed stands to lengthy reaches of wind. Water quality is good but susceptible to degradation because of long retention time and intensive recreation use.

Desired Condition: Developed recreation facilities are safe, clean, efficient and barrier-free. Risk to the public from an uncontrollable wildfire has been lowered through fuel loading reduction and use of prescribed fire in appropriate places. Trails, pathways, and campsites are well defined, protecting vegetation and reducing disturbance to bald eagles. Late-structural forest continues to dominate the vegetated area. Suitable ponderosa pine trees are available to replace large, blowndown trees. Water quality remains at a fairly high level.

Social and ecological function

- Desirable high use area for developed recreation opportunities.
- Good opportunities exist for viewing wildlife, especially waterfowl.
- Potential osprey and bald eagle foraging area.
- Historical fire regime was a frequent (7-15 years), low intensity event.

Ecological integrity is rated moderate as a result of the following:

- Fire exclusion has allowed understory trees to become more dense causing impacts from insect and diseases to increase.
- Large overstory trees are becoming stressed as they compete for limited resources.
- Developed campground, resort, cabins, biking and hiking trails, and parking limit wildlife use to some extent.

Trend: Increasing recreational demand in developed settings is challenging the Forest Service to provide an expected quality experience to the public while funding to maintain facilities continues to diminish (M).

Trend: Susceptibility of landscape to high severity fires is increasing due to fuels buildup, causing a potential for human entrapment, loss of structures, injury, and death (M).

Trend: Loss of large diameter pine to insects, diseases, and blowdown is resulting in a corresponding increase in early structure, placing affecting dependent species and the visual

quality at risk (M).

Trend: Decline in solitude to species sensitive to disturbance (M).

#5 Davis Lava Flow (1,410 acres)

Current Condition: (Scenic Views, BEMA, Matrix, Riparian Reserves) This area is comprised of lava, surrounding a small vegetated island (kipuka). Prescribed fire has been returned to some of the adjacent meadows to the lava flow and Davis Lake, restoring the decadent grasses and willows. Approximately 80% of the kipuka is within late-structural stand conditions. Perched aquifers adjacent to the lava provide unique habitat which supports aspen trees, wet meadow vegetation and other riparian-dependent vegetative and wildlife species. Roads currently allow access to the base of the lava flow and to the borrow pit on the east side.

Desired Condition: Fire is allowed to burn under natural and prescriptive conditions on the kipuka and in the meadow habitats adjacent to the lava flow. Vehicle access to the interior vegetation is within guidelines of the management designations, or eliminated.

Social and ecological function:

- There is a designated BEMA within the sub-area and two other adjacent BEMAs along the shores of Davis Lake.
- Bald eagles are not presently nesting in the area, but the potential is good given the proximity of high value foraging areas in Davis Lake.
- Provides dispersal between Davis Mountain and Browns LSRs.
- Historical fire regime was a frequent (7-15 years), low intensity fire within the vegetated portions
- Contains a significantly sized kipuka, which provides a unique and isolated habitat for vegetative and wildlife species.

Ecological integrity is rated high as a result of the following:.

- Direct effects from humans are low.
- Most of the area is in a late-structural stage and is confined to a kipuka in the south-central portion of the flow.
- Road density is very low and limited to the edge of the lava flow.
- Unique habitats adjacent to the lava are currently functioning as riparian refugia, although access from dispersed camping sites during low water years may impact the vegetative and wildlife species present.

Trend: The natural fire regime is becoming altered, increasing stem densities and allowing a buildup of natural fuels. This could ultimately diminish connectivity between Davis Mountain and Browns LSR by affecting large tree health and stand progression (M).

#6a, b, c, d Browns Mountain LSR (7,240 acres)

Current condition: (LSR, BEMA, Scenic Views, General Forest, Old Growth, Eligible Wild and Scenic River, Riparian Reserve, Osprey) A wide variety of riparian and upland habitats are present within the boundary of the LSR, including perennial streams, wet meadows, forested lavas, and upland forests. Direct effects from humans are high, primarily from past harvest activities and recreational use along water bodies within and adjacent to the LSR. Road densities within the sub-area are high. A recent (1996) attempt was made to close roads to dispersed sites in the Browns Mountain boat ramp area. This effort was successful in moving impacts away from the lakeshore and protecting riparian vegetation for a short period of time, however, much of the closure has been disrupted from campers breaching roads and re-establishing camp sites. The remaining campsites which were not closed, need additional site definition and public education to be consistent with LSR objectives. In addition, toilets at the boat ramp are old and failing. Late-structure forest comprises approximately 60% in 6a, 50% in 6b, 50% in 6c, and 40% in 6d. Fire exclusion has allowed encroachment of shade tolerant species at densities exceeding recommended levels in significant portions stands within the ponderosa pine and mixed conifer dry PAGs. Regeneration of past harvest units near Wuksi and Shukash Buttes has been retarded due to competition from ceanothus and compacted soils. Large, old ponderosa pine trees are dying due to understory competition for scarce nutrients and water (sub-area 6a). Several large fires have recently occurred near the area, most notably the Four Corners Fire in 1994. Due to low water levels in Crane Prairie Reservoir during the drought years (ending in 1995), the Deschutes River did not meet state water quality standards for temperature. In general, wetlands, riparian zones and perennial streams within the analysis area are in a functional and healthy condition except for the following conditions: (1) the Deschutes River is deficient in spawning gravel; (2) lodgepole pine is encroaching into Browns Creek meadows; and (3) vehicle access at Browns Creek road crossing (Road 4280) has destroyed riparian vegetation.

Desired Condition: Late-successional and old-growth species habitat and ecosystems are maintained and enhanced to protect them from loss due to large-scale fire, insect attacks, disease epidemics, and major human impacts. The ponderosa pine component is restored within its range. Dispersed campers have adequate access to recreational sites excluding existing closures and rehabilitation efforts. At the Browns Mountain boat ramp, dispersed sites which remain open are well-defined and the facilities are efficient and barrier-free. Plantations adjacent to Wuksi and Shukash Buttes are free to grow. Risk of a landscape level loss from fire on Browns Mountain is lessened while Aquatic Conservation Strategy objectives for wetlands and riparian zones are met. Wetlands, riparian zones and perennial streams remain in a functional and healthy condition.

Social and ecological function:

- Similar to the conditions found on Wickiup Reservoir (4a), dispersed recreation use adjacent to Crane Prairie Reservoir is very popular and the use level is high.

- A portion of the LSR is also within an Osprey Management Area.
- Within the dry PAG, the historical fire regime includes a frequent (7-15 years), low intensity event on the lower elevation and southern aspects of Browns Mountain.
- Provides the largest block of dry mixed conifer and ponderosa pine late-successional habitat within the watershed.
- Provides wetland and perennial habitat within the watershed.

Ecological integrity is rated moderate as a result of the following:

- The northern portion of the LSR adjacent to Crane Prairie Reservoir is at very high risk to an uncontrollable wildfire, given the high density recreation, limited ingress/egress, and a large component of dead and down fuels (sub-area 6a).
- Past selective harvest of large ponderosa pine and Douglas-fir trees has eliminated most of the potential nest trees for northern spotted owls adjacent to Crane Prairie and on Browns Mountain.
- Timber harvest and roading in areas adjacent to the LSR have eliminated dispersal habitat.
- Snags and coarse woody material levels are below the minimum needed in many stands.
- Human disturbance in the northern portion of the LSR adjacent to Crane Prairie Reservoir is a concern for effects to bald eagles.
- Other late-successional and old growth related species may be affected by edge effects from fragmentation of late-structural habitats throughout the LSR.
- 6a is adjacent to a very high-use recreation area which includes boat ramps, dispersed camping, a cinder pit, and a dam. In addition, 6a has a very high road density as a result of past harvest activities.
- Water temperatures in the Deschutes River at times are below state water quality standards.

Trend: Susceptibility of landscape to high severity fires is increasing due to fuels buildup, stand densities, and encroachment of shade-tolerant species. This condition compromises public safety and places the LSR at risk to loss function (High).

Trend: Loss of large diameter pine due to increased competition for limited water and nutrients and corresponding increase in early- to mid-structural forests affecting dependent species and social values for large trees (6a, High).

Trend: Mortality in lodgepole and mixed conifer PAGs is due to insect and disease activity above endemic levels (High).

Trend: Fragmentation of the forest matrix from roading and previous harvest activities causing a decrease in amount and quality habitat for interior dependent species, loss of connective habitat within the LSR and adjacent Matrix lands, and an increase in edge (6a, 6b, 6d, High).

Trend: Trend to late seral stage of meadows and riparian stream sides, potentially affecting desired vegetation (6c, 6d, Moderate).

Trend: Decreasing scenic and aesthetic quality due to a declining vegetative condition and mortality of large trees along road 4285 and the south shore of Crane Prairie Reservoir (6a, Moderate).

Trend: Impaired soil quality in timber harvest areas (6a, 6b, Moderate).

Trend: Decline in solitude to species sensitive to disturbance due to roading and increasing recreational use of the area (Moderate).

Trend: The white pine component is diminishing (6a, Moderate).

#6e Round Mountain LSR (220 acres)

Current Condition: (LSR, Scenic Views) Late-structural habitat comprises about 70% of the sub-area. Direct effects from humans are moderate, primarily from use as a fire lookout. The sub-area comprises the upper half of Round Mountain. A seasonal road closure helps in retaining solitude in the area for bald eagles.

Desired Condition: As listed in the Browns Mountain LSR (sub-areas 6a-d), maintenance and enhancement of LSR values is the primary objective. Fire is allowed to play a role in appropriate stands, reducing brush and other vegetative components which exist above historic levels. Round Mountain lookout remains as an effective and early detection facility for wildfires, while minimizing tree removal. The seasonal road closure to the lookout is retained.

Social and ecological function:

- Round Mountain lookout serves as the primary lookout west of Highway 97, providing important fire detection for the Deschutes and the Willamette National Forests.
- Round Mountain is considered to have nesting potential for bald eagles. Sub-adults have been observed in the area.
- Spotted owls could potentially travel through this sub-area, but nesting is unlikely due to the limited size of the late-structural forest component which is designated as LSR.
- The historical fire regime includes a frequent (7-15 years), low intensity event.

Ecological integrity is rated moderate as a result of the following:

- Fire exclusion has allowed ceanothus brush to dominate many stand understories on the western and southern aspects, raising the risk of a stand replacement event.
- Habitat has been permanently removed or altered by the fire lookout facility and

access road to the top of the mountain.
- Removal of trees to accommodate helicopters and improve visibility from the lookout
- Edge effects are of high concern in this LSR due to its small size. Numerous openings created by past fires and harvest activity have fragmented the habitat present in the area.

Trend: Susceptibility of landscape to high severity fires is increasing due to a buildup of the brush model (6) and timber litter model (10) resulting in an increased fire hazard (High).

Trend: Active fire exclusion has advanced forest vegetation to extreme densities (High).

Trend: Mortality in mixed conifer PAGs (Moderate).

Trend: Fragmentation of the forest matrix from fires, roading and past harvest activities causing a decrease in amount and quality habitat for interior dependent species and an increase in edge (Moderate).

Trend: Decline in solitude to species sensitive to disturbance due to roading and the fire lookout (Moderate).

The following Table 5-1 summarizes the trends found in the sub-areas described above:

Table 5-1

Trends

Trends - The codes "B" = Biological, "P" = Physical and "S" = Social elements of the watershed .	Sub-Area	Causes	Resources Affected
B1 - Increase in late-structural stage forests in mountain hemlock PAG dominated by historic disturbance regimes including fire	1a	• Natural succession • Fire exclusion	• Species composition
B2 -Increase in susceptibility to insect and disease and corresponding loss of large diameter pine resulting in an increase in early- and mid-structural stands	2a, 2b, 2c 3, 4b, 4c, 6a	• Creation of Wickiup Reservoir causing windthrow • Other disturbances such as low severity fire exclusion resulting in stagnation • Lack of recruitment • Drought • Forest succession • Root pathogens	• Stand structure and species change • Scenic integrity • Dependent LSOG species (plant and animal)
B3 - Succession advancement of regeneration. Late- has been replaced by early-structured stands	1b	• Past harvest activity • Human-caused wildfires • Natural succession	• Species dependent on mid- and late-structured stands • Scenic integrity
B4 - Fragmentation of the forest matrix causing a decrease in amount and quality habitat for interior dependent species and an increase in edge	2a, 2b, 2c 2e, 3, 6a, 6b, 6d, 6e	• Past timber harvest activity has contributed to a disruption in wildlife connectivity • Wildfire • Insects and disease • Roads • Other developments such as campgrounds and the reservoir	• Dispersal and movement for dependent species (e.g. big game, American marten, northern spotted owl • Hunting opportunities (increase) • Survey and manage plant species • Economies for forest products
B5 - Decline in solitude for species which are sensitive to disturbance	2a, 2b, 2d 2f, 4a, 4b 4c, 6a-e	• Human disturbance (e.g. roads, boating, timber harvest, camping)	• bald eagle

Trends - The codes "B" =Biological, "P" = Physical and "S" = Social elements of the watershed .	Sub-Area	Causes	Resources Affected
B6 - Loss of connective habitat	2a, 2e	• Past timber harvest activities which disrupt connectivity • Wildfire • Insects and disease • Roads • Developments such as campgrounds and reservoirs	• Dispersal and movement for dependent species (e.g big game, American marten , northern spotted owl • Hunting opportunities
B7 - Increasing mortality in the LP and/or MCD PAGS	2b, 3, 6a, 6b, 6d, 6e	• Loss of vigor through fire exclusion, insect and disease, and natural succession • Increased stocking density and resulting competition	• Large diameter trees • Stand structure and species change • Neotropical migrants/resident bug eaters • Scenic integrity • Survey and manage plant species
B8 - Encroachment of shade tolerant species and increasing stand densities from other disturbance agents	2e, 2f, 6e	• Fire exclusion • Natural succession	• Loss of habitat for native plants and dependent wildlife species • Vegetation health and vigor • Air quality • Water quality • Scenic integrity • Public and firefighter safety • Recreation use • Recreational facilities
B9 - Slow recovery and loss of vegetation through trampling and roading	2d	• Dispersed camping and associated user-created roads • Roading from past harvest activities	• Plant diversity and associated dependent wildlife • Scenery • Recreation experience • Soil quality
B10 - Decline in woody material (stumps) which provide fish habitat within the reservoir	4a	• Fluctuating water levels • Natural decomposition	• Natural fish and invertebrate production • Raptor forage base

Trends - The codes "B" = Biological, "P" = Physical and "S" = Social elements of the watershed .	Sub-Area	Causes	Resources Affected
B11 - Increase of undesirable non-native plant species	4a	• Increase of land base with conditions favorable to spread • Increase opportunity for spread of existing and new populations from boats, cars, domestic animals, and humans	• Native plant species and habitat • Scenic integrity
B12 - Trend to late seral stage of meadows and riparian stream sides	6c, 6d	• Natural succession through lack of disturbance • Changing water regime	• Meadow adapted plant species • Meadow dependent animals (e.g. great gray owl)
B13 - The white pine component is diminishing	1a, 1b, 6a	• White pine blister rust • Competition stress • Bark beetles	• Species diversity
P1 - Decline in soil quality	1b, 2a, 2b 2c, 2e, 3 6a, 6b	• Compaction or displacement resulting from past harvest activity • Hardening of dispersed camping sites • Roads	• Site productivity affecting species diversity and quantity • Economic • Soils
S1 - Increasing recreation demand such as camping, fishing, and motor boating in developed and undeveloped settings.	4a, 4b, 4c	• Increasing human population • Promotion of Central Oregon as premiere recreational area • Ecotourism • Lifestyle changes • Shift towards recreational-based economy	• Quality of recreational settings /experiences (solitude, user conflicts) • Soil quality • Water quality • Native plant community • Scenic integrity • Fire management • Recreational facilities
S2 - Recreation users continue to access dispersed sites using an extensive network of roads	2a, 2b, 2d	• Relocation of displaced campers from adjacent areas • Increased fee camping • Increased recreation demand for dispersed campsites	• Recreational settings/experiences • Native (including riparian) vegetation • Soil quality • Dependent wildlife habitat • Scenic integrity

Trends - The codes "B" =Biological, "P" = Physical and "S" = Social elements of the watershed .	Sub-Area	Causes	Resources Affected
S3 - Susceptibility of the landscape to high severity fires is increasing due to fuels buildup with a corresponding potential for human entrapment.	2a, 2b, 2f 3, 4b, 4c 5, 6a, 6b, 6d, 6e	• National policy for fire suppression • Natural succession • Social values favoring limited vegetation management • Past harvest activities which removed fire tolerant species, allowing fire sensitive species to flourish. • Changing species composition in dry PAGS (fir) • Other natural disturbances (e.g. windthrow) • Increased use of the area and the elevated risk of an ignition • Change in vegetation which increases lateral and horizontal fuels continuity increasing crown fire potential	• Public and firefighter safety • Loss of habitat for native plants and dependent wildlife species including connectivity between late and old stands • Air quality • Scenic integrity • Recreation use patterns • Recreational facilities • Natural stand progression • Large tree health
S4 - Requests to extract commodities and commercially utilize resources within the sub-area are increasing and diversifying	3, 4a	• Social expectations and demands • Increasing requests from outfitter guides to provide service • Economic value of forest products (e.g. timber and Matsutaki mushrooms) • Recreation based economy • Outdoor recreation demand	• Local economies • Recreational settings • Habitat connectivity and effectiveness • Natural role of fire • Survey and manage species associated with extracted commodities (Allotropa)
S5 - Increasing scenic and aesthetic integrity.	3, 4a, 6a	• Conditions improve as trees grow and lessen the visual impact from previous harvest activities	• Quality of recreational settings • Local economies (recreational-based resorts)
S6 - Deterioration of recreational facilities has diminished natural resource conditions and recreational experiences	4a	• Increasing age of facilities • Diminishing recreational budgets • Failure of older metal vault toilets • Increasing human population • Increasing use • Promotion of Central Oregon as premiere recreational area	• Quality recreational settings (solitude, user conflicts) • Soil quality • Water quality • Native plant community • Scenic integrity

Trends - The codes "B" = Biological, "P" = Physical and "S" = Social elements of the watershed .	Sub-Area	Causes	Resources Affected
S7 - Displacement of campers which use traditional dispersed areas as restrictions on campsites and access increases popularity of the remaining unrestricted sites	4a	• Road closures • User fees	• Quality of recreation settings (solitude, user conflicts) • Soil quality • Water quality • Dependent wildlife habitat • Native plant community • Fire management
S8 - Human use and waste disposal, including pit toilets, is likely to increase within the riparian zone	4a	• Increasing demand for camping in undeveloped settings • Causes listed in S1	• Water quality • Riparian vegetation and dependent wildlife
S9 - Increasing user fees	4a	• Diminishing congressional funding for recreation • Aging infrastructure such as buildings, campgrounds and trail systems.	• Access for people who cannot afford to use public lands

Trends and Interpretation

The following section addresses the key questions or core topics identified during the watershed analysis for each resource. Analysis results which identify the level of change between reference and current conditions, as well as the reasons for those changes, are included.

SOILS

Erosion processes and management impacts:

Erosion processes within the watershed have been altered as a result of road construction, harvest activities and recreational use along waterbodies within the watershed. Landscape sub-areas in which harvest activities have occurred on more than half of the acreage, or those containing primary use waterbodies, have had the most extensive increase in unnatural erosional activity.

Sediment movement associated with overland water flow and wind erosion has most likely increased within the watershed as a result of increased road densities (Tables 3-14, 3-15) and the removal or disturbance of vegetation. The amount of soil that is currently compacted and/or denuded of vegetation from machine traffic or road building over reference conditions has increased in nearly every landscape sub-area. The majority of movement, however, is on upland sites and does not reach perennial streams or lakes. Vegetative buffers remain intact along Browns Creek and the Deschutes River and are generally in a low impact condition, minimizing the direct input of sediment from overland flow into the only two perennial stream reaches in the watershed.

Recreation areas around Wickiup Reservoir and the Twin lakes are the primary shoreline locations within the watershed where erosion and sediment transport is occurring above reference levels. Dispersed camping, as well as general foot traffic for hiking, fishing and swimming, have removed vegetation and compacted soils, leaving portions of the shoreline exposed to wind and water erosion. The banks along the Twin lakes and the majority of Wickiup Reservoir are relatively stable, primarily due to the gentle slope transition between the upland and waterline. One section at the south end of the Deschutes Arm was identified as having active erosion where the bank height was estimated to be three to four feet high. While sediment movement into the reservoir is occurring, the rate of input and length of suspension of the ash and pumice soil material is such that the actual contribution to the outflow into the Deschutes River channel appears to be negligible.

Water

Although current water quality data does not suggest a problem with cultural eutrophication of lakes and streams, the potential will increase with the projected increase in recreational use in Central Oregon estimated to double in 30 years. The potential for introduction of pathogens into water bodies, including the Deschutes River below Wickiup Dam will also increase.

The flow regime at the outlet of Crane Prairie Reservoir will continue to be prioritized to meet irrigation demands. Water quality and habitat for aquatic species in the Deschutes River between Crane Prairie and Wickiup Reservoirs will continue to be degraded periodically due to flow regime management specific to irrigation needs.

The shoreline will continue to erode at Wickiup Reservoir, adding sediment to the water. Presumably, most of the sediment will settle out and will not be transported downstream from the reservoir.

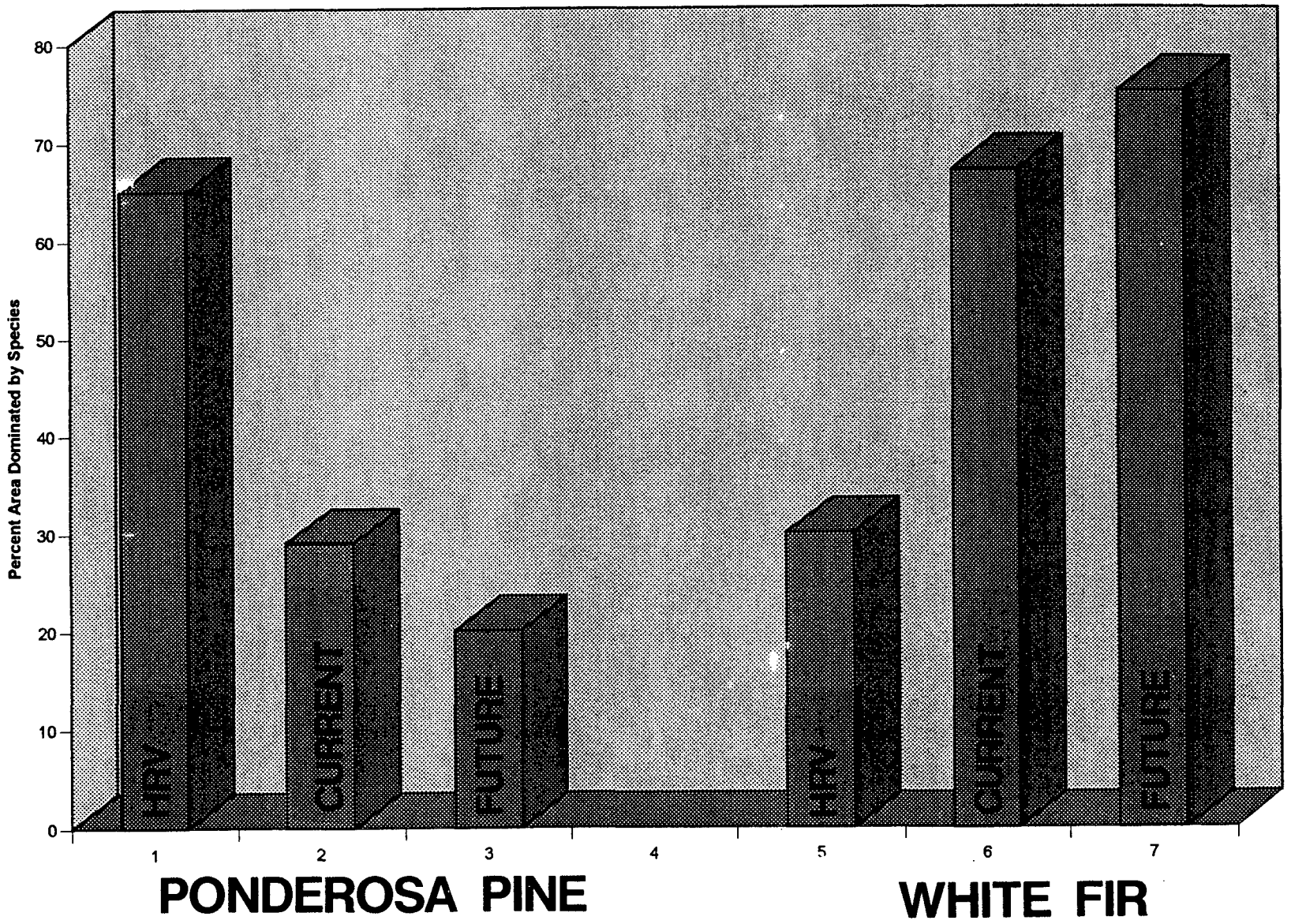
There will be a continued loss of water yield from Browns Creek due to diversion of intermittent tributary channel at West and East Davis rock quarries.

Vegetation

Summary of Trends in Forested Communities:

The following Figure 5-1, "Dominant Species Coverage on Dry Mixed Conifer Sites" (reference data source, ICBEMP DEIS, 1997) indicates the probable landscape trend if passive management with fire exclusion were to occur.

FIGURE 5-1 Dominant Species Coverage on Dry Mixed Conifer Plant Association Groups



Dry Forests (Lodgepole Pine Dry, Ponderosa Pine Dry, Mixed Conifer Dry PAGs):

In the watershed analysis area, most landscape sub-areas are currently well outside of the historic range of variability (HRV) for the dry forest communities (Appendix Table A-11, Figure 3-4). This is especially so for landscape areas 2, 3, and 6. While the HRV is typically not a management goal, it provides a template for understanding the processes that have shaped the forested landscape, namely forest succession and disturbance regime.

In lodgepole pine plant communities, the mid-structural stages are found in greater abundance across the landscape than expected under HRV. Under HRV, a large percentage of the stands were in a stand replacement stage due to a natural fire regime. Present mid-structural stage conditions can be related to the linkage of several connected actions: fire exclusion and increased stand densities which allows ideal conditions for pine beetle activity, resulting in salvage or firewood harvests following the beetles. In combination, these events have resulted in a shift towards the mid-structural stages, especially where fire exclusion activities have been most effective.

For the ponderosa pine-dominated PAGs, the late-single structural stage, which once dominated the landscape at 30-60% of acres, historically, is now virtually absent from the landscape. These were the open, park-like pine stands, which once extended across the western states. In their place now are multi-layered stands of white fir, ponderosa pine, and lodgepole pine, with increased tree densities and the many health and vigor susceptibilities that this brings.

What does this mean for the future of these landscapes?

Passive management (with continued fire exclusion) is projected to result in more late/multi-layer dry forest stands, where ponderosa pine types would continue to depart from HRV. Tied to this projection is the assumption that fire exclusion efforts would continuously need to be increased, as accumulated fuel loadings made control of fires more difficult. It is expected that fire control efficacy would continually diminish over time and that some late/multi-layer forest structures would have stand-replacing fires, resulting in shifts from late/old structures to stand initiation (early) stages. In essence, there would be a net loss of some of the late/old structures that are critical to long-term habitat needs.

Moist Forest Types (Ponderosa Pine Wet, Lodgepole Pine Wet, Mixed Conifer Wet, Meadow/Riparian PAGs):

For the moist forest communities, although specific locations may depart from what would be expected under historic landscapes, the departure from HRV is not as great as that seen in dry forest communities.

For the lodgepole pine-dominated plant communities, the mid-structural stages are found in greater abundance across the landscape than expected under HRV. Like the lodgepole pine dry stands, this can be related to the combination of fire exclusion and increased stand

densities, along with pine beetle activity and salvage/firewood harvest. The resulting shift towards the mid-structural stages has occurred especially where fire exclusion activities have been most effective.

For the true fir-dominated PAGs, the late/multi-layer structural stage, which historically was prominent on the landscape (10-30% of acres) is still found at a rather high frequency (currently at 24%) throughout the watersheds. These multi-layered stands are not quite as susceptible to insect and pathogen activities as the dry forest types, although drought conditions often negate these distinctions.

Passive management (with fire exclusion) is projected to result in increases in late-multi layer structural stages in both the true fir and ponderosa pine-dominated PAGs. For the lodgepole pine and Engelmann spruce-dominated PAGs, the increase from HRV is seen in the mid-structural stages.

Cold Forest Types (Mountain Hemlock PAG):

For the cold forest communities, the general landscape has not departed greatly from HRV conditions, with the exception of a delay in some fire activity. Although specific locations may show a departure from what would be expected under historic landscapes, the departure from HRV is not as great as that seen in dry forest communities.

For the mountain hemlock-dominated PAG, the late-multi layer structural stage, which historically was dominant on the landscape (20-40% of acres) is found at a higher frequency within the watersheds (about 60% of hemlock acres are now in the late-old stage). These multi-layered stands are not quite as susceptible to insect and pathogen activities as the dry or moist forest types, and have become more dominant on the landscape simply by fire exclusion activities and resulting successional advancement that comes in the absence of disturbance.

Passive management (with fire exclusion) is projected to result in further increases in late-multi layer structural stages in mountain hemlock-dominated PAGs. If wildfires or other disturbance events (windstorm, insect and disease pathogens) occur, some of these late structural stands may shift to early structural stages. For the lodgepole pine-dominated PAGs, future increases are seen in the mid and late structural stages, once regenerated stands begin to advance successionally.

Summary of Trends:

Dry Forest types:

- Increased stand densities, continuing shift to shade-tolerant (true fir) species
- Movement from single-storied stands to multi-layer (true fir, as well as lodgepole pine)
- Decreased species diversity, especially as the shade intolerants fade out (e.g. ponderosa pine and Douglas-fir)
- Increased fragmentation (harvest); decreased patch size (harvest)

- Increased bark beetle activity (more host material with fire exclusion) and mistletoe infestations
- Increased susceptibility to defoliator insect epidemics
- Substantial change in the historic fire regime from frequent, low-intensity to mixed severity and stand-replacing burns

Moist Forest types:

- Increased stand densities and resulting increased root pathogen activity
- Decreased species complexity with loss of western white pine species
- Increase in exotic pathogens (e.g., White pine blister rust)
- Continued recycling of lodgepole pine stands with bark beetle attacks

Cold Forest types:

- Increased stand densities and resulting increased root pathogen activity
- Decreased species complexity with loss of western white pine species
- Increase in exotic pathogens (e.g., white pine blister rust)
- Delayed stand-replacing fire cycles
- Continued patch/pattern on landscape from native disease agents (e.g. root rots in mountain hemlock)

What are the natural and human caused disturbances that have shaped the existing landscape and watershed condition?

Fire was once the dominant landscape modifier of vegetation --- both in terms of species composition, and structure. The greatest change in forest vegetation throughout the watersheds is seen in the dry mixed conifer and ponderosa pine plant associations, which represent nearly one-half of all forest acres within the watershed. Open, park-like ponderosa pine stands once dominated these landscapes, and were subjected to frequent, low-intensity fires.

However, this has changed dramatically within many of our lifetimes. With fire exclusion and selective tree harvesting over the past several decades, the domain of the late, single-storied stands has been reduced tenfold. White fir and lodgepole pine trees have encroached over time and have changed the dominant species composition, as well as converting single-storied stands to multi-storied ones.

What is the resilience of large trees in the dry forest type?

Along with encroaching stand densities following fire exclusion, has come the added concern of increased bark beetle attacks, root pathogens and dwarf mistletoe inoculum. Simply put, the remaining large, old ponderosa pine --- in the absence of frequent, light fires --- have become stressed for resources, particularly moisture. This has put these individual trees and stands at much greater risk of epidemic insect attacks.

These conditions are found throughout the watersheds, but appear most pronounced along the buttes --- from the north slope of Davis Mountain to Browns Mountain LSR. Heavy stand densities, combined with the advancing age and general loss of vigor, has placed many of the remaining old, ponderosa pine trees under such stress that their future health is greatly compromised. As many as one-half of all forest acres within the watersheds are at high stand densities, which indicates that this situation is not localized, but extensive and chronic.

Wildlife

The detailed trend analysis for wildlife can be found in the Wildlife Appendix. The following text summarizes the findings:

What the root causes of the current unstable conditions within suitable bald eagle habitat and how can we best reduce the risk of losing that habitat?

The majority of the Bald Eagle Management Areas (BEMAs) within the analysis area are providing suitable habitat. The exceptions have been noted in the Appendix under Wildlife Recommendations. The principal issue in the BEMAs is the maintenance of the critical habitat functions for eagles, which are large nest trees and solitude during the courtship and nesting period. The BEMAs are at risk in the future because of the following conditions: 1) Increasing tree density particularly in the understory, which has been dominated by white fir; 2) Regeneration of shade intolerant species such as ponderosa pine and Douglas-fir has been significantly depressed because of the increasing canopy cover and competition in the understory; 3) Competition from both trees and shrubs has increased the stress on the existing overstory trees that are generally mature or old-growth with less vigor; 4) Losses of existing overstory to insect/disease as a result of increasing stress, windthrow or wildfire; and 5) Disturbance from humans who are primarily engaged in dispersed recreation activities. Therefore, the overall trend is down.

Potential solutions for reducing the risk of losing this habitat include: 1) Thin understory trees to reduce the dominance by white fir and to reduce the competitive stresses on residual overstory ponderosa pine and Douglas-fir, which are the preferred tree species for eagle nesting; 2) Thin the mid-story to reduce competition with desirable tree species of all ages and to create openings that would favor the establishment of shade intolerant species; 3) Plant ponderosa pine and Douglas-fir where needed, particularly in existing plantations within the BEMAs; 4) Re-introduce fire in stands where it is desirable and risks have been reduced to reduce understory competition, reduce fuel loading; 5) Maintain, re-design and/or establish road closures to reduce human disturbance during the nesting season; and 6) Develop an education program including signing to inform the public of eagle needs and to promote voluntary compliance to meet eagle solitude objectives.

Each BEMA is unique. The referenced wildlife recommendations and supporting data in the Appendix provide additional details which should be useful at the project scale. Other important habitat variables that are important to eagles must be considered when developing long-term management plans for these areas, considering that eagle home ranges are much

larger than the designated BEMAs.

What are the effects of forest fragmentation on interior forested habitat and connectivity between habitats for dependent plants and wildlife?

Fragmentation of the late successional old growth (LSOG) habitats within the watershed analysis area has been a result of past timber harvest/salvage, wildfires, road/facility construction and reservoir construction. The effects are variable across the watershed, however, in general, the low to mid elevations are substantially fragmented. The measures of fragmentation include degree of edge contrast, length of edge by type, patch size, core area size, distance of micro site influence from edge, and the type of matrix and its condition. An extensive multi-variant fragmentation analysis was not done due to time and data limitations. However, the following effects have been determined from the level of analysis done including: 1) Average patch sizes of the remaining LSOG are small; 2) The majority of effective core habitats within the LSOG patches are small; 3) Roads, reservoirs and facilities have permanently removed a substantial acreage of historic LSOG habitat; and 4) LSOG species that are dependent upon large core areas appear to have been negatively impacted, however quantitative population estimates and trends are unavailable. An indication of this is that the Browns Mountain area currently has suitable habitat but its total size is likely inadequate, as it is currently unoccupied by spotted owls. Approximately 10-15 percent of the LSOG patches are of significant size that fully meets the needs of forest interior species. Trend is slowly upward.

Connectivity of LSOG habitats has been negatively affected by the previously described conditions. The importance of connectivity is highly variable between species, so a range of conditions must be provided in order to accommodate this variability. The role of riparian corridors along streams can be an important one for connectivity. However, the watershed has only a few perennial streams, so upland connectivity is critically important. Some species may never be able to adequately move across the watershed because of some of the permanent barriers such as paved roads, reservoirs, and lava.

In conclusion, fragmentation in the watershed has been substantial but the majority of the effects are reversible. The overall trend is slowly improving. Connectivity corridors have been identified and recommended to ensure that future movement and dispersal needs of plants and animals are met. The corridors have variable conditions and some examples of restoration treatments could include: tree planting, culturing, and road closures. Guidelines for management within the corridors are provided in the Wildlife Recommendations in the Appendix.

What late-successional and old-growth forest related animal species have potential for occupancy within the LSR?

This question has been addressed in detail in Chapter VII. In brief, a variety of species are known or suspected to occur in the LSR. The diversity of habitats within the LSR will provide a rich biological community of plants and animals. However, the small sizes of the

LSRs is of concern for species that have poor mobility and/or large home ranges. This issue further stresses the importance of connectivity to other LSOG habitats within and outside the watershed. The overall trend for late-successional dependent species is declining in the fire climax forest types and slowly improving in climatic climax forests.

What are the nesting, roosting, and foraging (NRF) habitat requirements for the northern spotted owl in an eastside forest and how much NRF exists within the watershed?

Generally, the spotted owls in this area have home ranges approximately 3,000 acres in size. The area within the home range that provides a pair's nest site is the Core Area. The Core Areas generally average about 1,000 acres in size. There is presently an estimated 5,250 acres of NRF habitat within the Browns/Wickiup watershed boundary, however the current classification of NRF habitat in this area is based solely on aerial photography interpretation and has questionable accuracy. Many stand attributes that are important to maintain a viable owl pair are not easily assessed using remote techniques such as aerial photo interpretation. Sub-areas 1a (High Elevation Unroaded) and 6 (LSRs) have the majority of the classified NRF habitats. NRF habitat also occurs within the recommended Connectivity Corridors, however they are primarily located outside of the watershed boundary. The watershed has only had documented owl sightings in the high elevation areas near Johnny Lake. The LSRs have no historic owl sightings, however known pairs reside within five miles of them. There is an estimated 1,960 acres of NRF habitat within the LSRs with the majority of it on Browns Mountain. The overall trend for NRF habitat in the watershed is slowly improving.

What percentage of the LSR or adjacent stands is in excess of NFR requirements and which can be manipulated to maintain future resiliency?

None of the currently classified NRF is in excess, because the amount is less than the minimum needed to support a pair of spotted owls (i.e. 3,000 acres). The NRF habitat within and near the Round Mt. LSR is significantly below the home range requirements and has a very low potential to support owls except for dispersal and foraging. The Browns Mountain LSR NRF is much more significant and has good long-term potential to support a pair of owls provided that the current unsuitable habitat in the area is developed. The majority of the acreage of both the currently suitable NRF and the adjacent potential habitat could be manipulated. Refer to Chapter VII for specific details and supporting data. The establishment of a viable pair of spotted owls on Browns Mountain is a long-term goal. The other NRF habitats within the watershed have not been evaluated. The vast majority of it is within the sub-area 1a where the best management approach is protection, not manipulation. As previously stated, the trend for NRF habitat is slowly improving.

Fish

- Fish population numbers are influenced by factors other than natural ones (i.e. numbers stocked by ODFW), angling pressure and success, and reservoir levels. The watershed is expected to continue to produce fish similar to present numbers into the future.

•With the recent illegal introductions of black crappie and bluegill into Crane Prairie Reservoir, it is likely these species will eventually end up in Wickiup Reservoir. Like the largemouth bass, they are not anticipated to flourish in the reservoir due to receding water levels reducing available spawning habitat.

•The brown bullhead in North Twin lake will overpopulate and outcompete the trout.

•Species composition may change within the watershed if ODFW changes stocking strategy.

•Because of declining salmon and steelhead runs on the Pacific coast and in the Columbia River system, and the subsequent diminishing recreational fishing opportunities, increased fishing pressure is expected in areas such as Central Oregon (Marx, personal communication 1995).

•Tree stumps within Wickiup Reservoir will continue to become dislodged and wash away, resulting in the loss of fish and invertebrate habitat.

•Fluctuating water levels within Wickiup Reservoir will continue to adversely affect habitat of fish, invertebrates, aquatic plants, and birds.

•The presence of Crane Prairie Reservoir continues to block the downstream movement of spawning gravel in the Deschutes River. Spawning habitat is still below capacity despite recent spawning gravel additions by ODFW/USFS.

•The water temperatures will continue to be elevated within the Deschutes River below Crane Prairie Reservoir, especially during low water years. Fish, invertebrates, and other aquatic organisms will continue to be adversely affected.

•ODFW goal is to rely more on natural reproduction rather than stocking, especially in light of shrinking budgets. Fish habitat restoration and protection will continue to be very important.

•Fish habitat is improving in some areas of Browns Creek and the Deschutes River because of increase in large wood recruitment from natural windfall and USFS/ODFW restoration projects.

Recreation

Based on the current conditions discussed previously, the following is a summary of trends predicted to continue into the 21st century.

General Recreation

Sustaining recreation quality for both developed and dispersed activities is key in developing a strategy for managing the recreation, biological, and physical resources.

What level and quantity of recreation use can be maintained in recreation (both developed and dispersed sites) and riparian areas and continue to sustain biological and physical resources in the long-term?

Potential keys in answering this question will come through identification of the need for improvements, such as: improved recreation facility site design and definition, restoration and rehabilitation of sites, access and travel planning, interpretive and information services, and the development of use regulations and restrictions.

Ironically, the continuing trend of increased population and urbanization puts at risk the resources that attracted many people to move here. People are moving to the Central Oregon area for the quality of life they find here, which is directly related to the natural resources the area has to offer. The open spaces, spectacular mountain views, variety of environments from mountain forest to high desert, and the freedom that these have to offer continue to attract residents and visitors alike. With population increases predicted for Deschutes County (Center for Population Research and Census, School of Urban and Public Affairs - Portland State University), not only Bend, but the LaPine and Redmond areas will see an increase in numbers and urbanization. More people arriving translates into an increased number of forest users, and makes it harder to "get away from it all". This increased use of public lands has in turn brought about the need for restrictions to control use on public lands as increased user impacts to the resources occur, and more emphasis is placed on ecosystem restoration and less on consumptive uses. Road closures and trail restrictions to protect resources are already a common management tools.

An emerging trend is the use of concession operations to provide recreation opportunities that the Forest Service has traditionally managed. This is directly related to the reduction in recreation management funding allocated by Congress. Currently, the operation and maintenance of developed campgrounds, and some dispersed camp sites, have been turned over to concession operators. It is likely that concession operations will expand to include more dispersed recreation management, and other recreation activity programs (day use areas, interpretive services, etc.). This could include private operators to provide services currently not available to the recreating public (i.e rental of recreation equipment). This in turn could create further social, biological, and physical impacts. New recreation opportunities such as those described above will be determined by public demand for such activities and evaluated by the Forest Service.

Increasing opportunities offered through concession or other private operators will draw more people, increasing public expectations. Increased use levels will incense those publics that are wanting less activity and people recreating on the forest, while those looking for new and more opportunities will be satisfied with the increased activity options.

Also an emerging trend, use fees may be utilized as a result of lower recreation budgets to operate and maintain facilities and programs. Recent pilot projects using this concept are likely the start of a trend that will continue into the future. In general, recent newspaper articles around the Northwest have concluded use fees will be accepted by the public as long

as there are not individual fees for each activity, and improvements on the ground are being accomplished benefitting recreation resources.

New technologies have also played a role in the increased demand for diversified recreation in both developed and non-developed (dispersed) settings. Mountain biking, windsurfing, and personal watercraft are a few examples of new uses in the National Forest system. These and traditional uses within and adjacent to riparian areas will continue to create conflict with recreation, wildlife, fisheries, and water use.

Dispersed Recreation

Dispersed recreation activities, especially overnight dispersed camping and boating, will continue to increase as the population increases, and as the area is nationally promoted as a vacation destination. Historic use around Wickiup Reservoir included experiences where fishing and sitting around the campfire were the main activities, with few administrative restrictions. However, this is changing. User impacts have necessitated a year round restriction for camping below the high water mark. Within the last 10-20 years, use of dispersed camps has increased to the point that it is not uncommon to have crowds of camps dotting lakesides during weekends. This has changed the overall dispersed character of Wickiup from a quiet, serene setting to a more active, crowded, and faster-paced setting.

Sites will continue to be adversely impacted from the increase of recreational use the area is receiving. Sites located in the recreation/riparian interface will continue to degrade vegetation, soil (through compaction), put at risk the water resources (from sewage disposal), and change the site character (lessening the aesthetic quality) of an area. Specific recommendations are listed in Chapter VI to mitigate these anticipated effects.

Due to the increased popularity and use levels of the area, the character of Wickiup Reservoir and, to a lesser degree the surrounding lakes, will continue to experience a setting change to less solitude with a diversity of activities (including motorized recreation use). The majority of recreating users enjoy their visits to the National Forest and do not understand issues associated with current trends.

An increase in use restrictions and regulations placed on dispersed users is likely to help maintain site character and aesthetic integrity, and to improve vegetative conditions and wildlife habitat. This could create negative reactions from portions of the public, however, this may be offset by people who desire a sense of solitude..

Developed Recreation

Without restoration efforts and capital investment/replacement of aging facilities, sites will continue to deteriorate. This will continue to degrade the recreation/riparian interface (through compaction and increased runoff), vegetation (loss of site screening and character), soil (through compaction), and a change in site character (lessening the aesthetic quality). However, most of the recreating public enjoys their stay, and do not see many of the facility

problems or impacts during their visit.

Scenic Quality

Forest insect and disease agents will continue to impact the area due to overstocked forest conditions. Scenic integrity and recreation experiences are at risk. Scenic integrity of high use areas does not meet the expectations and/or preferences of some of the users due to the effects of overcrowding, forest health, commodity extraction, outdated facility design, a backlog of recreation facility maintenance, and fire exclusion. With the public's strong attachment and reverence for this landscape and settings, it is likely they will demand action.

Scenic recovery of damaged insect and diseased areas will vary depending upon insect/disease intensities and site characteristics such as moisture, aspect, and elevation. Salvage and other harvest activities will also affect recovery. In some cases, natural regeneration will best aid scenic recovery, in others, salvage followed by reforestation efforts through prescribed burnings and plantings will accelerate recovery. The potential to increase diversity and open up distant views to mountains, lakes and streams is high.

Social Expectations

The trend of increased public involvement and vocalization with Forest Service management practices has increased with the influx of residents and forest users. The Forest Service, and other public agencies, have responded by increasing public scoping during the analysis of projects. It is difficult for the Forest Service to address or resolve all public issues or concerns given differing perspectives on how the forests should be managed. Planning efforts need to engage the public in meaningful dialogue to provide a two-way conduit to listen and understand the publics needs and concerns. The Forest Service should meet the public in the field where decisions are implemented, as well as in meeting halls to discuss the issues and concerns raised during the planning process.

Recreation Experience

Crowding in developed and dispersed camp areas will continue to change the character of the sites and the quality of the recreation experience. Opportunities for isolated recreation opportunities are decreasing around Wickiup Reservoir. Overcrowding is increasing dispersed use patterns, exacerbating riparian, water, and wildlife impacts. Recreational, riparian, and wildlife functions are being reduced by these further impacts.

Recreation Access

The likelihood of more restrictions on recreationists is high, especially for dispersed campers. Road closures to protect resources in the area have denied motorized access. The public may feel they are being "locked out" of their public lands. This response may result in increased conflicts between resource management strategies and recreation use. Closure restrictions will be hard to enforce with minimal of law enforcement and recreation personnel.

Restricting access or activities that currently exists in one area will displace that use to another location, creating new impacts. The public could react to further restrictions in a negative way, increasing the amount of lawlessness in the form of closure breaches and/or vandalism until the reasons and benefits for restricting access and use are better understood by the public.

Increasing use on poorly maintained roads providing access to remote areas around Wickiup Reservoir has created resource damage and changed the quality of the dispersed recreation experience in the area. There is a demand for use that is likely exceeding carrying capacity of some roads and dispersed sites.

Resource Extraction

Social expectations for resource extraction often conflicts with recreation and other resource management objectives. Decreasing availability of large diameter trees from public lands has affected the local timber industry by shifting available products for mills to smaller diameter trees as well as dead and down material. Although this is only one factor in a changing timber industry, many local mills and wood manufacturing companies are reducing employees and/or closing. This may decrease the importance of the wood products economic sector (from #1 based on 1993 Deschutes County Comprehensive Management Plan) for Deschutes County as the county markets the area as a destination point for recreation and tourism. In turn, this is likely to create an even greater influx of recreationists and tourists to the area, although the cause and effect is not well understood.

Public Safety

High recreational use interfacing with areas where forest health has been impacted by insect and disease has created a greater hazard to the recreating public from increasing numbers of snags. Exacerbating the problem is the increased opportunity of ignition resulting from fire starts from human activities. Records indicate the ratio of human-caused fire verses natural to be three to one.

Recreation Opportunity Spectrum (ROS)

The existing ROS designations developed for the Deschutes National Forest LRMP and the Northwest Forest Plan allocation areas do not pose conflicting direction within the analysis area. Where there is overlap between the two plans, the more restrictive allocation would be followed.

Increasing use levels could change the ROS classification to the next less restrictive class, especially for landscape area 4 (e.g. Roaded Natural to Roaded Modified). The demand for more recreation is likely to exceed the availability of the slower-paced ROS classes (Roaded Natural).

Integrity

Integrity of landscape character is based on whether the amount of use an area receives, and its scenic integrity, corresponds to its ROS designation. Those areas that are moving towards more healthy conditions (forest health, reduction of recreation impacts, restoration of recreation facilities) would have a corresponding increase in their integrity. In general, the integrity of the analysis area would remain moderate.

Following is the integrity trend by landscape area:

Landscape Area 1: High; will remain unless the popularity of dispersed recreation (i.e. camping) increases

Landscape Area 2: Low to moderate; due to the current amount of forest health problems and past harvest activities, especially along roads

Landscape Area 3: Moderate; although this area includes Davis Mountain which has forest health problems, it is likely that impacts will remain subordinate to the overall scenic and recreational quality of the area

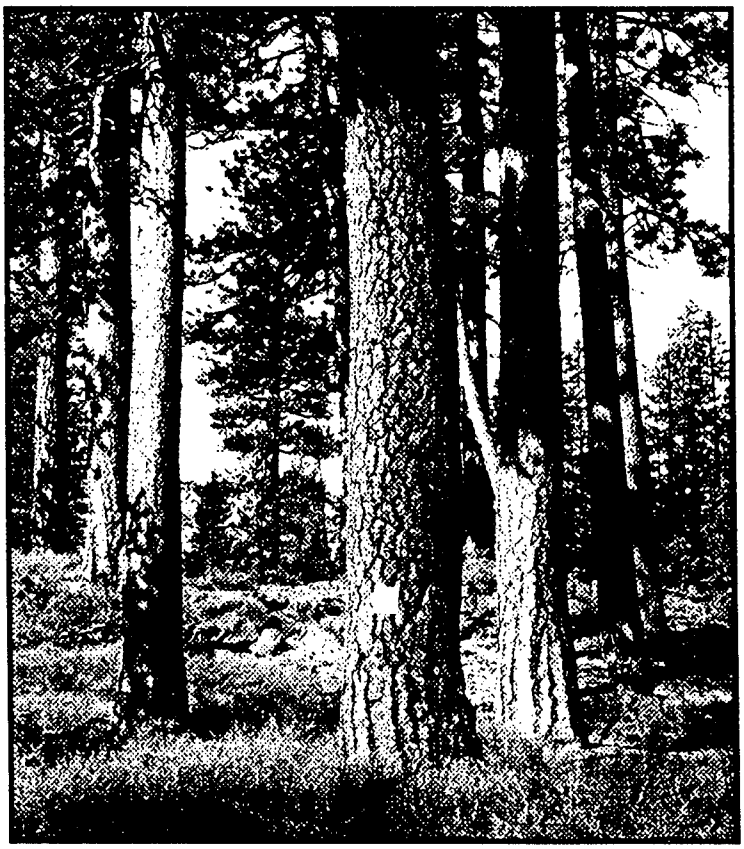
Landscape Area 4: Moderate to low; developed campgrounds will continue to degrade due to increasing recreation use and associated impacts, lack of capital investment funds for restoration or replacement of facilities, and dispersed use expansion into areas that are not currently impacted. These trends have the potential to change the character and setting. In addition, road closures will to be breached and riparian rehabilitation efforts destroyed as a few people continue to exhibit unlawful behavior.

Landscape area 5: High; limited use and accessibility of the Davis lava flow has kept this area intact.

Landscape area 6: Moderate; late-successional reserves in the area (except for the Crane West area) are currently rated as low to moderate for recreation use. These areas provide aesthetic quality for motorists and other recreationists that pass through the LSRs. Declining forest health has the potential to reduce scenic and aesthetic quality along some routes of popular travel (i.e. roads 42 and 4270).

Chapter VI:

Management Goals and Recommendations
Data Gaps and Monitoring
Aquatic Conservation Strategy



Chapter VI
Management Goals and Recommendations
Data Gaps and Monitoring
Aquatic Conservation Strategy

Management goals and recommendations were developed as a result of the trend analysis, incorporating overall knowledge of the area and resources at risk. These goals were also developed with consideration of the human element and are recommended by the team as a way to maintain and protect critical elements and processes which occur within the watershed and LSRs.

Management Goals and Recommendations

Soil

- Maintain soil in a productive condition.

Water/Fishery

- Maintain and restore riparian reserves to meet Aquatic Conservation Strategy and Inland Native Fish Strategy objectives.

- Maintain and restore water quality and habitat features for productive fisheries. Increase natural reproduction and reduce reliance on hatchery stocking.

Vegetation

- Maintain forest vegetation at levels which are sustainable and resilient, managing native disturbances at endemic levels to provide forest defect needed by dependent wildlife.

- Maintain species diversity.

Wildlife

- The principal objective for the BEMAs is to maintain critical habitat functions for eagles. These components include large nest trees and solitude during the courtship and nesting period (January 1- August 31).

- Manage wildlife connectivity corridors in order to make them viable and functional according

to the Northwest Forest Plan (B1, B6, B13, B23, C44) and Riparian Habitat Conservation direction.

- Maintain big game hiding and thermal cover.

- Restore late-structural habitats.

- Reduce disturbance to wildlife from recreation use.

- Maintain meadow habitats for dependent species

- Protect unique habitat values adjacent to Davis lava flow in sub-area 5.

- Reduce fragmentation, increasing distribution of effective wildlife connectivity habitat

- In late-successional reserves, maintain late-successional and old growth species habitat and ecosystems on federal lands. Within Old Growth Management Areas, ensure habitat needs are met for indicator species.

Fire/Fuels

- Maintain transportation systems for quicker access to potential fire starts by fire suppression resources. Consider access to buttes and isolated unroaded areas. Whenever possible, gate important access roads before considering obliteration. Roads should be re-evaluated for access needs as fire risks are reduced.

- Maintain and enhance the current late-successional habitats while moving conditions toward future sustainable areas for late-successional reserves.

- Restore fire as a natural disturbance process by developing and implementing prescribed fire plans on a landscape scale.

- Reduce the existing risk (fuels modifications of the different fuels layers) of late-successional habitat loss from large, high intensity wildfires.

Social/Recreation

- Prior to site-specific analysis for activities within the Browns/Wickiup Watershed Analysis area, a public involvement strategy to be developed. The following methods can be used to provide a mechanism for the public to comment on proposed management of the area: distribute fliers at developed and dispersed sites, provide comment cards, schedule public meetings including a constituent analysis. Use subsequent mapping and/or surveys to target

interested users.

- Provide/maintain large tree component for scenic quality along main travel routes, Wickiup Reservoir, and North/South Twin Lakes.

- Maintain low impact (including roadless in 1a, 1c) conditions for dispersed recreation and wildlife uses.

- Provide/maintain safe, clean, efficient and barrier-free recreational facilities.

- Provide/maintain road closures to promote remote settings.

- Provide/maintain public and firefighter safety.

- Provide/maintain public information/education, especially in high traffic areas.

Management Recommendations

Recommendations and opportunities resulted from a culmination of Chapters I through V. For example, recommendations to realign an ephemeral stream channel to promote attainment of Aquatic Conservation Objectives resulted from synthesis of Key Issue #1 as it relates to water quality. Other recommendations surfaced during the analysis process such as a management area allocation boundary change to resolve inconsistencies between objectives and resource capabilities. The following team recommendations and opportunities are listed by landscape area after **Table** 6-1, which lists recommended restoration activities at a glance. Relative need for restoration and/or management activities were identified using the current trends, resources at risk, relative urgency for action, and the desired condition (by landscape sub-area) on **Figure** 6-1. Reference Figure 3-1, "Landscape Areas and Sub-Areas" in Chapter III. Table 6-2, "Current and Projected Integrity for Landscapes", sets relative importance of recommended restoration activities by landscape area.

Table 6-1 **Recommended Restoration by Landscape Sub-Area**

Sub Area	Rx Fire	Reduce Fuel Loads	Reduce Road Densities	Convert to Trail or Relocate	Thin Trees	Release and Culture	Plant Trees or Veg.	Prune Trees	Reduce Noxious Weeds Pop.	Restore Soil Productivity	Camp Site Improvements	Restore Channel/ Fish Hab. Enhance	Facil. Maint.	Addition. Dispersed Camping Require.	Change MA Bdry /Designation	Educate/ Provide Public Info.
1A	X		X	X												
1B		X	X		X		X			X						
1C											X					X
2A	X	X	X		X	X	X		X	X		X			X	
2B	X	X	X		X	X	X			X						
2C	X	X			X	X				X						
2D			X		X											
2E	X				X			X								
2F	X		X		X		X			X						
3	X	X	X		X					X						X
4A	X		X		X	X	X		X		X	X	X	X		X
4B	X	X	X		X		X	X			X		X		X	X
4C	X	X		X	X	X	X						X			
5	X		X				X									
6A	X	X	X		X	X	X			X		X	X		X	X
6B	X				X		X									
6C				X					X		X	X				
6d	X														X	
6E					X											
6f																

Listed below are priority restoration and management opportunities identified for each landscape sub-area. Parenthesis ( ) designate relative restoration priority listed in Table 6-2, "Current and Projected Integrity for Landscapes". Following each restoration listing, a table links the existing and desired conditions (Chapter V) with the management goals and recommendations in this chapter.

#1a High Elevation Unroaded (Low)

1. Close approximately 2.0 miles of road 4290-200 to Johnny Lake and convert to a trail to maintain the low impact status of the sub-area. The obliteration would occur from the junction of roads 4290 and 4290-965. The trail would be constructed from the junction to the current trailhead.
2. Control conifer invasion in meadows within sub-area. These habitats are unique and important for the great grey owl and dependent species.
3. Plant rust resistant western white pine seedlings in appropriate areas to offset the overall loss of the western white pine component across the landscape.

#1a Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Low impact condition from human uses	Maintain	Maintain for dispersed camping and wildlife	Convert road to trail
Meadow encroachment from conifers	Maintain meadows	Same	Control conifer invasion
Diminishing western white pine component	Species diversity	Same	Plant western white pine

#1b Roaded Lodgepole Pine (Moderate)

1. Thin lodgepole pine trees in naturally regenerated and planted units to accelerate achievement of the desired condition: a resilient forest, where one-half of the dry forest is in the mid-structural condition and one-third in a late-structural condition.
2. Subsoil in units identified as high priority activity units (Figure 6-2); reduce road densities through closure and rehabilitation.
3. Salvage dead material with the objective of fuels reduction.
4. Plant rust resistant western white pine seedlings in appropriate areas to offset the overall loss of the western white pine component across the landscape.

#1b Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Large, regenerated units	Increased late-structure component	Promote late-structure habitats	Thin
Compacted soils	Productive soils	Maintain soil in a productive condition	Subsoil

#1b Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Uncontrollable wildfire likely	Reduced risk	Public safety, endemic native disturbance levels	Salvage to reduce fuels
Diminishing western white pine component	Species diversity	Same	Plant western white pine

#1c Johnny and Found Lakes (Low)

1. Designate dispersed sites on Johnny and Found Lakes to maintain current status of low impact from humans.

#1c Existing Condition	Desired Condition	Management Goal(s)	Recommended Action
Little impact from dispersed campers	Maintain status-quo	Same	Designate dispersed sites

#2a Highway 46 (Low)

1. Culture around large diameter trees along Highway 46 (Cascade Lakes Scenic Byway) to enhance scenic quality.
2. Reduce hazards such as snags and down logs within pre-identified fire camp location adjacent to East Davis gravel quarry.
3. Realign intermittent stream channel on north side of West and East Davis Quarries #1057 and #1058. Enhance/create wetlands within the quarries by moving suitable soil from adjacent borrow area and planting or seeding native riparian vegetation.
4. Close roads to reduce disturbance to wildlife
5. Maintain/improve existing road closures. Improve road 4280-120 in areas prone to springtime flooding to maintain access to dispersed camping on Wickiup Reservoir shoreline, and to maintain integrity of gated road 4280-100 during bald eagle nesting season.
6. Subsoil in units identified as high priority activity units (Figure 6-2)
7. Move designated Old Growth boundary identified as OG5 on Figure 3-9 to reflect conditions most favorable for Management Indicator Species.
8. Restore late-structural habitats within BEMA and Old Growth management areas by thinning in ponderosa pine and mixed conifer dry PAGs. Continue treatment by using prescribed fire in appropriate stands.
9. Reduce overall fuel loadings and fire hazard, while maintaining adequate levels of snags and CWM for wildlife.
10. Control noxious weeds, especially knapweeds, invading adjacent to Highway 46.

#2a Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Large trees obscured from vision from Scenic Byway	Large trees visible	Maintain large tree component for scenery	Culture around large trees
Hazards within pre-identified fire camp	A safer environment for firefighters	Public and firefighter safety	Reduce hazards in pre-identified fire camp
Diverted intermittent stream channel	Stream channel is within native course	Maintain/Restore Aquatic Conservation Strategy objectives	Realign intermittent stream channel
High road density	Road density is reduced	Reduce fragmentation	Close roads
Ineffective road closures in BEMA	Effective road closures	Maintain critical habitat for bald eagles	Maintain road closures
Compromised long-term site productivity	Soil compaction is reduced	Maintain soil in a productive condition	Subsoil
Old Growth MA is in poor location	Old Growth MA is in more suitable location	Ensure habitat needs are met for MIS within OG MA.	Move Old Growth MA boundary
Reduced late-structure conditions/fragmentation	More late-structure, less fragmentation	Maintain connectivity, restore late-structural habitat	Thin and Rx Burn
Moderate risk of an uncontrollable wildfire	Uncontrollable wildfire risk is lessened	Endemic native disturbance levels	Reduce fuel loadings
Noxious weed populations are increasing	Noxious weed populations are declining	Vegetative diversity	Control noxious weed populations

#2b N. Wickiup (Moderate)

1. Restore late-structural habitats within BEMAs by thinning, tree culturing, and regeneration in ponderosa pine and mixed conifer dry PAGs. Continue treatment by using prescribed fire in appropriate stands.
2. Close roads to minimize disturbance to nesting bald eagles and dependent wildlife.
3. Subsoil in units identified as high within the north unit (Figure 6-2) and within the identified wildlife connectivity stand (Figure 7-3).
4. Reduce overall fuel loadings and fire hazard.

#2b Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Increasing large tree mortality and fuel loadings within BEMA	Replacement trees and lowered fuel loadings within BEMA	Maintain critical habitat for bald eagles	Thin and Rx Burn Tree culturing
Fragmentation within BEMA	Reduced disturbance to nesting bald eagles	Maintain critical habitat for bald eagles	Tree culturing Close roads Regenerate PP
Low soil productivity within harvested units	Productive soils within harvested units	Maintain soil in a productive condition	Subsoil impacted areas
Increasing fuel levels over entire area	Fuel loading is within desired levels, especially within BEMA	Public safety/Maintain critical habitat for bald eagles	Reduce fuel loadings

#2c Eaton Butte (Moderate)

1. Thin understory and culture large trees to enhance stand attributes within the BEMA.
2. Restore soil productivity in units identified as high priority (Figure 6-2)
3. Reduce fuels and prescribe burn on the southern and western slopes of Eaton Butte.

#2c Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Reduction of late-structural habitat	Increasing late-structural component	Maintain critical habitat for bald eagles	Thin and culture
Low soil productivity within harvested units	Productive soils within harvested units	Maintain soil in a productive condition	Subsoil
High stem densities, fir encroachment	Desirable BEMA characteristics	Maintain critical habitat for bald eagle, public safety	Reduce fuels, prescribed burn

#2d Davis Arm (High)

1. Thin naturally regenerated and planted lodgepole pine units to accelerate towards a late-structural condition.
2. Close roads and reclose/restore landings created by users and previous timber salvage activity which are redundant or causing resource damage.

#2d Existing Condition	Desired Condition	Management Goal(s)	Recommended Action
Early-structured lodgepole pine	Increasing late-structured stands	Maintain sustainable and resilient vegetation	Thin
High density road system	Reduced road densities	Promote remote settings, reduce disturbance to wildlife	Close roads

#2e Forested Lavas (Moderate)

1. Use prescribed fire to reduce fuel loadings in appropriate places with care to maintain objectives of wildlife connectivity corridors displayed in Figure 7-3.
2. Thin ponderosa pine trees to accelerate growth of trees within early- and mid-structural stages.
3. Implement dwarf mistletoe control measures such as pruning, selective understory thinning, and overstory removal within plantations.
4. Convert white fir dominated stands back to historic levels of ponderosa pine in appropriate places.

#2e Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Altered fire regime	Historic fire regime	Endemic native disturbance levels	Rx fire to reduce fuel loadings
High density stand conditions	More late-structured, low density stands	Maintain forest vegetation levels which are sustainable/resilient	Thin ponderosa pine within early and mid-structural stages
High levels of mistletoe in plantations	Healthy stands	Same as above	Control dwarf mistletoe within plantations
Fir encroachment	Resilient stands	Same as above	Convert fir dominated stands to ponderosa pine

#2f Wickiup Butte (High)

1. Thin understory ponderosa pine to achieve suitable replacement trees for the bald eagles. Reintroduce prescribed fire in appropriate places.
2. Assess condition of undesignated Off Highway Vehicle (OHV) play area located off of road 4260, including hill climbs as well as rutted areas at the southern extent.
3. Close roads.
4. Subsoil in selected high priority activity units (Figure 6-2).

#2f Existing Condition	Desired Condition	Management Goals	Recommended Action
Dense understory lacking in bald eagle nest trees	Suitable nest and replacement trees are available	Maintain critical habitat for bald eagles	Thin and Rx burn
Uncontrolled hill climbing and erosion resulting from OHVs	Appropriate use of OHVs	INFISH objectives Maintain critical habitat for bald eagles	Assess OHV play area
High road density	Reduced road density	Maintain critical habitat for bald eagles	Close roads
Harvest activity units have lowered soil productivity	Soil productivity is within desired levels	Maintain soil in a productive condition	Subsoil

#3 Davis Mountain (High)

1. Reduce the overall risk of firefighter injury and enhance public safety around the base of Davis Mountain adjacent to high use areas by reducing fuel loadings where high/extreme crown fire susceptibility (Figure A-5) combine with fuel models 9 & 10.
2. Understory thin to significantly decrease competition, especially within the mixed confer dry PAG with a large ponderosa pine overstory component. Reintroduce prescribed fire in appropriate places.
3. Subsoil in selected high priority activity units (Figure 6-2).
4. Reduce open road densities. Maintain/restore closures on roads which are already closed.
5. Install kiosk at intersection of Highway 46 and road 44 junction to educate/provide public information on the area attractions, restrictions, wildlife, and low impact camping techniques.

#3 Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
High large-scale fire risk	Upper elevation stands are protected from large-scale event	Endemic native disturbance levels	Reduce fuel loadings at base of mountain
Dense understory, Competition with large PP overstory	Stands are in resilient and stable condition	Same as above, Maintain critical habitat for bald eagles	Thin and Rx burn
Harvest activity units have lowered soil productivity	Soil productivity is within desired levels	Maintain soil in a productive condition	Subsoil
High density road system	Reduced road densities	Manage wildlife connectivity, Reduce disturbance to wildlife	Close roads
Well-traveled area, gateway to dispersed camping	Same	Provide public education at high traffic areas	Install kiosk at Highway 46 and road 44 junction

#4a Reservoir Shores (High)

1. Consider a minimum 150' setback for pit toilets from the high water line. Assess existing campsites and determine if Aquatic Conservation Objectives (ACS) are met. If site-specific analysis determines ACS objectives are not being met or recent sampling of water quality has determined a decline, offer walk-in tent camping and/or human waste containment as an alternative to closure. Post interpretive signs at the highest use areas to explain set back and to encourage compliance to maintain dispersed camping privileges.
2. Redesign brochure titled "Guidelines and Regulations For Use of Undeveloped Areas" (1976) to include consistent set back requirements, correct CFR, and guidelines for recreational vehicle waste disposal.
3. Develop site plan for Sheep Bridge and Reservoir Campgrounds.
4. Replace or restore developed recreation facilities at Wickiup Butte campground and boatramp, North Davis, and Gull point campgrounds. Incorporate barrier-free design.

5. Restore riparian vegetation along Wickiup Butte campground and boatramp.
6. Define campsites and parking areas within selected dispersed camping areas.
7. Close roads and reclose/restore landings created by users and previous timber salvage activity which are redundant or causing resource damage.
8. Stabilize shoreline on peninsula of southern Deschutes Arm (Figure 3-11).
9. Thin understory and culture around large trees to enhance stand attributes for raptor perches.
10. Introduce large woody material into Wickiup Reservoir to provide habitat for fish and aquatic invertebrates.
11. Enforce period of stay restrictions on National Forest Lands.
12. Reduce noxious weed populations, especially Klamath Weed on Wickiup Dam.
13. Assess condition of undesignated Off Highway Vehicle (OHV) play area located off of road 4260, including hill climbs as well as rutted areas at the southern extent.
14. Educate the public on the hazards of illegal fish introductions.

#4a Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Impacts from dispersed recreational uses	High water quality	Maintain/restore ACS objectives	150' setback for pit toilets
Same as above	Same as above	Same as above	Brochure for correct waste disposal
Deteriorating developed recreational facilities/ diminishing dispersed camping setting	Safe, clean, efficient and barrier-free facilities, quality dispersed camping setting	Same as desired condition	Site plan for Sheep bridge and Reservoir CG
Same as above	Same as above	Same as above	Upgrade recreational facilities
Trampled riparian vegetation	Protected riparian vegetation	Maintain/restore ACS objectives	Restore riparian vegetation
Diminishing dispersed camping setting	Quality dispersed camping setting	Maintain low impact condition for dispersed camping	Define campsites and parking areas
High density road system (including user-created)	Reduced road densities	Maintain quality dispersed camping setting, reduce disturbance to wildlife	Close roads
Eroding shoreline in some places	Stable shoreline	Maintain/restore ACS objectives	Stabilize shoreline
90% of the sub-area is in early- to mid-structural	Increase in late-structural	Restore late-structural habitats	Thin and culture

#4a Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Loss of stumps for fish habitat	Suitable habitat for the current fishery	Maintain habitat to reduce reliance on hatchery stocking	Introduce large woody fish habitat in reservoir
Diminished dispersed camping setting	Quality dispersed camping setting	Same as desired condition	Enforce period of stay limit
Noxious weed populations are increasing	Noxious weed populations are declining	Vegetative diversity	Control noxious weed populations
Uncontrolled hill climbing and erosion resulting from OHVs (linked to sub-area 2f)	Appropriate use of OHVs	INFISH objectives Maintain critical habitat for bald eagles	Assess OHV play area
Excellent fishery	Same	Maintain productive fishery	Educate public on hazards of illegal fish introductions

#4b North Twin Lake (Moderate)

1. Reduce the overall risk of firefighter injury and enhance public safety around North Twin Lake by creating a recreation interface defense zone. In these areas, reduce fuel loadings wherever high/extreme crown fire susceptibility combine with fuel models 9 & 10.
2. Reintroduce prescribed fire in ponderosa pine on the west shore of the lake.
3. Reconfigure the BEMA to enhance nesting potential and reduce disturbance by recreationists.
4. Thin to promote health and vigor of ponderosa pine; control dwarf mistletoe infection through pruning.
5. Assess need for planting riparian vegetation west of the boatramp.
6. Upgrade developed recreational facilities to barrier-free design.
7. Maintain/improve existing road closures on 4260-050.
8. Eliminate illegally introduced bullhead trout in cooperation with ODF&W. Provide education to the public on the hazards of illegal fish introductions.

#4b Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
High risk of an uncontrollable wildfire	Crown fire potential is lessened	Restore fire as a natural disturbance process, maintain critical bald eagle habitat	Reduce fuel loadings Re-introduce prescribed fire
Encroachment of understory vegetation	Role of fire returned to stands	Public safety, restore fire as a natural disturbance process	Re-introduce prescribed fire

#4b Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Unoccupied nest trees	Occupied nest trees	Maintain critical bald eagle habitat	Reconfigure BEMA
Encroachment of understory vegetation	Suitable bald eagle nest trees are available	Same as above, maintain/restore scenic quality	Thin
Denuded willows	Willows are restored	Maintain/restore ACS objectives	Plant riparian vegetation at boatramp
Facilities lack barrier-free design	Efficient and barrier-free facilities	Same	Upgrade developed recreational facilities
Heavy recreation creates disturbance to bald eagles	Occupied bald eagle nests	Maintain critical bald eagle habitat	Improve existing road closures
Illegally introduced bull trout are displacing rainbow trout fishery	Illegally introduced fish are not present	Maintain productive fishery	Educate public on hazards of illegal fish introductions

#4c South Twin Lake (Moderate)

1. Promote vegetation and redefine pathways in resort and campground areas.
2. Redefine/reconstruct portions of lake trail (i.e. northeast shoreline).
3. Replace or rehabilitate deteriorating developed recreational facilities at South Twin and West South Twin Campgrounds, upgrade to barrier-free design.
4. Thin understory and reintroduce prescribed fire in appropriate stand conditions.
5. Reduce the overall risk of firefighter injury and enhance public safety around South Twin Lake by creating a recreation interface defense zone. In these areas, reduce fuel loadings wherever high/extreme crown fire susceptibility (Figure A-5) combine with fuel models 9 & 10.
6. Educate/provide public information on the hazards of illegal fish introductions.

#4c Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Heavy use is impacting vegetation	Protected vegetation	Maintain species diversity, maintain/ restore ACS objectives	Promote vegetation by defining pathways between high use areas
Pathways not well defined	Pathways are defined	Maintain/restore ACS objectives, reduce disturbance to wildlife from recreational use	Redefine/reconstruct portions of trail
Facilities lack barrier-free design	Efficient and barrier-free facilities	Same	Upgrade developed recreational facilities

#4c Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Encroachment of understory vegetation	Role of fire returned to stands	Public safety, restore fire as a natural disturbance process	Re-introduce prescribed fire
Encroachment of understory vegetation, high fuel loadings	Risk of uncontrollable wildfire is lessened	Public safety	Reduce fuel loadings
Potential for illegally introduced bull trout	Illegally introduced fish are not present	Maintain productive fishery	Educate public on hazards of illegal fish introductions

#5 Davis Lava Flow (Low)

1. Assess condition and need for roads which access lava flow.
2. Develop a prescribed natural fire plan for kipuka within lava flow.
3. Continue to maintain/restore riparian vegetation (e.g. willows) by using prescribed fire and planting.

#5 Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Access to base of lava flow and borrow pit	Appropriate vehicle access is allowed	Maintain low impact condition in riparian areas, protect unique habitat values	Assess need for road access in lava
Historical fire regime is lacking on the kipuka	Fire is returned and allowed to play native role	Protect unique habitat values	Developed Rx natural fire plan
Unique riparian habitat	Same, in a healthy condition	Protect unique habitat values, maintain/restore ACS objectives	Maintain/restore riparian vegetation

#6a Browns Mountain (High)

1. Remove dead and dying trees adjacent to road 4270-200 on the eastern shoreline of Crane Prairie Reservoir outside of watershed/LSR boundary to provide public safety by creating a recreation interface defense zone. In these areas, reduce fuel loadings wherever high/extreme crown fire susceptibility (Figure A-5) combine with fuel models 9 & 10.
2. Thin understory multi-species on the northern aspect of Browns Mountain (see Chapter VII).
3. Reintroduce prescribed fire on the southwest slope of Browns mountain and between 4285 and Crane Prairie Reservoir to achieve fuels reduction and wildlife objectives.
4. Recreate intermittent stream channel and restore riparian vegetation adjacent to quarries #1057 and #1058 near the crossing of road 46 to continue recommendation as listed in 2a.
5. Restore ponderosa pine in appropriate areas where lodgepole pine has encroached and become the dominate species.

6. Improve road closures.
7. Restore by subsoiling high priority activity units (Figures 6-2, 7-3) in wildlife connectivity corridors to maintain and enhance late-successional habitat.
9. Define/designate dispersed sites and develop interpretive/enforcement program to inform the public about low impact camping techniques adjacent to Browns Mountain boat ramp.
10. Replace toilet facilities at Browns Mountain boat ramp.
11. Rehabilitate by blocking vehicle access and planting riparian vegetation on Browns Creek road crossing (road 4280). Provide fishery and recreation information through interpretive program.
• See additional recommendations for MSAs in Chapter VII.

#6a Existing Condition	Desired Condition	Management Goal(s)	Recommended Actions
Encroachment of fir in dry PAGs	Protected from large scale loss	Public safety, endemic native disturbance levels	Thin
Same as above	Same as above	Same as above	Prescribed fire
Diverted intermittent stream channel	Stream channel is within native course	Maintain/restore Aquatic Conservation Strategy objectives	Realign intermittent stream channel, enhance/restore riparian area in east quarry
Diminishing ponderosa pine component	Ponderosa pine is restored within its range	Endemic native disturbance levels	Restore ponderosa pine
High density road system	Reduced road densities	Maintain/restore ACS objectives, reduce disturbance to wildlife	Close roads
Harvest activity units have lowered soil productivity	Soils are productive	Maintain soil in a productive condition	Subsoil
Poor site definition allowing inappropriate use	Dispersed camping is consistent with LSR objectives	Maintain/restore ACS and LSR objectives	Define dispersed sites/ inform public
Failing toilets at Browns Mountain boat ramp	Facilities are efficient and barrier-free	Maintain/restore ACS objectives	Replace toilets at Browns Mountain boat ramp
Vehicle access at Browns Creek has denuded riparian vegetation	Impacts from vehicle access are stopped; stream bank is vegetated	Maintain/restore ACS objectives	Protect/plant riparian vegetation on Browns Creek

#6b Browns Forested Lava (Moderate)
1. Thin and prescribe burn where appropriate for LSR values.
2. Convert white fir dominated stands to ponderosa pine, based on root pathogen events.
• See additional recommendations for MSAs in Chapter VII.

#6b Existing Condition	Desired Conditions	Management Goal(s)	Recommended Action
Encroachment of fir in dry PAGs	Protected from large scale loss	LSR objectives, endemic native disturbance levels	Thin and Rx burn
Loss of ponderosa pine component due to encroachment and succession	Maintain forest vegetation at levels which are sustainable and resilient	Same as desired condition	Convert white fir dominated stands to ponderosa pine

#6c Browns Deschutes Arm (Low)

1. Control noxious weed populations of reed canary grass and Klamath weed.
2. Restore spawning gravel to the Deschutes River.

• See additional recommendations for MSAs in Chapter VII.

#6c Existing Condition	Desired Condition	Management Goal(s)	Recommended Action
Noxious weed populations are increasing	Noxious weed populations are declining	Vegetative diversity	Control noxious weed populations
Insufficient spawning gravel due to dam	Sufficient gravel for spawning	Maintain productive fishery	Restore spawning gravel

#6d Browns Creek (Low)

1. Maintain Brown Creek meadows adjacent and within the Sokol land exchange. Consider reintroduction of prescribed fire to improve vigor of the grasses and to remove encroaching lodgepole pine seedlings.
2. Designate Sokol land exchange as a NWFP Late-Successional Reserve Management Area.

• See additional recommendations for MSAs in Chapter VII.

#6d Existing Condition	Desired Condition	Management Goal	Recommended Action
Encroaching lodgepole pine into Browns Creek meadows	Functional meadow habitat	Maintain meadow habitats for dependent species	Maintain Browns Creek meadows
Newly acquired private land is surrounded by LSR designation	Acquired land is designated for which it is most valued	Maintain/restore ACS objectives	Designate land exchange as LSR management area

#6e Round Mountain LSR (Moderate)
See additional recommendations for MSAs in Chapter VII.

The following Table 6-2 summarizes a composite integrity for each landscape sub-area by listing the integrity indices of each resource analyzed. Projections for the composite integrity were then identified in the context of short-term and long-term time frames in order to better clarify the relative need for restoration and/or management activities for a given sub-area. Resource conditions in the short-term were identified as either stable or unstable based on resource issues and trends over the next 10 years. Integrity over the long-term for each sub-area was identified as improving or declining based on resource conditions and trends projected beyond 10 years.

Table 6-2

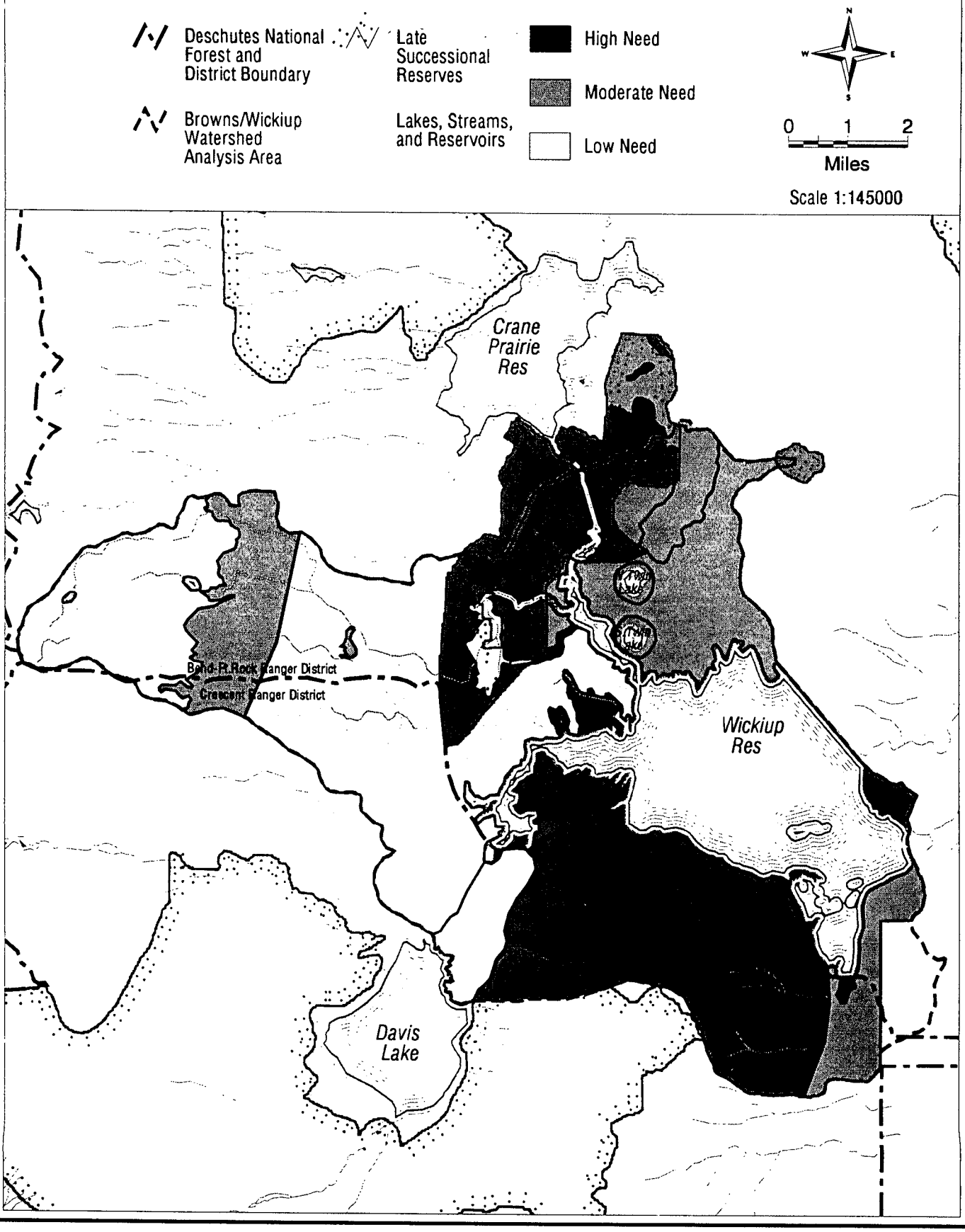
Current and Projected Integrity for Landscapes Using Social and Ecological Integrity Indices

Sub-Area	Integrity Indices									Composite Integrity	Term Short——Long		Rrelative need for Restoration and/or Mgmt Activities
	Hydro.	Aquatic	Forest	Fire	Social	Soils	Roads	Frag.	Conn.				
1a	N/A	N/A	High	High	High	High	N/A	High	High	High	Stable	declining	Low
1b	N/A	N/A	Low	Mod	Mod	Mod	Mod	Low	Low	Low	Unstable	improving	Mod
1c	High	High	N/A	High	High	High	N/A	N/A	N/A	High	Stable	No change	Low
2a	N/A	N/A	Mod	Mod	Mod	Low	Low	Low	Low	Low	Unstable	Improving	Low
2b	N/A	N/A	Low	Mod	Mod	Low	Low	Low	Low	Mod	Unstable	Declining	Mod
2c	N/A	N/A	Low	Low	High	Low	Low	Low	Low	Low/Mod	Unstable	Declining	Mod
2d	Mod	N/A	Mod	Mod	Low	Low	Low	Low	N/A	Low	Unstable	Improving	High
2e	N/A	N/A	Mod	Mod	High	Low	Low	Low	Low	Mod	Stable	Declining	Mod
2f	N/A	N/A	Low	Low	Mod	Mod	Low	Low	Low	Low	Unstable	Declining	High
3	N/A	N/A	Low	Low	Mod	Mod	Low	Mod	Mod	Mod	Stable	Declining	High
4a	Mod	Low	Mod	Mod	Low	Low	Low	N/A	N/A	Low	Unstable	Declining	High
4b	Mod	Low	Low	Low	Mod	Low	Mod	N/A	N/A	Mod	Unstable	Declining	Mod
4c	Mod	Low	Low	Low	Mod	Low	Mod	N/A	N/A	Mod	Unstable	Declining	Mod
5	High	High	High	Mod	High	High	Mod	High	High	High	Stable	Declining	Low
6a	Mod	Mod	Low	Low	Low	Low	Low	Mod	Mod	Mod	Unstable	Declining	High
6b	N/A	N/A	Mod	Low	High	Mod	Mod	Mod	Mod	Mod	Unstable	Declining	Mod
6c	Mod	Mod	Mod	Mod	High	High	Mod	High	High	Mod/High	Stable	Declining	Low
6d	High	High	Mod	Low	High	Mod	Mod	High	High	Low/Mod	Stable	Declining	Low
6e	N/A	N/A	Low	Low	High	Mod	Low	Mod	Mod	Mod	Unstable	Declining	Mod

Fig. 6-1

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Relative Need for Restoration and/or Management Activity



Recommendations and Opportunities by Resource

Soils

The restoration priority layer is generated by spatial analysis of the existing condition and inherent productivity layers. The following Table 6-3 shows the combinations for generating the restoration priority for a given area within the watershed.

Table 6-3 **Soil Restoration Priority**

Inherent Productivity [1]	Existing Condition [2]	Restoration Priority [3]
High	C or D	High
High	A or B	Low
Moderate	C or D	Moderate
Moderate	A or B	Low
Low	C or D	Moderate
Low	A or B	Low

1. Inherent productivity is based on the site class determined for a given soil class. Site class 4 equals high, 5 and 6 equals moderate and 7 equals low.
2. Existing condition is the percentage of the soil resource in a given area currently in a detrimental state. Class A = 0 to 10%, class B = 11 to 20%, class C = 21 to 40% and class D = >40%.
3. inherent productivity + existing condition = restoration priority

The following Table 6-4 and Figure 6-2 summarizes the acres of high, medium and low soil restoration priority by landscape sub-area.

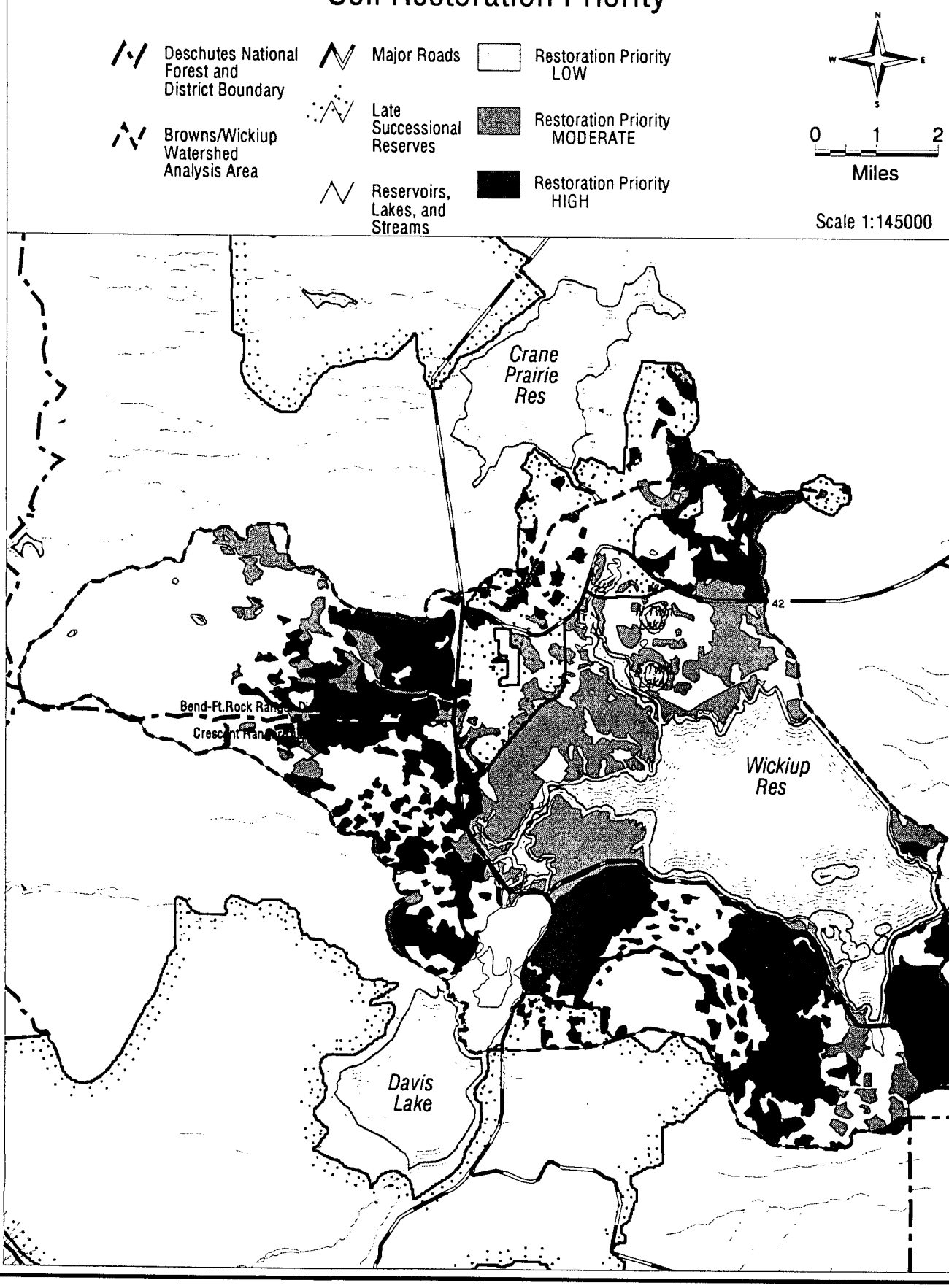
Table 6-4 **Soil Restoration Priority by Landscape Sub-Area**

Landscape Sub-Area	Priority		
	High	Moderate	Low
1	2%	7%	91%
2	37%	29%	34%
3	51%	4%	45%
4	1%	47%	52%
5	-	-	20%
6	15%	10%	75%

Fig. 6-2

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Soil Restoration Priority



Harvest Areas

Landscape areas 2 and 3 have the greatest percentage of high priority restoration, a condition that is attributable to the large number of ground-based harvest entries that have occurred on inherently high productivity soils. Many of these areas are proposed for subsoiling under KV plans of timber sale environmental assessments. Areas not covered under these plans would have the highest priority for rehabilitation efforts in the future.

Other prioritization criteria to be considered for the rehabilitation of impacted areas include the location within connectivity corridors and administratively allocated Late-Successional Reserves, or an area's proximity to a perennial stream or waterbody. General goals to improve the health or promote growth within connectivity corridors that are currently fragmented and impacted raise the priority for rehabilitating these areas. LSR soil conditions, while generally lower in terms of the presence of detrimental damage, also have some weight in terms of prioritization in order to maintain or enhance the condition of the stands present for bald eagle, spotted owl and other LSOG species.

The Deschutes River and Browns Creek are the only perennial streams within the analysis area. Wickiup Reservoir, Johnny, Found, and North/South Twin lakes are the only waterbodies of significant size. Conditions that are a result of harvest practices have not generally impacted the immediate area along the edges of these waterbodies. Prioritization in terms of assessment and treatment of these areas is, however, a consideration when impacts and conditions are a result of recreational use.

Recreation Areas

Restoration prioritization of areas adjacent to waterbodies having impacts and conditions that are a result of recreational use should be assessed on a site-specific basis. Dispersed recreation areas within the watershed are primarily located on upland soils around Wickiup Reservoir. Restricted dispersed camping above the high water mark at Wickiup Reservoir has reduced the amount of vehicle traffic in transitionally wet and riparian areas from unrestricted levels of the past.

Much of the shoreline area around Wickiup Reservoir has been designated as a low to moderate priority for rehabilitation. Field reconnaissance of representative portions revealed that soil damage on the shoreline itself varied primarily as a result of the length and slope of the bank leading from campsites to the water.

The majority of the shoreline around the lake is not actively eroding. Bank steepness is consistently greatest on the Davis Arm and the west side of the Deschutes Arm area. The density of dispersed campsites is also highest along these stretches, placing these areas as higher priority for assessment, rehabilitation and site designation. Recommendations include limiting site size and creating a setback for vehicle parking.

The south shore and Gull Point areas have the most gradual bank slopes and the least amount of impacts from dispersed camping. Road closures on the Gull Point shore and the presence of thick stands of trees on the south shore are primarily responsible for limiting impacts to these areas. The density of sites in these areas is also the lowest on the reservoir. Both of these shoreline zones have a low priority for restoration.

Approximately 300 feet of shoreline on the eastern side of a small peninsula at the eastern extent of the Davis Arm area was the only extensive area found to have actively eroding cutbanks. Old log structures are present that had been ineffective in stabilizing these banks. While the extent and continuation of erosion is obvious in this area, the effects of this erosion on water quality are less and appear to be relatively negligible. The primary concern is the rate of loss of existing upland soil that is currently used as a dispersed camping site.

An undesignated Off Highway Vehicle play area located within the south shore area off of the 4260 road was also found to have impacted soils, including areas of erosion on steep hill climbs and rutted and puddled areas of soil on a road leading to the southern extent of the play area. Use of this area has been unmanaged for years, creating a highly impacted zone in which soils and vegetation have been compromised. There is an opportunity to close and rehabilitate some of the hill climbs that are present, as well as the rutted area at the southern extent, without formally designating this area for OHV use.

Vegetation

Upland Forest Vegetation

Forest conditions east of the Cascade Mountains in Oregon are much more susceptible to de-stabilizing stand disturbances than those forests west of the Cascades (ICBEMP, 1997). This is similar in assessing Browns/Wickiup watershed conditions, and the realization is that on most eastside forest communities, suitable late-successional habitat conditions are generally not sustainable (Cultus/Sheridan Mtn. LSRA, 1996; Big Marsh LSRA, 1997).

It is also understood that the immediate need for wildlife habitats, scenic beauty, and a natural-appearing landscape, desired by the many public users, often outweighs the need to manage forest vegetation for the long-term. For these reasons, public land managers often tolerate higher forest instability in managing vegetation, than would have evolved under native disturbance regimes. Due to these factors, forest structures will necessarily depart from those conditions under which they once evolved across the landscape.

The overall objective for management of upland forest vegetation is to develop and maintain stands that are resilient in the face of endemic disturbance agents. In this fashion, the watershed analysis is focused on describing forest vegetation conditions in terms of general resiliency and stability. Some portions of the landscape will never have highly stable conditions due to the dynamic nature of the native forest species and structures. Lodgepole

pine dominated plant associations are a good example of highly dynamic landscapes, both historically and in the present day. Other areas, such as mountain hemlock dominated communities, are much more stable, and hence resilient to many of the native disturbance agents. Yet others, such as dry forest communities which were once dominated by ponderosa pine and Douglas-fir, but are now dominated by white fir, have lost much of their resiliency to disturbance agents, and are subject to a much higher incidence of instability. The highest priority in upland forest vegetation management is with this last group, with the goal and moving toward restoring these stands to their once more resilient stature.

Part of the vegetative condition and trend assessment is to look at management of risk, as identified by several descriptive factors. Criteria used to measure existing stability and resiliency of vegetation to disturbance include measures of stand density, insect and disease levels, and vigor. Categories were generalized to assess upland forest vegetation stability, and were referenced to historic levels to provide a context of change since that era.

Recommendations: (see also Appendix, Silvicultural Treatment Priorities)

- Restore mixed conifer dry PAG stands, through thinning, culturing, and reforestation, on sites where ponderosa pine once was dominant;
- Arrest the epidemic spread of pine beetles and capture mortality through thinning and salvage harvest;
- Thin, prune, and select against ever-increasing levels of dwarf mistletoe, especially in stands of ponderosa pine.

Riparian Vegetation

Proper functioning riparian areas are critical to water quality and habitat for aquatic and terrestrial riparian-dependent species. Riparian areas also improve the scenic quality of the area. Within the project area, riparian vegetation and soils are affected by recreational activities such as hiking, fishing, and camping, and by recreationists riding OHVs and other motorized vehicles through riparian areas. Damaged vegetation, compaction of soils, and exposure of tree roots are evident at most locations where dispersed camping occurs next to riparian vegetation. Areas with compacted soils and denuded vegetation can increase overland flow with potential for sediment delivery to the water bodies. Overland flow is evident but not common. The majority of the deposits end up in the reservoirs and do not contribute towards altering spawning gravel downstream.

Introduced noxious and alien weeds species compete with and cause a decline in existing native plant vegetation. Evidence of competition with native plant vegetation is occurring on approximately 27 acres within the watershed. Some noxious weeds, such as Canada thistle, are unpleasant and can reduce the recreational experience.

Recommendations:

- Reduce recreational impacts by redesigning trails and pathways to avoid or minimize impacts from trampling. Install barriers to restrict motorized vehicles in sensitive areas. Use methods such as public education as a tool for prevention.
- Eliminate noxious weed species
- Expand riparian vegetation (by planting) along unvegetated area

Threatened, Endangered, and Sensitive Plants

Browns Meadow

Rich plant diversity exists in the meadow. The meadow is fenced and no human disturbances have been seen. A wildfire on the southeast side has burned down to the meadow's edge.

Recommendations:

- Southern part of meadow has too much rush component (*Juncus* sp.) and probably would benefit from prescribed burning so that other native species can become established.

Browns Creek and springs

There is great plant diversity in Browns Creek and springs areas except at the interface at Browns Creek and Wickiup Reservoir where there is little diversity. Baltic rush (*Juncus balticus)* an early seral species, is the most common plant in the interface and it has suffered from disturbance from heavy foot traffic. A recent fish habitat restoration project has included placing down trees in the reservoir.

Recommendations:

- Plant willow cuttings to continue improving fish habitat.

Wildlife

The following Table 6-5 summarizes wildlife restoration prioritization by sub-area:

Table 6-5 Wildlife Restoration Prioritization Ratings

	General Wildlife Management Strategies										
Landscape Sub-Areas	**T/E/S Habitat**	**LSOG Habitat**	**Spp. of Concern Habitat**	**Riparian Habitat**	**Unique Habitat**	**Movement Corridor**	**MIS Habitat (LRMP designated)**	**Solitude**	**CWM/ Snag Habitat**	**Overall Rating**	**Comments**
#1a High Elevation Unroaded	VH/P, NSO	VH/P	VH/P, W, F, AM	M/P, streams	VH/P, R?, meadows	VH/P, NSO	H/P, elk, deer, raptors	VH/P, wolverine	H/P	H/P	NSO sightings in 1990 and 1992
#1b Roaded	na	M/R	M/R, PCN, AM, NGH	M/P, streams	na	M/R, NSO	M/R, elk,	M/R, elk	M/R, PCN	M/R	Existing large clearcuts, regenerate, restriot access
#1c Johnny & Found Lks.	na	na	VH/P, aquatic	H/P, NMB	na	na	H/P, elk	H/P, elk, W	H/P	H/P	Potential fish stocking conflicts
#2a, e, Hwy 46 Area	VH/R, BE (3 BEMAs)	L/R, VH/R (3 OG areas)	M/R, NGH, AM	M/P, streams, Wickiup Res.	Forested Lavas	H/R, NSO, LSOG spp.	M/R deer, raptors	H/R, BEMAs	H/R	M/R	OG areas, linkage role between LSRs
#2b, e N. Wickiup	H/R, NSO, BE (2 BEMAs)	L/R	H/R, NGH	M/R, Wickiup Res.	Forested Lavas	VH/R, NSO, LSOG spp.	H/R, deer, raptors	M/R, roads	H/R	M-H/R	Movement corridor north end between LSRs
#2c Eaton Bu.	VH/R, BE (BEMA)	H/R	H/R, NGH	M/R, Wickiup Res.	na	H/R	M/R, deer, raptors	H/P, BEMA	H/R	M-H/R	BEMA (active), linkage area N-S.
#2d Davis Arm	H/P, BE forage	M/R	M/R	M/R, NMB	na	na	M/R, osprey	M/R, BE	H/R	M/R	Heavy rec use
#2f Wickiup Bu.	M/R, BE (BEMA)	L/R	M/R, NGH	M/R, Wickiup Res	na	M/R, LSOG	M/R, deer, raptors	H/R, roads, BE	H/R	M/R	BEMA (inactive), fair potential
#3 Davis Mt.	VH/R, BE, NSO (BEMAs)	VH/R	VH/R, NGH, AM	H/R, Wickiup Res.	na	VH/R/P, NSO, LSOG spp., elk	M/R deer, raptors	H/R	M/R	H/R	High quality habitat in strategic location near LSR
#4a Reservoir Shores	H/R, BE (BEMAs)	na	H/R, raptors	H/R, NMB	na	na	H/R/P, osprey waterfowl	H/R BEMAs	M/R	H/R/P	Variable riparian types, heavy bird use zone
#4b North Twin Lk.	H/R, BE (BEMA)	na	H/R, raptors	H/R, NMB	na	M/R, LSOG	M/R, osprey	M/R/P, roads	H/R	M-H/R	BEMA inactive, fair potential, hvy rec use
#4c South Twin Lk.	M/R, BE	na	H/R , raptors	H/R, NMB	na	M/R, LSOG	M/R osprey	L/R	H/R	M-H/R	BE, Osprey foraging
#5 Davis Lava Flow	H/P, BE (BEMA)	M/P, "island"	H/P, wood duck	H/P, ponds	H/P, ecotone	H/P "island"	M/P, waterfowl	H/P, roads	M/P "island"	M-H/P	Unique edge habitats
#6a, b Browns LSR	VH/R, BE, NSO (BEMAs)	VH/R, PWP (OG)	VH/R, NGH	H/R, NMB, Crane Prairie	na	H/R/P, NSO LSOG	VH/R, osprey	H/P, roads	VH/Restore	H-VH/R/P	Variable conditions, several past harvest units need rehab, high rec use
#6c Deschutes Arm (LSR)	VH/R, BE (BEMA)	na	H/R, raptors,	H/R, NMB	na	na	M/R, elk, raptors	H/P	H/R	H/R/P	High quality wet meadows, active eagle nesting

Landscape Sub-Areas	T/E/S Habitat	LSOG Habitat	Spp. of Concern Habitat	Riparian Habitat	Unique Habitat	Movement Corridor	MIS Habitat (LRMP designated)	Solitude	CWM/ Snag Habitat	Overall Rating	Comments
#6d Browns Creek (LSR)	VH/P, BE, s. frog	na	H/P, GGO	VH/P/R, NMB	VH/P, springs, wet meadows	VH/P, NSO, LSOG spp.	H/P/R, osprey, elk	M/P	VH/P	VH/P/R	High quality riparian corridor
#6e Round Mt. LSR	H/P, BE	VH/P/R	M/R, NGH	na	na	VH/P, NSO	H/R, deer	H/R	M/R	H/P/R	Very small LSR

Note: Restoration Criteria/Codes--

Priority Rating:
R = Restore
P = Protect
na = not applicable

Successional Old Growth
VH = Very High

Indicator Species
H = High

Woody Material
M = Moderate
L = Low

NSO = Northern Spotted Owl
BE = Bald Eagle
NGH = Northern Goshawk
GGO = Great Gray Owl
NMB = Neotropical Migrant Birds

AM = American Marten
W = Wolverine
F =Fisher
PWP = Pileated Woodpecker
PCN = Primary Cavity Nesters

LSOG = Late
MIS = Management
CWM = Coarse

Note: Approximately one-quarter of the LSR lands are outside of the watershed boundary.

Recreation

The following recommendations are provided to identify opportunities for maintaining or enhancing the recreation experience for the Wickiup area:

- Provide a mechanism for the public to comment on how the area should be managed (i.e. "Sense of Place" mapping, constituent analysis, comment cards, public forums, surveys by volunteers or employees), especially as it relates to recreation.
- Emphasize interpretation/education through signing and increased Forest Service presence.
- Relocation/restoration/closure of dispersed sites or areas that pose a threat to physical, biological, or social values due to increased use.
- If ACS objective can not be met, consider designating dispersed camp areas/sites in less sensitive areas and where increased use can be accommodated.
- If needed, close/restore the dispersed sites not designated for overnight camping.
- Redesign Reservoir Campground to meet current standards. Remove sites which are not utilized due to the lack of proper facilities or desirable location. Provide full facilities at all camp sites (i.e. fire rings, picnic table, and site definition). Consider conversion of the campground from a developed site to a dispersed site.
- Promote use of designated boat ramps.
- Rehabilitate and define boat-in dispersed camp sites.
- Provide facility maintenance/restoration at all developed campgrounds and day use areas to provide quality recreation experiences and to comply with ACS objectives.
- Provide interpretive programs at North Twin, South Twin, Sheep Bridge, and West South Twin campgrounds. Promote restoration activities, wildlife, vegetation, and low impact camping/activities on the National Forest.
- Promote camping in developed sites through restoration of facilities.
- Develop barrier-free facilities.
- Design vegetation treatments that enhance scenic views and improve the recreation experience.
- Close/restore roads which provide unnecessary or duplicative access to dispersed sites.
- Maintain the Semi-Primitive ROS designation for landscape sub-area 1a.
- Close and rehabilitate those portions of the OHV play area south of Wickiup Butte Campground that conflict with other resource values.

The following Table 6-6 summarizes recommended restoration for recreation by sub-area:

Table 6-6 **Recreation Restoration by Landscape Sub-Area**

Sub-Area	Dispersed Recreation*	Developed Recreation*	Scenic Quality*	ROS*	Instability Symptoms	Restoration Possibilities	Priority*
#1a High Elevation Unroaded	L	L	M	Y (RN)	N/A	N/A	L
#1b Roaded LP	L	L	H	Y (RM)	Large harvest units visible from Charlton road (4290)	Consider interpretive signing or tree spading at high impact areas	L
#1c Johnny/ Found Lks	M	L	H	Y (SPNM)	Increased disp. overnight sites	Consider designating sites; close access road and convert to trail (4292200)	M
#2a HWY 46, Scenic Byway	L	L	H	Y/N (RN)	Some areas of past harvest treatments detract from scenic; loss of screening in N. Davis Creek CG and lack of facility replacement	Promote large diameter trees; consider tree spading in high impact areas; construct kiosk at south end to inform visitors of the areas attractions, restrictions, WL, etc. ; replace worn facilities at N. Davis Creek CG	M
#2b N. Wickiup	L	L	M	Y (RN)	N/A	N/A	L
#2c Eaton Butte	L	L	M	Y (RN)	N/A	Maintain large tree character for scenic quality along main travel routes and reservoir	L
#2d Wickiup Butte	L	M	H	Y (RN)	CG and BR. needs defining; outdated facilities; impact to scenery from insects and disease	Define dev. sites better; riparian restoration; reduce fuel loading to reduce risk of an uncontrollable wildfire	
#2e Forested Lavas	L	L	H	Y (RN, RM)	N/A	Maintain large tree character for scenic quality along main travel routes	L/M
#3 Davis Mountain	L	L	H	Y (RN)	Impacts to scenery from I&D	Selective salvage of dead & dying trees; maintain large tree character for scenic quality along main travel routes and reservoir	M

Sub-Area	Dispersed Recreation*	Developed Recreation*	Scenic Quality*	ROS*	Instability Symptoms	Restoration Possibilities	Priority*
#4a Reservoir Shores	H	H	H	Y/N (RN)	User-made CG & disp. sites; outdated facilities; loss of veg.; increase rec. use	Define Sheep Br. CG; rehab disp. sites & veg.; maintain existing road and disp. area closures; consider designating disp. sites at unique sensitive areas, possibly converting Reservoir and Round Swamp CGs to disp. sites; rehab/replace worn dev. recreation facilities (make accessible)	M
#4b N. Twin Lake	M	L	H	Y (R, RN)	Loss of screening at developed CGs; disp. sites close to water on s. shore; overstocked p. pine and mistletoe	Define, designate dispersed site around the lake; riparian restoration; provide low-impact camping technique information; thin to maintain p. pine; rehab/replace worn dev. recreation facilities (include barrier-free design)	M
#4c S. Twin Lake	L	M	H	Y (R, RN)	Some riparian impacts; outdated facilities; loss of screening at dev. CGs; crowding of lg. trees	Riparian restoration; better define foot paths from CG to water; thin to highlight large trees; rehab/replace worn dev. recreation facilities (include barrier-free design).	M
#5 Davis Lava Flow	L	L	L	Y (RM)	N/A	Monitor disp. use; define sites near the flow	L
#6a Browns LSR	H	M	H	Y/N (RN)	Increased rec. use; numerous user-made disp. sites; fire hazard (public safety)	Maintain large tree character for scenic quality; maintain road closures to promote remote setting; define/designate disp sites; replace toilet facilities; install an interpretive program to inform the public about low impact camping techniques, WL, fisheries, etc.	L H
#6b Wuksi Butte	L	L	M	Y (RN)	N/A	Maintain large tree character for scenic quality	L
#6c Deschutes Arm	L	L	M	Y (RN)	Road closure breaches to access dispersed sites; thick LP regeneration	Maintain road closures; thin LP	L/M
#6d Browns Creek	L	L	H	Y (RN)	N/A	Maintain riparian and fisheries	M
#6e Round Mountain	L	L	M	Y/N (RN, RM)	Some RN areas are heavily impacted from past harvest	Maintain large tree character for scenic quality	L

* Table 6-6 definitions:

Dispersed Recreation: This category is based on the need for restoration, regulation, or improvement. A "Low" rating indicates that use or impacts are negligible or manageable without or with minimal improvements. A "High" rating indicates that the area is in need of restoration, regulation, or improvement.

Developed Recreation: This category is based on the need for restoration or replacement of campground or day use facilities. Restoration could include both facilities and vegetation.

Scenic Quality: This category is based on the need to maintain or restore scenic quality in regards to forest aesthetics and vegetation. This consists of the aesthetic setting of an area or site, or on views seen from an area or road.

ROS (Recreation Opportunity Spectrum): This category displays whether an area is meeting the Deschutes National Forest Land and Resource Management Plan or Northwest Forest Plan direction.

Priority: The priority rating is based on the overall need for restoration or rehabilitation activities.

Data Gaps and Monitoring

Data Gaps

1. Direct measures of silvicultural stand densities (stand exams) for the entire Browns/Wickiup watersheds were not available; however, a sample size of approximately 50% was available for use. Integrated satellite Imagery, field reconnaissance, and aerial photo interpretation were used in conjunction with available stand exams to estimate stand densities. This method is suitable for broad scale analysis but for project level analysis, more site-specific analysis is needed.

2. Data which identifies forested areas of insect and disease activities was limited. Field reconnaissance, Forest Pest Management aerial surveys, stand exam summaries, and aerial photo interpretation were used to estimate insect and disease activities. For project level analysis, more site-specific data is needed.

3. Patch pattern analysis was accomplished using aerial photo interpretation at a coarse, gross scale. "Fragstats" or other comprehensive analysis methods were not used. General trends were summarized for wildlife habitat analysis. More comprehensive modeling for wildlife habitat requirements are needed for project level vegetation management treatments.

4. Historic range of variability (HRV) was used as an indicator of known, viable vegetation patterns. Patterns that fall outside of HRV are not well-understood. There may be other patterns outside of HRV that are healthy and will sustain viable ecosystem components.

5. Data to estimate quantities of coarse woody material in forested areas was not available.

6. A snag analysis for areas of the watershed outside of the LSR boundaries was not done due to a lack of data.

7. The genetic status of redband trout is currently unknown. The Deschutes National Forest and Oregon Department of Fish and Wildlife (ODFW) will pursue a Challenge Cost Share partnership program investigating the genetic identity of the redband trout in the watershed.

8. More recent lake survey data would provide current data to facilitate a more thorough analysis. Water quality data on Wickiup Reservoir is limited. The effects on water quality from dispersed camping are not well understood.

9. Data identifying bacterial contamination of water bodies in the Browns/Wickiup Analysis area is incomplete. Testing for e. coli in water bodies near high recreational use areas is a way to identify failing or insufficient septic systems or vaulted toilets.

10. Meadows within sub-area 1a (Johnny and Found Lakes) were not ground-truthed for reintroducing prescribed fire. Reconnaissance will be needed for site-specific analysis.

11. Direct measures of dispersed camping use are not available. Carrying capacity of the area is not known at this time. However, based on dispersed camp site inventory records from 1993, dispersed use sampling in 1997, and interviews with recreationists, trends and correlations can be deduced. For site- or area-specific analysis, more data in regards to carrying capacity is needed.

12. Preferences or expectations of the areas users (recreationists) are not known specifically. Planning efforts rely heavily on professional judgement and past experience. For project level analysis additional site-specific data is needed.

13. Arc/Info Geographical Information System (GIS) software was used for analysis on this project. Geographically referenced data exists for various themes, such as watershed boundaries, waterbodies and streams, plant association groups, and Forest Plan Management Areas. The data meets varying accuracy standards depending upon the original source of data such as USGS Primary Base Series, orthophotos, satellite imagery, Global Positioning Systems, and differing scales such as 1:24,000 or 1:100,000. Most data is subject to updates as specialists field-verify information or more accurate locations are obtained. Any acre summaries or analysis done with GIS for this project reflect the version of the data available on the system at the time of the analysis.

Monitoring

Common to All Areas

1. Monitor success of forest health treatments to restore tree and stand resilience to insect, disease, and wildfire.
2. Monitor the black-backed woodpecker in the dry and wet lodgepole pine plant association groups as an indication of vegetation treatment effectiveness for the maintenance and enhancement of late-successional habitat.
3. Consult the Oregon Eagle Foundation Report for annual monitoring of bald eagles in the Central Oregon Recovery Zone and analyze trends.
4. Monitor osprey nest sites within Browns/Wickiup watersheds annually once every 3 years for fledgling success.
5. Conduct initial surveys to determine the presence/absence and extent of non-native wildlife species within the Browns/Wickiup watersheds. Conduct 3-5 years of survey to obtain baseline data, then every 10 years conduct 2 years of surveys to determine the trend

or invasion potential.
6. Monitor successful application of silvicultural prescriptions that attempt to mesh habitat, fuels, and stand vigor treatments.
7. Monitor annually for further spread of known noxious weed populations adjacent to major roads (Hwy 42, 46), along the banks of the Deschutes River between Crane Prairie and Wickiup Reservoirs, and the shorelines of the latter.
8. Use established statistical sampling methods to determine use levels and trends for both developed and dispersed recreation.
9. Monitor existing dispersed camp site inventory to determine the establishment of new sites or the expansion of existing sites. Utilize a system that will track impacts or changes to the recreation resource or experience, as well as other resources (e.g. Limits of Acceptable Change).
10. Track the level of non-compliance with existing forest orders such as closures for resource protection and "no camping below high water mark" to determine further measures to reduce user impacts.
11. Monitor vegetation treatments along the Cascade Lakes Scenic Byway, and other roadways and recreation areas, to determine effectiveness.
12. Monitor survival of overstory trees by removal of understory trees.

#1a High Elevation Unroaded
- Identify trail crossings/grades in need of restoration.
- Consider implementation of a Prescribed Natural Fire Plan.

#1c Johnny and Found Lakes
- Inventory shorelines around lakes to assess dispersed camping impacts.
- Monitor water quality in Johnny Lake approximately every 10 years to protect oligotrophic status.
- Population data on amphibians and aquatic vertebrates is incomplete in the analysis area. The effects of introduced fish in lakes which historically were fishless is not fully understood.

Monitor amphibian populations to determine effect of non-native fish stocking.

#2b North Twin Lake
- Monitor for water quality approximately every 10 years.
- Monitor for bald eagle use.

#2c South Twin Lake
- Monitor for water quality approximately every 10 years.

#2e Forested Lavas
- Assess soil conditions for plantability before reforestation activities occur.

#4a Wickiup Reservoir Shoreline

- Monitor effectiveness of road closures in bald eagle, osprey, and sandhill crane habitats of Wickiup Reservoir annually.
- Conduct feasibility study in conjunction with ODFW to assess reintroduction of bull trout.

#5 Davis Lava Flow

- Monitor dispersed camping use to maintain the unique characteristics and quality of riparian habitats adjacent to lava flow.

#6a-d Browns LSR

- Assess plantability of soils where needed or desired
- Continue northern spotted owl monitoring once every three years to maintain records of nesting pairs and resident singles.

#6e Round LSR

- Continue northern goshawk monitoring once every three years to maintain records of nesting pairs and resident singles.

For landscape sub-areas 6a-e, Refer to detailed Monitoring Plan found in Chapter VII.

Aquatic Conservation Strategy

Introduction

The Northwest Forest Plan developed a strategy for the protection and restoration of aquatic/riparian ecosystems for Forest Service administered lands within the range of the Northern Spotted Owl. It also identified several objectives for the Aquatic Conservation Strategy. These objectives can be summarized as follows: ensure protection of aquatic systems, maintain connectivity, maintain water quality, maintain water and sediment storage and transport regimes, maintain and restore fish, wildlife, and plant populations and diversity. There are four components of the strategy: Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

Watershed Analysis is a planning tool which ensures the above objectives are considered and incorporated in all management decisions. Implementation occurs through watershed restoration and the following special standards, guidelines, and recommended riparian reserves.

The following section discusses resource considerations for setting riparian reserves, followed by recommended riparian reserves by landscape area. Refer to Figure 6-3 which displays the recommendations. Refer to the Wildlife Appendix for a quantitative analysis and summary (Table A-18) on riparian reserves.

Riparian Reserves

Resource Considerations for Setting Riparian Reserves

Processes which drive the dynamics of the floodplain and channel are paramount considerations for setting Riparian Reserve widths and conditions. The width of the channel and floodplain and flow regime characteristics dictate the minimum size of the trees needed to provide effective, instream wood. The presence of large woody material (LWM) within a stream channel is critical to maintaining the integrity of the system. This wood plays an active role in the storage of sediment in the channel. The general rule is, the larger the tree, the more stable it will be in the floodplain, and the more stream shade it will provide while it is alive. Natural sediment storage in the uplands results from woody material that accumulates on the forest floor and impedes its movement downslope.

The vegetation within the floodplain zone is important in resisting the erosive forces of flood events. These zones are very important filters of sediment and nutrients; the thick vegetation creates an extreme roughness which inhibits water movement through and over it.

Under the Aquatic Conservation Strategy, Riparian Reserves also are used to provide habitat

benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for species dependant on the riparian transition zone, improve travel and dispersal corridors for terrestrial animals and plants, and serve as connectivity corridors among late-successional reserves. Riparian areas provide a moist zone for amphibians and other wildlife species to travel and reside in. Ungulates use the riparian areas disproportionately more than terrestrial areas for fawning and calving, and lactating females take advantage of the improved cover and succulent vegetation. Nearly 80% of the terrestrial wildlife species are either directly or indirectly dependent upon riparian areas for meeting their habitat needs.

In the Riparian Reserves (particularly in the Lodgepole Pine and the Mixed Conifer Wet Plant Association Groups), it is desirable to maintain healthy forest stands over the long-term, while maintaining high snag densities and green tree replacements. Wildlife habitat requirements, water quality, and long term stand health should dictate vegetation treatment needs within the Riparian Reserves. It is recognized that the Reserves constitute an area where higher risks are taken (including reduced fire suppression efforts) in order to allow natural processes to occur and continue without a great deal of human intervention.

Riparian Reserve Widths and Management Requirements

The Riparian Reserves, as described in the Northwest Forest Plan (NWFP) and Record of Decision (ROD) have been adopted (USDA, USDI, 1994) for the Browns/Wickiup Watershed (Figure 6-3, Recommended Riparian Reserves). These Riparian Reserves will be managed as special management areas, utilizing the sideboards listed below in addition to the Standards and Guidelines in the ROD. Site specific conditions and mitigation will be developed in the project Environmental Assessments (EA).

Vegetation

East of the Cascades it is recognized that fire played an important role in shaping the vegetative pattern across the landscape. A combination of salvage, thinnings, and fire can be used as tools to create small openings in the riparian zone. No large trees that have the potential to provide shade (within the distance equal to the height of two site-potential trees) or LWM to the creek will be disturbed. Wildlife habitat needs will dictate the remaining condition of the patches to be created. The fuel loading in the Reserves will be greater than that in the surrounding uplands except within established facilities (i.e. campgrounds, summer home tracts, etc).

Roads, Grazing and Minerals Management

As per the NWFP Record of Decision (ROD), site specific conditions and mitigation will be developed in project Environmental Assessments (EAs). No net increase in roads will occur.

Recreation Management

New campgrounds will not be developed within the distance equal to the height of two site-potential trees of any water body. At existing campgrounds, redesignation of sites will be necessary if site-specific analysis determines they do not meet ACS objectives from the NWFP. Designation or limits on numbers of campsites may be necessary in dispersed camping areas that do not meet ACS objectives. Vegetative buffers will be used to contain any sediment that could wash into the waterbody. Avoid development or traffic in any areas lacking coarse soils.

Picnic tables within designated developed day-use areas should be located away from areas where the riparian vegetation is damaged or removed. Circulation patterns and access will need to be redirected away from riparian vegetation through trail realignment or trailhead relocation, the use of different surface materials such as wood boardwalks, wood viewing platforms or hard surfaces, trail borders or boundaries using natural elements such as the surrounding fallen woody material, semi-buried stones, or native shrubs or groundcovers. Native plant species are to be 12-18 inches minimum height where appropriate to prevent foot traffic. Trees of mixed size and spacing should be planted to ensure future generations of tree growth in areas of predominantly large trees. Native plant species need to be approved per site by the a District or the Forest Ecologist/Botanist.

Scenic views will need to be a consideration when relocating camping sites, day-use picnic sites, trails, and viewpoints. Opening views, providing more sun exposure and light, and replanting damaged riparian vegetation areas will improve not only the overall scenic quality but also the recreation setting.

Fire/Fuels Management

Develop a fire management strategy for the Riparian Reserves, allowing prescribed burning (both natural and human caused ignitions). The intent is for a reduction in areas where heavy loading of down fuels compromise public safety, protection of existing developments, and adjacent natural resources. Openings can be created in order to provide a diversity of habitats and to reduce encroachment of conifers in the wetlands.

The fire management plan should allow fire to return to a native role in the water influence zone. No mechanized equipment to construct firelines should be allowed within riparian areas. Manage fire commensurate with the surrounding vegetation zone, allowing for structural diversity.

Lands, General Riparian Area Management, Watershed and Habitat Restoration, Fish and Wildlife Management and Research

As per the ROD, site specific conditions and mitigation will be developed in project EAs.

Riparian Reserves Within the Landscape Areas

The designated riparian widths are designed to be wide enough to maintain floodplain integrity and water quality. These widths ensure enough room for anticipated water storage during flood events, allowing for sediment deposition to occur, and adequate vegetation to provide long-term large woody material recruitment. Corridors for wildlife are needed which extend beyond the readily recognizable riparian/wetland vegetation.

A small portion of the watershed lies east of the northern spotted owl line, therefore this land falls under the Inland Native Fish Strategy (INFS) management plan (1995). Rather than Riparian Reserves, INFS defines riparian areas and associated lands as Riparian Habitat Conservation Areas (RHCA). As with Riparian Reserves, riparian-dependent resources receive primary emphasis. With a few exceptions, the widths for RHCAs mimic those of Riparian Reserves from the NWFP. Within this document, RHCAs will be considered as Riparian Reserves.

Areas within the watershed that consisted of landtypes 02, 05, 08, 43, WE, and WF from the Deschutes National Forest Soil Resource Inventory were included as Riparian Reserves. These are wet soil types. Refer to Figure 3-1 for a map of landscape areas.

Landscape Sub-Areas 1a-c

Mountain hemlock and lodgepole pine are the dominant vegetation species within this landscape area. Mountain hemlock occupies north slopes and higher elevations while lodgepole pine tends to occur at lower elevations. Natural processes have prevailed across much of this landscape and vegetative manipulations have been minimal in the rest of the area. There are few roads within this area.

The majority of the stream channels are intermittent or ephemeral. There is a narrow floodplain/water influence zone and the outer terrace defining the vegetation break is very close to the edge of the active channel. There are a few meadows.

Recommended Riparian Reserve Widths

The recommended Riparian Reserve widths to be used in this portion of the watershed are equivalent to the greatest distance reported in the NWFP (minimum slope distance being: 300 feet from lakes and fish bearing streams; 150 feet from permanently flowing non-fish bearing

streams or edge of riparian vegetation on wetlands greater than 1 acre; 100 feet from intermittent streams or wetlands less than 1 acre {Pages C-30, 31, Record of Decision (ROD) of NWFP}). Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs for these Riparian Reserves.

Landscape Sub-Areas 2a-f

The vegetation is dominated by lodgepole and mixed conifer stands, with some stands of ponderosa pine (primarily forested lavas). Slopes are gentle. This landscape area has undergone intense harvest activity, including vast areas of lodgepole pine salvage. The road system is well-developed. There are no lakes or perennial streams, and few intermittent streams. There are two ponds and associated wetlands; one is located between North and South Twin Lakes; and the other is located north of North Twin Lake. There are large areas of wet soil types near the northeast and southern shores of Wickiup Reservoir. The riparian habitat on the stream channels is limited to a narrow band along the banks.

Recommended Riparian Reserve Widths:

The recommended Riparian Reserve widths to be used in this landscape area for the intermittent streams are equivalent to the recommendations of the NWFP (Page C-31, ROD). For streams within this landscape area, the Reserve should be 100 feet slope distance from the edge of the stream channel. For wetlands less than 1 acre, the Reserve should extend to the outer edge of riparian vegetation.

For the ponds and associated wetlands near the Twin lakes, and the wetlands near Wickiup Reservoir, the Riparian Reserve width is equivalent to the recommendations of the NWFP (Page C-30, ROD). The Reserve should extend 150 feet beyond the edge of the wetland.

Landscape Sub-Area 3

The vegetation is this landscape area is dominated by mixed conifer stands. Slopes are relatively steep on the northern slope of Davis Mountain. A great deal of harvest activity and roading has occurred.

Surface water is limited to two small intermittent channels, with a narrow floodplain/water influence zone.

Recommended Riparian Reserve Widths:

The intermittent streams are split by the owl line, therefore portions of each stream fall under both the NWFP and INFS. The minimum Reserve differs between the two management plans, INFS having a minimum Reserve of 50 feet slope distance from the stream edge and NWFP a more generous 100 feet. The recommended width for these two streams is to follow the NWFP for the

entirety of each channel, therefore the Reserve should be 100 feet slope distance from the edge of the stream on each side.

Landscape Sub-Areas 4a-c

This landscape area is limited to Wickiup Reservoir and associated seeps and springs, North/South Twin Lakes, a portion of Browns Creek and North Davis Creek, and the Riparian Reserve associated with each of these water bodies. The vegetation around Wickiup Reservoir and Browns Creek is dominated by lodgepole pine, while mixed conifer or ponderosa pine dominate around the North/South Twin Lakes.

Although there has been little harvest activity in this area, extensive utilization for both developed and dispersed recreation has resulted in impacts to streambanks and shorelines.

Around Wickiup Reservoir, pockets of riparian vegetation exist between the water and the tree lines. Plant diversity in these riparian pockets varies from areas of low diversity along North Davis Creek to the higher diversity of the large meadow at the southern extent of the reservoir. These riparian areas are separated by long narrow stretches of bare shoreline where native vegetation is absent in areas used to construct the reservoir.

Noxious weeds and other non-native plant species are invading some vegetated and non-vegetated areas.

Recommended Riparian Reserve Widths:

Riparian Reserve widths from the NWFP are recommended for this landscape area. For Wickiup Reservoir, the widths are equivalent to the recommendations for constructed ponds and reservoirs, and wetlands greater than 1 acre (Page C-30, ROD). The Reserve would be the body of water or wetland and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas. For perennial seeps and springs, the widths associated with permanently flowing nonfish-bearing streams (Page C-30, ROD) are recommended. The Reserves would consist of the stream and extending 150 feet slope distance from the stream edge, or to the edge of the riparian vegetation, whichever is greatest.

For the Twin lakes, the Riparian Reserves are equivalent to the recommendations for lakes and natural ponds (Page C-31, ROD). A slope distance of 300 feet from the high water line is recommended to provide the greatest protection.

For the portions of Browns Creek and North Davis Creek not inundated when Wickiup Reservoir is at full capacity, adopt the widths for fish bearing streams (Page C-30, ROD). A slope distance of 300 feet from the stream edge on both sides constitutes the Riparian Reserve.

Landscape Sub-Area 5

This landscape area is dominated by a lava flow and seasonal ponds adjacent to the shoreline of Davis lake. Adjacent to the lava flow, pockets of ponderosa pine are interspersed with moist areas supporting aspen along the fringes. The area is generally undeveloped.

Recommended Riparian Reserve Widths:

The recommended Riparian Reserve widths will follow those of the NWFP for wetlands (along the lava flow). For those less than 1 acre the Reserve would extend to outer edges of the riparian vegetation (Page C-31, ROD). For wetlands greater than 1 acre, the Reserve should extend 150 feet from the edge of the wetland (Page C-30, ROD). For the small portion of Davis Lake which is in the analysis area, a minimum slope distance of 300 feet from Davis Lake is recommended totaling approximately 29 acres (pages C-30, 31, Record of Decision (ROD) of NWFP). Water quality, wildlife corridors, and vegetative integrity are key components controlling the management needs for these Riparian Reserves.

Landscape Sub-Areas 6a-e

The vegetation is dominated by mixed conifer, with some stands of ponderosa pine (forested lavas). Some wet meadows and Engelmann spruce stands also exist. The area has been moderately roaded, and slopes range from nearly flat to high. The entire area is in Browns/Round Mtn. late-successional reserve.

Riparian habitat within this landscape area is composed of narrow riparian zones along Browns Creek and the Deschutes River, a large wet meadow and some spruce stands near Browns Creek, a narrow zone around Crane Prairie Reservoir, a pond north of North Twin Lake, and a spruce/lodgepole stand south of the large wet meadow of Browns Creek.

Recommended Riparian Reserve Widths:

The Riparian Reserves for the perennial streams (Browns Creek and the Deschutes River) will follow the recommendations of the NWFP for fish bearing streams (Page C-30, ROD). The Reserve should be from the edge of the streams extending 300 feet slope distance from either side.

For the intermittent section of Browns Creek, the recommendation from the NWFP will be adopted (Page C-31, ROD). The Reserve should be 100 feet slope distance from either side of the stream.

For the Browns Creek meadow and the pond and associated wetland north of North Twin Lake, and any other wetlands over 1 acre, the recommendation from the NWFP will be adopted (Page C-30, ROD). The Reserve should be 150 feet slope distance from the edge of the wetland.

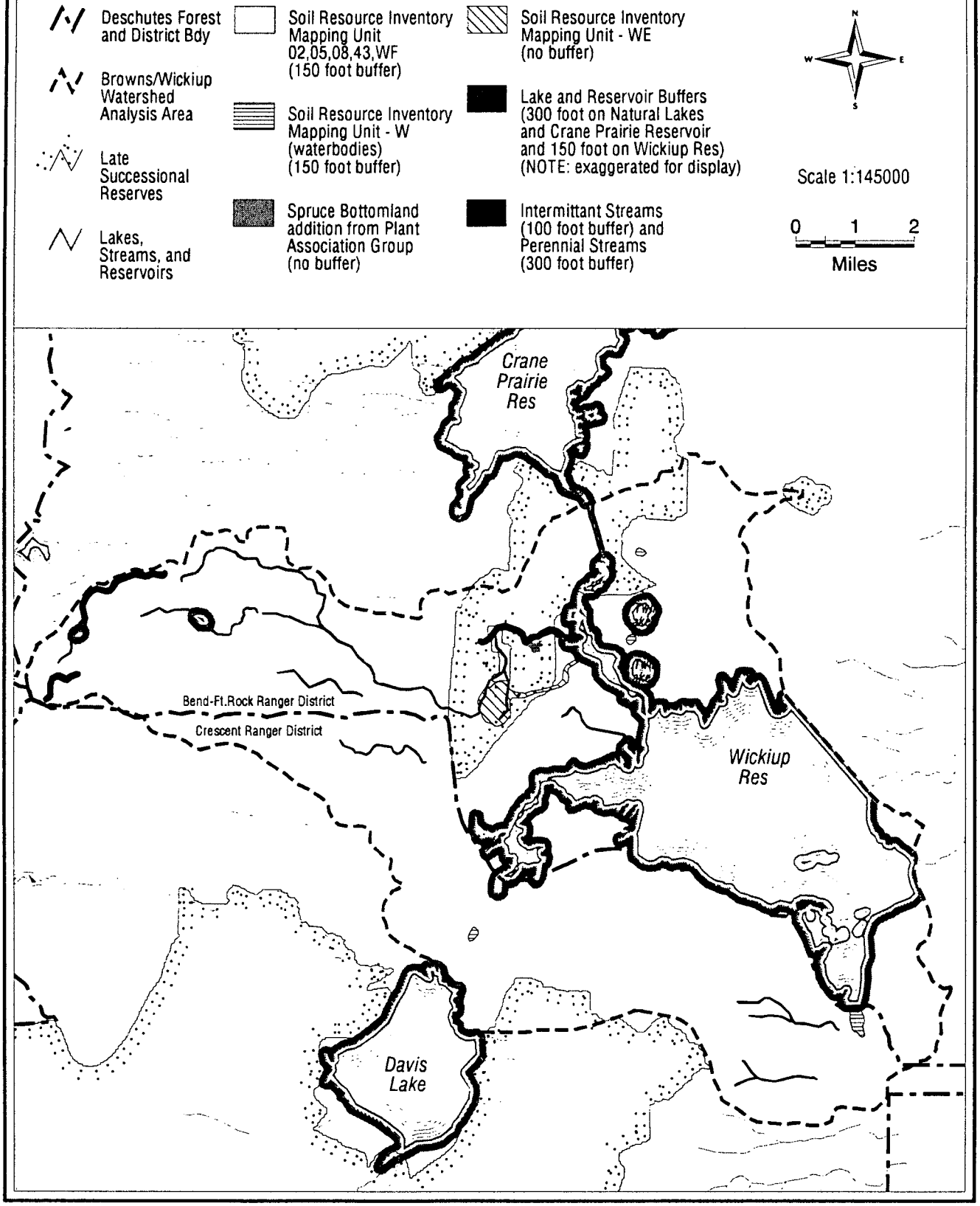
For the spruce/lodgepole stand south of the large wet meadow of Browns Creek, the Reserve should include but not extend past the mapped soil type of "WE". For the spruce stands near Browns Creek, the plant association was originally mapped as mixed dry conifer, which is apparently not accurate. It should be classified as a lodgepole pine wet community. The overstory is nearly pure spruce. The water table was within 2 feet of the surface in August 1997. The area is considered to be a riparian zone, and the Reserve should include but not extend past the edge of the riparian vegetation.

For the Riparian Reserve for Crane Prairie Reservoir, refer to the Cascade Lakes Watershed Analysis. The recommendation from that analysis was for an expansion of the Reserve to 300 feet from the maximum pool elevation.

Fig. 6-3

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Recommended Riparian Reserves



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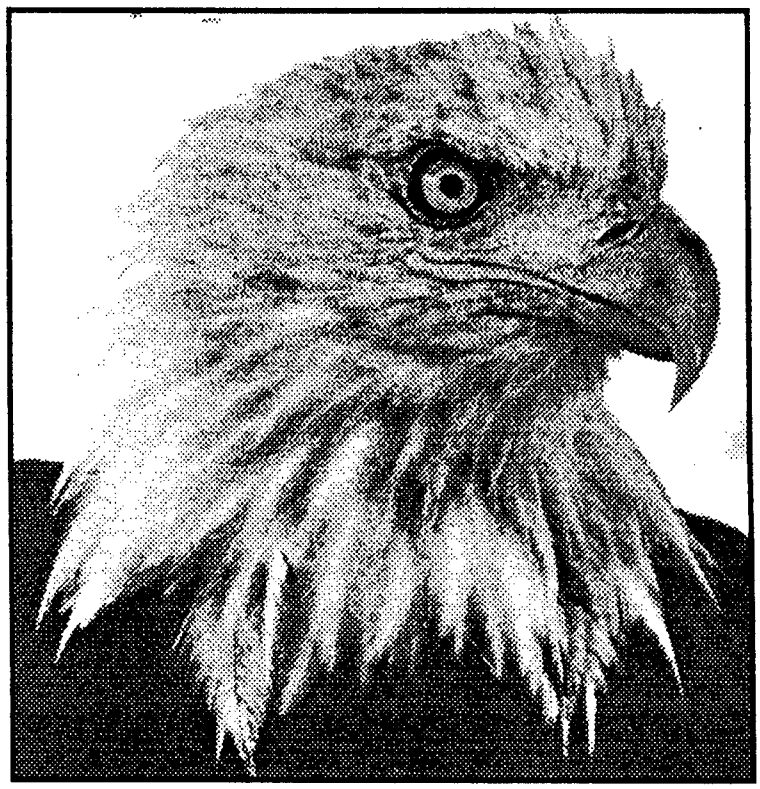
Late-Successional Reserve Assessment



Chapter VII

Browns/Round Mtn. Late-Successional Reserve Assessment

CONTENTS

CONTENTS (Continued)

Chapter VII
Late-Successional Reserve Assessment

Introduction

Purpose

The following chapter was written to fulfill the criteria for a Late-Successional Reserve Assessment as outlined within the 1994 Northwest Forest Plan (NWFP). Management assessments of LSRs (NWFP, Record of Decision, C-11) are required before habitat manipulation activities are designed and implemented and include the **eight elements which can be found on the following pages:**

1) A history and inventory of overall vegetative conditions within the reserve **(beginning on page 7-4).**

2) A history and description of current land uses within the LSR **(beginning on page 7-16).**

3) A list of identified late-successional associated species known to exist within the LSR and information on their locations **(beginning on page 7-18).**

4) Identification of specific areas that could be treated **(see "Management Strategy Area Descriptions" beginning on page 7-28).**

5). Criteria for developing appropriate treatments **(see"Criteria for Developing Appropriate Treatments" beginning on page 7-61).**

6) A proposed implementation schedule tiered to larger scale plans **(see "Treatment Implementation Schedule and Recommendations " beginning on page 7-74).**

7) A fire management plan **(see "Fire Management Plan" beginning on page 7-81).**

8) Proposed monitoring and evaluation components to help evaluate if future activities are carried out as intended and achieve desired results **(see "Monitoring and Evaluation of Management" beginning on page 7-90).**

The Northwest Forest Plan also directs the management of reserves:

"(T)o protect and enhance conditions of late-successional and old growth forest ecosystems, which serves as habitat for late-successional and old growth related species including the northern spotted owl. These reserves are designed to maintain a functioning, interacting, late-successional and old growth forest ecosystem." (C-11)
Other objectives include:

"...provide a distribution, quantity, and quality of old-growth forest habitat sufficient to avoid foreclosure of further management options...provide habitat for populations of species that are associated with late-successional forest...and help ensure that late-successional species diversity will be conserved." (B-4, 5)

The Northwest Forest Plan acknowledges that late-successional reserves (LSRs) east of the Cascades have an increased risk of fire due to lower moisture conditions and higher stand densities as a result of fire exclusion, allowing for additional protection oriented activities to occur in these LSRs. At the same time, the Deschutes National Forest Late-Successional Reserve Overview (1995) emphasized that the integrity of late-successional ecosystems is dependent on providing connectivity between individual LSRs, especially east of the crest near the edge of the range of the northern spotted owl. Neither of the LSRs covered in this assessment currently support owls, but they do provide both existing suitable and potential nesting habitat plus refugia for dispersal and movement between other LSRs to the north or south.

Management Strategy Areas (MSAs) have been developed within the LSRs based on the potential natural vegetation and the major wildlife species associated with specific stand types and conditions. A primary goal of this assessment is to identify where stand and habitat conditions are currently out of balance with potential or sustainable conditions and recommend prescriptive methods for reducing this imbalance in areas where the risk of major stand replacement fire is unacceptable for the goal to maintain or enhance late-successional old growth (LSOG) species.

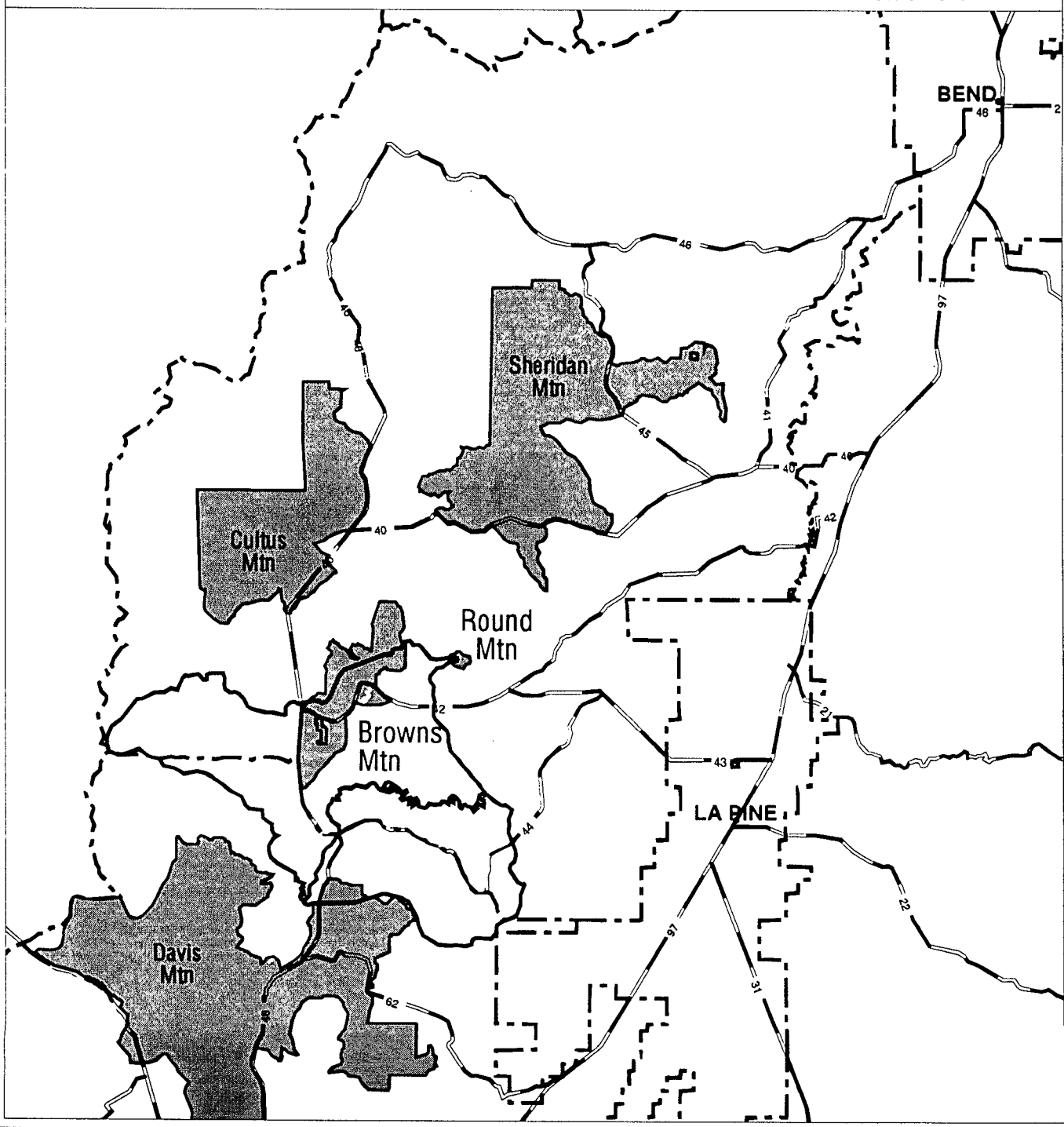
General Description/Locations

This assessment covers the Browns Mountain LSR (Regional #0-55), approximately 7,240 acres, and the Round Mountain LSR (Regional #0-551), approximately 220 acres. Both LSRs are located around the northern portion of the Browns/Wickiup Watershed Analysis area with significant acreage outside of the watershed's boundary but within the Cascade Lakes Watershed Analysis area (Deschutes National Forest, 1996). See Figure 7-1, Browns/ Wickiup Watershed Analysis Area, Late-Successional Reserves.

Fig. 7-1

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Late-Successional Reserves



Relationship to Watershed Analysis

The placement of this assessment within the Browns/Wickiup Watershed Analysis allows for a more site-specific assessment of the LSR component within the context of the landscape scale analysis. Portions of the eight elements covered in this assessment are addressed in previous chapters of this document. Where appropriate, these earlier narratives are cited within this chapter and elaborated upon, if necessary. The 1995 Deschutes National Forest Late-Successional Reserve Overview and the 1990 Deschutes National Forest Land and Resource Management Plan (LRMP) may also contain components of these elements and are cited within the text of this chapter.

History and Inventory of Overall Vegetative Conditions

Biotic Environment

Descriptions of forest vegetation throughout this chapter continue to use the concept of potential natural vegetation as related to site conditions. Potential natural vegetation provides a measure of land capacity to support vegetation composition, structure, and function, which in turn provide habitat conditions for wildlife species. The historic vegetative composition and dynamic nature of the late-successional reserves were previously discussed in Chapter II of the Browns/Wickiup Watershed Analysis, and are provided in greater detail for the LSRs in this chapter.

In order to facilitate the tracking of the dynamic nature of vegetation within the LSRs, broad groupings of vegetation associations have been made. These broader groups used to describe the probable historic landscape conditions were then sub-divided into smaller groups that provide more specificity to moisture regimes, species composition, and soil development.

Current vegetation conditions have been assembled from Forest-wide vegetation mapping completed in 1995 (Plant Associations and Groups). These plant associations and series were then grouped by their potential climax species, site potential, and productivity into similar plant association groups (PAGs) using the categories listed in the Deschutes Watershed Evaluation and Analysis for Viable Ecosystems document (WEAVE, DNF, 1994). Minor amounts of mapping changes were made for this project area in order to bring in site-specific changes and adaptation to new information found during on-site reviews. The table below details the PAGs, based on potential natural vegetation, that are found within the Browns and Round Mtn. LSRs.

Table 7-1

Current Vegetation by Plant Association Groups in the LSR

Plant Association Group (PAG)	Common Abbreviation of PAG	Potential Forest Vegetation Group (for analysis purposes)	Acres within LSRs	% of Area within LSRs
Mixed Conifer Dry	MCD	Dry	4,150	56%
Lodgepole Pine Dry	LPD	Dry	1,250	17%
Ponderosa Pine Dry	PPD	Dry	1,340	18%
Lodgepole Pine Wet	LPW	Moist	520	7%
Ponderosa Pine Wet	PPW	Dry	40	<1%
Mixed Conifer Wet	MCW	Moist	10	<1%
Riparian	RIPARIAN	Non-Forest	40	<1%
Meadow	MEADOW	Non-Forest	60	1%
Water	WATER	Non-Forest	20	<1%
Cinder	CINDER	Non-Forest	30	<1%
Total			7,460	100%

Individual PAGs have unique disturbance regimes that affect the long-term stability of the stand structures and composition that exists there. These regimes are discussed later in this chapter in terms of their general characteristics. Each PAG also provides individual potential for LSOG habitat for a specific set of wildlife species. The discussion of species associations and PAG is also described later in the chapter (see Late-Successional Species summaries for both terrestrial and aquatic/riparian species).

1) Historic Vegetation Composition and Stand Dynamics

The historic vegetation of the LSR areas was most likely one controlled by short interval fire cycles that maintained most of the potential mixed conifer stands in ponderosa pine dominance. As these frequent, gentle fires would favor the larger, more fire-tolerant ponderosa pines, they would necessarily discriminate against the true firs and lodgepole pines that invade mixed conifer sites in the absence of disturbance. Disturbance events (fire, insect and disease, windthrow) in the ponderosa pine stands maintained relatively small patch sizes, generally less than 5 acres (see Table 3-10, in Chapters III & IV).

Stands of large diameter, open-grown ponderosa pine probably occupied as much as one-half of the mixed conifer sites at any one point in time, with the remainder a variety of early-, mid-, and multi-species stands. Ponderosa pine dominated the tree environments simply in

its rapid response to disturbance events that punctuated the landscape. See Table 3-11 in the Browns/Wickiup Watershed Analysis for a representative example of likely historic vegetation composition.

Landscape patterns and patches are complex to describe, yet help us explain vegetation changes in a historic frame of reference. Insect and pathogen disturbances, fire events, and windstorms have all created patches, thus defining landscape patterns over time. The number of patches, patch size, vegetation affected, and the spatial distribution across the landscape have been determined by a multitude of environmental conditions and gradients. A more detailed discussion of these topics is found in the Cultus/Sheridan Mtn. Late-Successional Reserve Assessment (Deschutes National Forest, Bend-Ft. Rock Ranger District, 1996), which offers a portrait of similar landscape evolutionary processes.

Note that in the Browns/Wickiup Watershed Analysis, only 10 acres of Mixed Conifer Wet PAG type was originally mapped within the entire area, as the majority of true fir-dominated stands are classified as falling within the mixed conifer dry PAG. Upon closer inspection, there appear to be mixed conifer dry zones that are transitional to the mixed conifer wet PAG category, having properties of both PAGs (approximately 300 acres). Along the continuum of vegetation composition, these diverse areas of MCD/MCW are generally confined to the north slopes of both Browns and Round Mountains. Slight aspect changes have developed a more mesic environmental gradient to exist, as evidenced by increased tree species diversity and higher-than-expected stand densities, and an apparent lengthened fire return interval. For more information, see the Vegetation Appendix for descriptions of biophysical environments.

2) Current Vegetation Composition and Stand Dynamics

Vegetation Overview

The majority of the vegetation within the LSRs is comprised of the mixed conifer plant associations. The dominant tree species today, in the absence of disturbance, is (#1) white fir with (#2) ponderosa and lodgepole pines; and (#3) minor amounts of Douglas-fir with the very occasional mountain hemlock on the upper slopes and Engelmann spruce in the riparian bottoms. Ponderosa pine and lodgepole pine plant associations are also commonly found throughout the LSRs, with ponderosa pine and lodgepole pine as the dominant tree species, with occasional stands of western white pine. Heavy shrub coverages exist, most notably ceanothus and manzanita, and often follow fire or other stand-opening disturbance. Shrub coverage occurs heaviest on south- and west-facing slopes.

The following table summarizes acres by PAG and structural or seral stage within each LSR. Note that these values are derived from stand examination summaries, where individual stands were classified into structural/seral stages based on dominant tree species, size, and density averages. For more information, see the Vegetation Appendix, which describes modeling methods used to process databases, especially development of structural stage assignments.

Table 7-2

Current Dominant Tree Species by PAG and Structural Stage in the LSR

Forested PAG	Dominant Species	Acres and Percent by Structural/Seral Stage						Percent Species by PAG
		Early		Mid		Late		
		Acres	%	Acres	%	Acres	%	
MCD Round LSR*	PP	0	<1%	0	<1%	88	2%	2%
	WF	0	<1%	64	2%	45	1%	3%
	DF	0	<1%	0	<1%	27	1%	1%
	LP	0	<1%	0	<1%	0	<1%	<1%
MCD Browns LSR	PP	84	2%	42	1%	1058	23%	26%
	WF	42	1%	743	18%	1950	46%	65%
	DF	0	<1%	0	<1%	42	<1%	<1%
	LP	42	1%	84	2%	0	<1%	3%
PPD/W Browns LSR	PP	28	2%	200	14%	984	71%	88%
	WF	0	<1%	0	<1%	28	2%	2%
	LP	14	1%	91	6%	28	2%	9%
LPD Browns LSR	LP	74	6%	842	69%	195	16%	91%
	PP	37	3%	12	1%	49	4%	8%
	ES	0	<1%	0	<1%	12	1%	1%
LPW Browns LSR	LP	0	<1%	245	49%	181	35%	84%
	PP	5	1%	26	5%	32	6%	12%
	WF	0	<1%	16	3%	5	1%	4%
MCW Browns LSR	ES	0	<1%	0	<1%	30	75%	75%
	LP	0	<1%	0	<1%	10	25%	25%
Total (weighted average)		310	4%	2356	32%	4637	64%	10

*All stands within Round Mountain LSR are classified Mixed Conifer Dry PAG. Both LSRs together represent 100% of the MCD PAG.

In addition to plant associations and structural/seral stages, tree species coverage is an important indicator of vegetative composition dynamics across the landscape. Species dominance indicates the successional pathway, and can be used, in combination with structural/seral stage and plant association, to estimate the past, present, and future trajectory

of forest composition. Species composition also presents additional information related to diversity, as well as providing management implications related to stand stability and resilience to opportunistic disturbance agents.

Of greatest departure from the historic vegetation conditions is the decrease in dominance of open, ponderosa pine stands, and the corresponding increase of dense, multi-layered white fir dominated stands. Where ponderosa pine once dominated about 70% of the mixed conifer stands, it now occupies less than 30% of these same sites. Conversely, white fir, which comprised less than 30% of the mixed conifer sites historically, now dominates the overstory on roughly 70% of these acres. Although most stand structures in the LSRs are currently classified as late structures, the qualitative aspects of species configuration and density have changed dramatically, relative to generally-understood historic conditions of this landscape.

For the other major plant association groups, species dominance has not changed in such a dramatic way. Lodgepole pine stands still dominate about 90% of the lodgepole pine plant association sites. Similarly, ponderosa pine stands fill almost 90% of ponderosa pine plant association sites. Stand structures are not greatly different either from what would be expected under historic conditions, with relatively rare exception. In summary, lodgepole pine stands are mostly mid-structural stages, much like the conditions that historic beetle and fire disturbance events would have caused. Ponderosa pine stands are still largely dominated by late-structural stages, much like the prevalent historic condition. However, existing ponderosa pine stands are much more dense than those stands once controlled by frequent, light-intensity native fires.

Canopy Cover Overview

Canopy cover, sometimes referred to as crown cover, is the ground area covered by a crown as delimited by the vertical projection of its outermost perimeter (Society of American Foresters, 1971). Although variable throughout the Browns and Round Mtn. LSRs, there exists a high percentage of canopy cover relative to that expected under historic conditions, particularly on the more xeric southern- and western-facing slopes.

3) Vegetation Disturbance Elements

"The objective of Late-Successional Reserves is to protect and enhance the conditions of the late-successional old growth forest ecosystems, which serve as habitat for late-successional old growth related species including the northern spotted owl," (NFWP, 1994). Disturbance elements, such as fire, insect and disease agents, weather (precipitation influence, windstorm), and human-caused events, are capable of changing habitat conditions for LSOG dependent species. These changes, whether subtle or dramatic, may been seen as decreasing or increasing habitat quality, depending upon their changes to forest structure, composition, and density. The following discussion focuses primarily on fire, insect, and disease agents of change associated with the vegetation conditions found within the LSRs.

For a more detailed discussion on vegetation disturbance elements, the reader is encouraged to see the Cultus/Sheridan Mtn. LSR Assessment (Deschutes NF, 1996).

Fire as a Disturbance Agent

Fire has historically been a major disturbance element across these landscapes (Agee, 1993). The magnitude and intensity of the fires were historically determined by the time of the ignition (late spring to fall), fuel load and composition, the weather at the time of the ignition, and the climatic regime during the previous years. Fire patterns currently will differ greatly from historic patches and patterns, simply as a result of ever-increasing stand densities and fuel loadings. Historic fire disturbance patterns were probably controlling a landscape on a much larger scale than that of the Browns and Round Mtn. LSRs (about 7,500 acres total). For this reason, discussions on historic range of variability (HRV) are necessarily limited in their explanatory power, and may not be fully sufficient in understanding the localized vegetation dynamics. In essence, the historic vegetation conditions within the LSRs were most likely controlled by landscape patterns and processes larger than these two areas, thus the vegetation condition seen today may be artifacts of suppressed disturbance regimes, most notably fire.

Human Disturbance Agents

Human-caused disturbances and fire exclusion activities have created a different patch size and pattern within the LSRs and surrounding areas than that which existed historically. The most noticeable changes are with openings created by timber harvest activities (Figure A-2, 1993 Landsat Image). Additionally, insect and disease patches are becoming more pronounced due to current vegetative conditions which favor insect and disease infestations. In effect, fire exclusion and timber harvest have altered the historic/native mosaic fire pattern. Fires that do occur have increasingly become stand-replacing events where they were once predominantly low-intensity ground fires. Overall, landscape patches and patterns are very different today from what probably existed historically.

Differences in patch size and landscape pattern are most pronounced in the mixed conifer and ponderosa pine-dominated PAGs, where harvest disturbance has created patches larger than those found historically. Similarly pronounced, but in the opposite direction, recent harvest disturbance in lodgepole pine stands has created patches of typically smaller size than found historically.

Harvest activities are more pronounced within the Browns Mountain LSR, where fragmentation of many lodgepole pine stands has followed mountain pine beetle events over the past two decades. Additional fragmentation of mixed conifer stands has occurred with plantation establishment, although this has been much less extensive than that occurring in the lower elevation lodgepole pine zones. Shrub recovery in the mixed conifer openings has often been prolific, and in cases has hindered establishment of trees, thus prolonging openings.

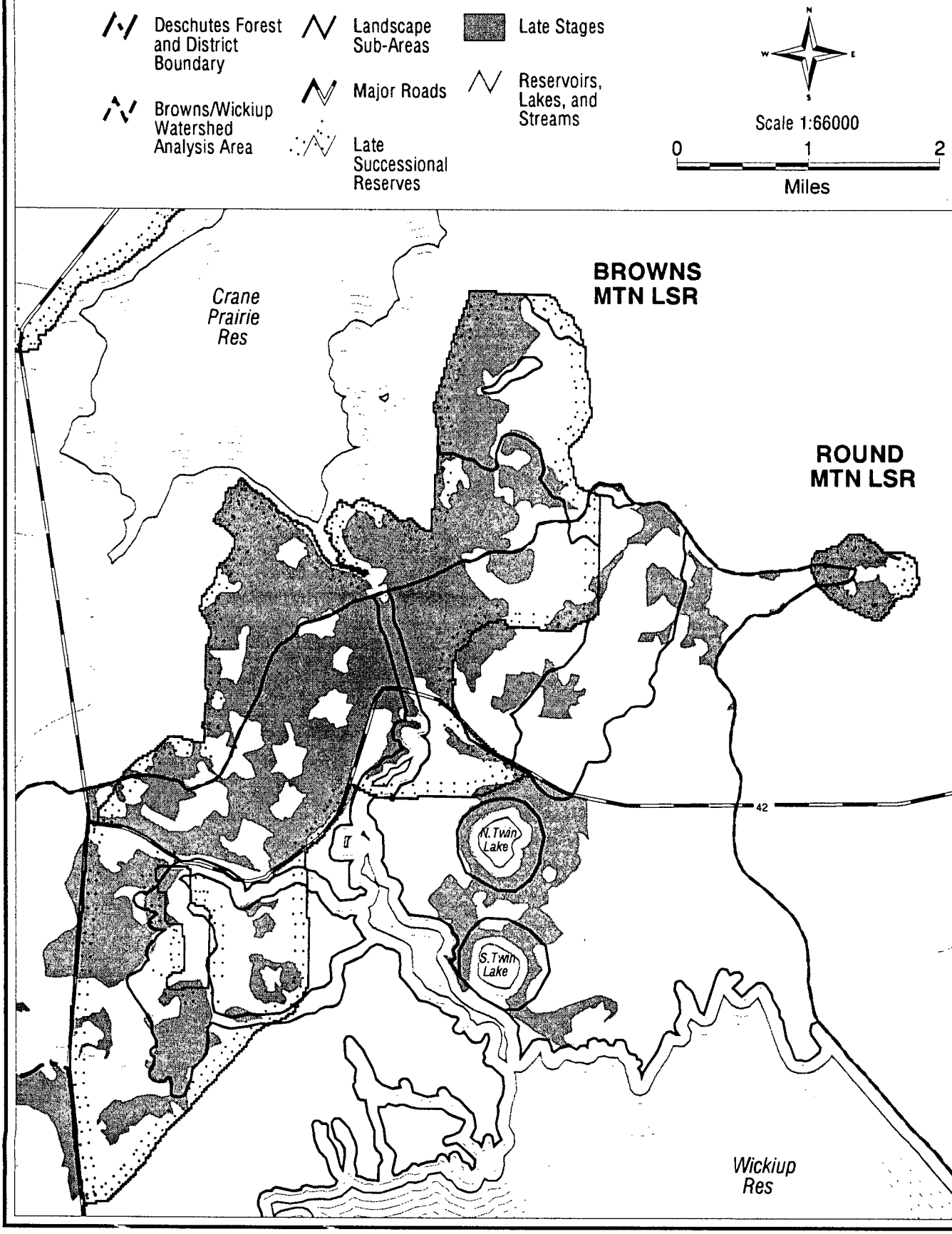
These openings then have become longer term open patches on the landscape of both LSRs.

A fragmentation analysis was not done for the LSRs. However, a coarse filter patch evaluation was done for the late-seral structural stages. Out of a total of 6 late-seral patches, 3 exceed 200 acres. Only 1 exceeds 1,000 acres. The effective core areas are unknown because the effects of edge were not calculated, but it may be inferred by study of patches displayed in Figure 7-2, Late Structure Stage.

Fig. 7-2

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Late Structure Stage



Insect & Disease Agents

Insect activity within the LSRs in a historical context would typically have been endemic in scope and may not have caused large-scale disturbance patterns on the landscape. Endemic activity would have probably occurred in small patches (generally less than 5 acres), creating holes across the landscape as compared to epidemic insect activity and associated patches/patterns, which may have created large patches (as much as 1,000 acres), such as the results of a mountain pine beetle epidemic in lodgepole pine stands.

Currently, insects have caused substantial vegetative changes within the LSRs, causing a reorganization of emergent landscape patches and patterns. Lodgepole pine stands, particularly low-lying pure stands, have had repeated bark beetle attacks, and subsequent heavy tree kills. Previous heavy mortality of lodgepole pine adjacent to both LSRs has compromised the immediate connectivity and quality of habitat between LSRs. Mixed conifer stands are imminently susceptible to defoliator insect attacks, such as western spruce budworm and pandora moth, as well as more subtle disturbance events caused by bark beetles. Although there is not certainty of defoliator or bark beetle epidemics occurring, there is a great predisposition for outbreaks to occur within the mixed conifer dry PAGs, specifically within the higher-density stands. If an outbreak of host-specific defoliator or bark beetle species occurs at an epidemic level, then large patches may be created that would change the look of the current landscape, as the mixed conifer vegetative type is the dominant plant association group within both LSRs.

Root pathogens/diseases alter vegetation by changing the structure and species composition within the disease centers, contributing to changes in landscape pattern and patches. Root diseases evolved with tree species, and historically were a native part of the forest succession process, and thus endemic to the area. When a root disease center expands, trees on the edges of openings become susceptible to infection and ultimate mortality. Over time, these openings are colonized by species more resistant to the root disease, thus regenerating a new stand of different composition. Lodgepole pine and western white pine are shade intolerant species typically more resistant to root pathogens than the tolerant firs, thus allowing a mechanism that promotes species diversity over successional advance. As mortality continues, root pathogens can create openings that exceed desired sizes or scales, as colonization of patches requires timely and successful seed establishment.

For the LSRs, the greatest departure from historic root diseases is currently seen in the mixed conifer dry PAG. These dry forests have experienced the greatest physical changes, most notably from ground based logging and fire exclusion, and have drifted farthest from their native species assemblages. Once dominated by ponderosa pine, the mixed conifer dry PAG has become dominated by white fir, with an attendant increase in root disease susceptibility, particularly Armillaria root disease. Root pathogen activity has increased in this dry forest PAG, although it is difficult to estimate the magnitude of change from the Historic Range of Variability (HRV) conditions.

Dwarf Mistletoes

Dwarf Mistletoes of ponderosa pine, lodgepole pine, and white fir are found throughout the LSRs. Although these are native to the vegetation found within Browns/Round Mtn. LSRs, they have increased in distribution and abundance, a direct response to fire exclusion and limited harvest practices. Mistletoe levels comprise the development potential and longevity of some stands within the LSR. For more information, refer to Chapters III and IV for a discussion on dwarf mistletoe.

Other Agents of Change

Many other disturbance agents exist within the LSRs, including Douglas-fir tussock moth, pandora moth, windstorm, and snow breakage. Refer to the Cultus/Sheridan Mtn. LSR Assessment (Deschutes NF, 1996). Additional biotic components can are addressed in the following sections: Wildlife, Fish, and Botany.

Abiotic Environment

Geology

The primary landforms within the Browns/Round Mtn. LSRs are volcanic in origin and are either vent complexes comprised of layers of basaltic andesites or cinder cones. Browns Mountain provides a relief change of approximately 800 feet, while Round Mountain rises approximately 1,400 feet from the surrounding basin floor. The entire landscape is covered by ash and pumice expelled from Mt. Mazama approximately 7,700 years ago.

Portions of the southern extent of the Browns Mountain LSR are underlain by outwash gravels from the last major glacial advance which occurred 30,000 to 22,000 years ago. Approximately 800 acres at the northern extent of the Browns Mountain LSR are surficial lava flows that have been vegetated to varying degrees. A unique association between plant roots, lava rocks and soil mycorrhizae is suspected in these systems, enabling them to support trees and shrubs throughout their extent. For a detailed description of the characteristics and management implications of these "forested lavas" refer to the Cultus/Sheridan Mtn. LSR Assessment (DNF 1996), pp. II-2 to II-5.

Soils

The primary parent material comprising the root zone of trees and other vegetative plants within the two LSR areas is the ash and sand-sized pumice tephra from Mt. Mazama. This material was deposited in depths between 2 and 3 feet and has weathered enough to develop a 1 to 3 inch mineral A horizon and a 12 to 15 inch mineral A/C horizon, depending primarily on the aspect and elevation of a given profile. A buried paleosoil comprised of ash or material weathered from basaltic lavas is also present in some areas.

The depth and type of soil material present in these areas is generally not limiting to vegetative growth. The available water holding capacity of the soils is sufficient to support vegetative growth despite a low amount of summer rainfall. Soil moisture curves for these soils show that much of the water within the rooting zone is held at tensions that can be overcome by translocation processes. Growth can be inhibited, however, during dry summer months of below normal moisture years.

Reference Conditions

The soil resource was historically present in a low disturbance condition in both upland and riparian settings. Soil strength was generally very low and natural horizonation of mineral and organic horizons was clearly defined. The aspect and elevation of a given profile were the primary physical factors in determining the rate of soil development, both of which influence the amount of precipitation and subsequent transpiration that occurs on site. As a result, the greatest amount of weathering is located in soils located on northerly aspects at higher elevations where mineral A horizons and the surface litter and duff layers were historically the thickest.

The primary disturbance regime within these systems was fire, which occurred at varying intervals and intensities as a result of climatic and vegetative conditions. This disturbance historically kept the litter, duff and coarse wood component at relatively low levels, especially within the drier plant associations on southern and western aspects.

Current Condition

The soil resource within the LSRs has been disturbed to varying degrees as a result of past harvest, fuels reduction and recreation activities. Disturbance is primarily in the form of compaction of mineral soil, the displacement of surface organics and the subsequent removal or trampling of live vegetation. Past activity units in which ground-based harvest and skidding systems were utilized, along with dozer piling for fuels reduction, have been measured to detrimentally impact between 20% to 35% of the soil resource.

The total extent of impacts to the soil resource within the LSRs is relatively low due to the types of silvicultural prescriptions and the percentage of the areas actually entered.

Approximately 20% of the total acres within the Browns Mountain LSR and 5% of the total acreage within the Round Mountain LSR have been entered in the past thirty years, in some cases more than once. Approximately 15% of the soil resource within the Browns Mountain LSR and 3% within the Round Mountain LSR is considered to have been impacted to levels considered detrimental to long-term productivity as a result of managed harvest and fuels reduction activities.

Recreation and infrastructure activities within the two LSR areas have also impacted the soil resource in areas of recurring foot traffic, road access, automobile/recreational vehicle parking and lookout facilities. The greatest extent of impact from recreational use within the Browns Mountain LSR is located within the dispersed camping sites to the north of the Browns Mountain boat ramp along Crane Prairie Reservoir. Riparian areas and adjacent uplands along the Deschutes River and Browns Creek are also utilized for fishing access and dispersed camping and have evidence of impacts from foot and vehicular traffic, although in relatively limited amounts.

Management Implications

The young age of the soils present within the LSRs is the primary limitation to their productivity. Development of the mineral A horizon has been limited to less than a few inches in most profiles, making this layer very valuable as the primary storage component of soil organics and available nutrients. Substrates located within this layer are utilized by bacteria and mycorrhizal fungi instrumental in converting organic forms of nutrients into inorganic, plant-useable forms.

The vegetative communities present in these LSRs also contribute a limited annual input of biomass to the soil component of these systems. Historic soil carbon levels varied by plant association and fire return intervals, but were generally less than 5% by volume under natural conditions. Although fire exclusion has increased live understory biomass and organic material on the soil surface in some areas, harvest activities utilizing whole tree removal and fuel piling treatments have removed or displaced this material in areas managed for timber. Some increases of surface organics from historic levels have occurred within the dry mixed conifer and ponderosa pine PAGS, as well as within the forested lavas.

Riparian and wet soil types are present within the Browns Mountain LSR that are currently in a low impact condition. Subsurface flows feeding Browns Creek and the adjacent wet meadows to the south are important to the function of the ephemeral and perennial stream habitats located within the southern extent of the LSR, placing high value on maintaining undisturbed soil profiles in the area. To date, activities and associated impacts on upland soils do not appear to have altered these flows significantly. The removal of borrow material from the two gravel pits along Cascade Lakes Highway (road #46) have prevented a portion of the watersheds surface flow of snowmelt and thunderstorm events from reaching the wet meadows. Lodgepole pine encroachment along these meadows indicates that this may be

altering the level of subsurface water, although the previous years of below normal annual precipitation may also account for this vegetative change.

Two large blocks of Engelmann spruce and lodgepole pine bottoms located within the LSR are seasonally wet and are dependent on unimpeded subsurface flows in order to maintain their current vegetation. These are both currently in a low impact condition and are recommended to be included in the riparian reserves designated under this analysis.

Other Abiotic Components

Details on other abiotic components such as water and climate can be found in Chapters I, III, and IV.

History and Description of Current Land Uses

Settlement Patterns and Consumptive Uses

Within the Browns and Round Mtn. LSRs, very few vegetative changes caused by humans occurred prior to 1915, when the first mill in Central Oregon was in operation. Native Americans probably cut trees for a number of purposes, and undoubtedly set fires in selected areas to improve or maintain favorable conditions for the next year's hunt. EuroAmerican settlement was almost non-existent, except for approximately 140 acres (Sokol Land Exchange) which was homesteaded in the late 1800s by John A. Brown. Mr. Brown grazed cattle in meadows which surround what is now called Browns Creek. There were few buildings which used native wood, including summer homes along the Cascade Lakes Highway. The first "commercial" timber sales did not occur until the 1950s (Cultus/Sheridan Mtn. LSR Assessment, 1996). For more detail on settlement patterns, see the Cultural Resource Appendix.

Recreation

Recreation resource concerns for the Browns and Round Mtn. LSRs are related to dispersed camping and scenic quality. In general, both LSRs provide day use recreation opportunities. Fishing, mountain biking, hiking, big game hunting, sightseeing, and driving for pleasure are some of the more popular activities. Use levels for these activities are moderate to high. The Browns Mountain Boat Ramp on Crane Prairie Reservoir provides overnight dispersed camping opportunities as well. This area is quite popular and receives heavy use throughout the camping season (May through August; see "Crane Prairie West" in Chapters III-IV, Figure 3-15).

Facilities located within the Browns and Round Mtn. LSR area include a fish platform on the Deschutes River south of road #42 (day use only), Browns Mountain Boat Ramp, and Round Mountain Fire Lookout.

The greatest risk to the integrity of the LSRs (from a recreation aspect) are user impacts. Both day use and overnight activities can create impacts to LSR resources through such activities as firewood gathering (loss of snags and/or down woody material), impacts from dispersed camping activities (compaction, tree scarring from nails, erosion, etc.), wildlife disturbance caused by noise and other activities, and the risk of human-caused wildfires.

Browns Mountain LSR offers outstanding scenery and areas for recreationists to get away from crowded shorelines and adjacent recreation areas. The integrity of these LSRs should be maintained in order to continue providing high quality scenery and recreation opportunities which are expected when visiting these areas.

For a detailed discussion on recreational conditions and trends, see Chapters III-V and the Cascade Lakes Watershed Analysis (Chapter II, DNF, 1995), for an overview of similar historic conditions for the Browns/Round Mtn LSR Assessment area.

Capital Improvements

Recreation capital improvements for Browns Mountain LSR include a three-quarter mile hiking trail (Crane Prairie Trail #47) from road #42 to Crane Prairie Dam, and previously listed facilities . Other capital improvements include two paved transportation system roads (#42 and #4270).

In the Round Mountain LSR, there are no recreation capital improvements. Other than native surface and gravel roads, Round Mountain Fire Lookout is the only capital improvement within this LSR.

For further discussion on these improvements, in addition to bridges and cinder pits within the LSRs, refer to Chapters III and IV.

Forest Plan Management Areas

The following Deschutes National Forest Land and Resource Management Plan (LRMP) Management Areas are located within the Browns/Round Mtn. LSRs: Bald Eagle, General Forest, Intensive Recreation, Old Growth, Osprey, Scenic Views, and Eligible Wild and Scenic River (Figure 1-5, Forest Plan and NWFP Management Allocations).

Management area objectives are summarized on pages 4-90 through 4-142 of the LRMP. The following management areas, including a short summary, are either more restrictive, or change the complexity of management designed to implement LSR objectives:

Scenic Views (MA-9, 2,410 acres) - This management area is designated within both Browns and Round Mtn. LSRs. "Ponderosa pine in Foreground Scenic Views will be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger tree offering visual diversity.... Diversity in species, where biologically possible, is desirable. Small, natural-appearing open spaces help provide a sense of depth and are a desirable component.... In Retention areas visual changes will not be noticeable to the casual forest visitor".

Old Growth (MA-15, 840 acres) - This management area is designated within Brown Mountain LSR. Vegetative manipulation, including removal, may occur to perpetuate or enhance old growth characteristics.

Eligible Wild and Scenic and/or Recreational River (MA-17, 550 acres) - This management area is within Browns Mountain LSR, formerly designated as Old Growth (MA-15). Vegetation will be managed to appear natural and emphasize protection of riparian plant communities. A wide range of silvicultural practices could be allowed provided that such practices are carried on in such a way that there is no adverse effect on the river and its immediate environment. Vegetation outside of the boundary, but within the visual scene, should be managed and harvested in such a manner which provides special emphasis on visual quality.

Late-Successional Terrestrial Associated Species

Wildlife

The wildlife species that are associated with late-successional forested habitats have been described in detail in the Cultus/Sheridan Mtn. Late-Successional Reserve Assessment (DNF 1996). The forested habitat types within these LSRs are no different than those in the Browns/Round Mountain LSR area. Those species with federal listing status (i.e. threatened, endangered, proposed, or candidate) have been described in the watershed analysis section of this report. Additionally, a wildlife guild evaluation is presented in the Appendix, which addresses habitat specific late-successional old-growth (LSOG) guilds.

In review, the Browns/Round Mtn. LSRs have no known northern spotted owls. However, occupied sites are within five miles of the LSRs, and there is a significant amount of suitable habitat presently available. Spotted owl surveys were conducted during the summer of 1997 on Browns Mountain with negative results. Bald eagles nest within the Browns Mountain LSR having four active nests in 1997. Sub-adult bald eagles have been observed on Round Mountain, however there has been no documented nesting within that LSR.

The guild evaluation identified a core community of species for each major coniferous forest Plant Association Group (PAG). The dry and wet PAGs were combined which created a total

of four distinct guilds, i.e. ponderosa pine, lodgepole pine, mixed conifer and mountain hemlock (latter present in watershed but not within LSR areas). The guilds are strongly oriented to definable vegetative communities (Block et al. 1987). The guilds were not developed for the purpose of identifying every possible species but only the more prominent ones. Further, several Management Indicator Species (MIS) were designated for each guild. The results of the evaluation were that the ponderosa pine guild has 17 species assigned with two MIS, including northern goshawk and white-headed woodpecker. The lodgepole pine guild has eleven species assigned with two MIS, including black-backed woodpecker and American marten. The mixed conifer guild has 16 species assigned with three MIS, including northern goshawk, white-breasted nuthatch, and pileated woodpecker. All of the assigned species and designed MIS have been documented to occur on the Deschutes National Forest and are known, or likely present within the LSRs.

Habitat Needs/Population Status

The types, quantities and conditions of habitat needs of species that are associated with late-successional forested habitats have been fairly well documented. The Cultus/Sheridan Mtn. LSR Assessment (DNF 1996) reviews the needs of selected individual species in detail in Chapter III. Table 7-3, "Browns/Round Mtn. LSR Management Strategy Areas - Summary of Existing Conditions" summarizes the most dominant habitat attributes (i.e. conditions) from this reference for each of the designated Management Strategy Areas (MSA). The MSAs are described in detail under the heading "Management Strategy Area Descriptions" section of this chapter. Management Indicator Species (MIS) have been designated for most of the MSAs (excluding General Protection MSAs), and the referenced habitat information is specific to them.

With the exceptions of the spotted owl and bald eagle, the populations of late-successional species within the LSRs are unknown. Those species with special federal or State status due to population declines have been noted in the guild evaluation. Several other species without special status designations are of concern, e.g. neotropical migrant birds (refer to the Appendix for guild evaluation list).

In review, as stated previously the northern spotted owl is not presently found in the Browns/Round Mtn. LSRs. It requires relatively large tracts of mature and old-growth forest which provide high canopy cover, large trees and a relatively complex stand structure. The bald eagle is a resident of the LSRs with a known breeding population but less quantified wintering population. It requires large trees with a preference for Douglas-fir and ponderosa pine for nesting. Aquatic/riparian foraging habitats are critical to eagles. The other late-successional species have been documented in the referenced guild evaluation. Their habitat needs are highly variable in respect to within-stand attributes but there is significant overlap of general habitat needs. As an example, the northern goshawk prefers large trees for nesting and is dependent upon adequate understory conditions as related to its prey base. In comparison, the bald eagle also requires large trees for nesting but is not dependent upon

understory conditions to meet its forage needs. Refer to the Wildlife section of Chapters III, IV, and the Appendix for a more detailed discussion of species/guilds and technical references.

Vascular Plants

There have been few plant surveys within the Browns/Round Mtn. LSRs.

Sugar stick - *Allotropa virgata*, a "survey and manage" species (NWFP, Appendix J, 1994) has been located within the Browns Mountain LSR, but much potential habitat remains unsurveyed. Potential habitat also exists for this plant within the Round Mountain LSR. For a description, refer to Chapters III and IV.

Terrestrial Bryophytes

No surveys have been conducted for Late-Successional Terrestrial species of bryophytes and no "survey and manage" bryophyte species are known to exist within the two LSRs.

Fungi

One limited fungi survey had been conducted within the Browns/Round Mtn. LSRs, and white chanterelle, *Cantharellus subalbidus*, was located. There are no other known "survey and manage" species of fungi occurring within the two LSRs. There are, however, sites of other "survey and manage" species nearby. Bolete mushroom - *Gastroboletus subalpinus* was sighted at Elk Lake in the neighboring Cascade Lakes Watershed in the early 1980s. Rare False Truffle, *Rhizopogon evandens* var. *subalpinus*, also occurs within the Cascades Watershed. Descriptions of these three plants may be found in Chapters III and IV. Potential habitat for these plants exists within the two LSRs.

Lichens

No surveys for lichens have taken place and there are no known occurrences of any "survey and manage" lichen species within the two LSRs.

Potential habitat exists for other species of bryophytes, fungi and lichens. For descriptions, refer to the Cultus/Sheridan Mtn. LSR Assessment (pages 11-50 to 11-54).

Arthropods

There is a significant lack of information on the distribution, taxonomy, and habitat dynamics for arthropod species in general. Additional surveys and research are needed to enable managers to be more effective in providing for the needs of these species within the context of ecosystem management. Appendix J2 of the NWFP groups the terrestrial arthropods into functional groups. A review of the species range for these groups indicated that none of the

known sites are within the Browns/Round Mtn. LSRs.

Other Sensitive Species (Not Related to LSOG Habitats)

Jepson's Monkeyflower - *Mimulus jepsonii*
There is one small disjunct population of Jepson's monkeyflower growing in an opening in lodgepole pine within the Browns Mtn LSR. Although not closely associated with LSOG habitats, it should be noted that any disturbance regimes such as prescribed fire will likely benefit this species. For more information about Jepson's monkeyflower please refer to Chapters III and IV.

Non-Native Species (Noxious Weeds)

Noxious weeds are aggressive non-native plants that can invade and displace native plant communities and cause long-lasting management problems. By simplifying complex plant communities, weeds can also reduce biological diversity.

Noxious weeds within the Browns Mountain LSR are confined to Cascade Lakes Highway 46, riparian areas alongside Crane and Wickiup Reservoirs, and the section of the Deschutes River that connects the two reservoirs. Spotted knapweed, *Centaurea maculosa,* grows in patches alongside Cascade Lakes Highway 46 on the west side of the Browns Mountain LSR. It has the potential to invade and threaten sensitive plant habitat and reduce overall native plant diversity. Klamath weed, *Hypericum perforatum*, and to a lesser degree, spotted knapweed grow within the riparian areas in the Browns Mountain LSR. Reed canary grass, *Phalaris arundinacea*, a very invasive non-native, also grows within these riparian areas. Cheat grass, *Bromus tectorum,* and bull thistle, *Cirsium vulgare*, grow in a few disturbed suites within the LSR.

There are no known noxious weed or non-native plant sites within the Round Mountain LSR.

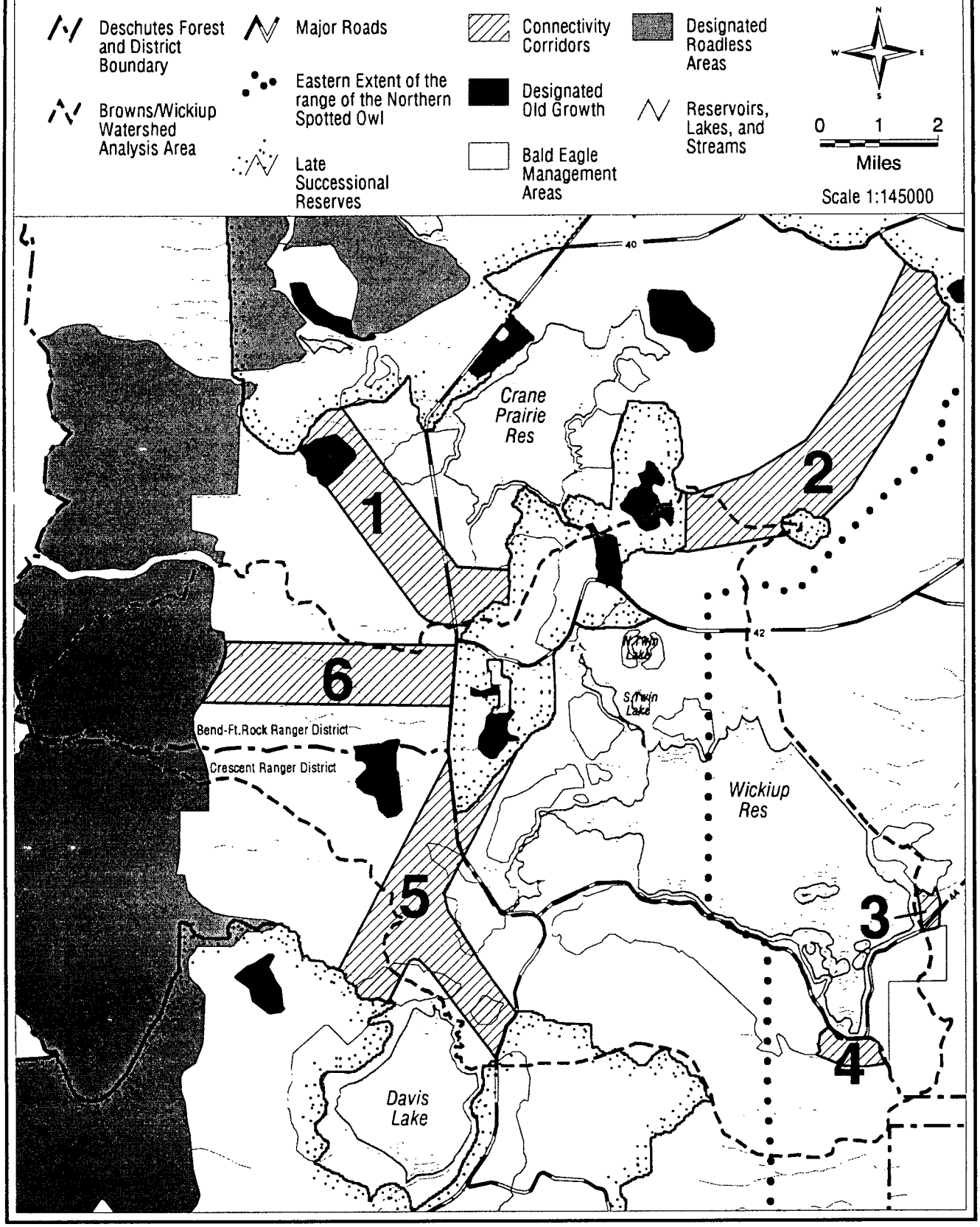
Terrestrial Connectivity

The Browns and Round Mtn. LSRs are somewhat isolated presently due to the cumulative effects of past timber harvest, road construction, wildfire and reservoir construction. Within the Browns Mountain LSR, past timber harvest activities has caused moderate fragmentation. Browns Creek and the Deschutes River provides good riparian reserve habitats (Figure 6-3, Recommended Riparian Reserves, Chapter VI) that facilitate the movements of terrestrial species. Figure 7-3 identifies the recommended connectivity corridors to link the LSRs to each other and to other areas with significant late-successional forest habitats. Refer to Table 6-5, Wildlife Restoration Recommendations in Chapter VI and to Tables A-17 and A-18 (respectively) in the Appendix for additional information on the corridors and the riparian reserves. In addition, refer to the Cultus/Sheridan Mtn. Late-Successional Reserve Assessment (DNF 1996; III 30-37) for a detailed discussion of the importance of connectivity.

Fig. 7-3

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Connectivity Corridors



Late-Successional Aquatic/Riparian Associated Species

Riparian Bryophytes

One limited survey for riparian bryophytes was conducted in May 1997 in the Browns Mountain LSR. The liverwort *Tritomaria exsectiformis*, a "survey and manage" plant species was located. For a description of this plant please refer to Chapters III and IV. No other surveys for bryophytes have taken place in either LSR.

Mollusks

No surveys specific to mollusks have been conducted by the Deschutes National Forest in the LSRs. Stream benthic macroinvertebrate sampling has been completed on the Deschutes River and Browns Creek (Tables A-21, A-22). Mollusks in the Planoridae family were collected in Browns Creek, but were not keyed to genus or species. A review of the NWFP Appendix J2 listed potential habitats for 2 species within the Browns Mountain LSR, although no specific known sites were listed. All other listed species are outside the LSRs. For more information, see the Appendix for more details on stream benthic macroinvertebrate sampling.

The species range for *Fluminicola columbiana* (Columbia pebblesnail) is the Columbia River and some larger tributaries, which include the Deschutes River. The likelihood of this species inhabiting the waters within the Browns Mountain LSR is minimal because: the habitat requirements do not include spring-fed systems (such as Browns Creek); and the species is intolerant of fluctuating dissolved oxygen concentrations, which is typical in the Deschutes River.

The species range of *Anodonta californiensis* (California floater) includes the Deschutes River. The range description in Appendix J2 was not specific to which areas of the Deschutes River the species has been located. The species occurs in large rivers, lakes, and perennial streams. The geographical extent for mitigation listed in Appendix J2 excludes the Deschutes River.

Under the scenario that the Columbia pebblesnail and the California floater were within the Browns Mtn LSR, the connectivity to downstream areas of the Deschutes River is likely eliminated by the presence of Wickiup Reservoir and dam, and connectivity to upstream areas of the Deschutes River eliminated by Crane Prairie Reservoir and dam.

Macro-Invertebrates

Stream benthic macroinvertebrate sampling resulted in the identification of several species of arthropods, primarily insects, from the Deschutes River and Browns Creek. A list of the species can be found in the Appendix (Tables A-21, A-22).

Fish

Bull trout were historically found in the Browns Mountain LSR within the Deschutes River, and are suspected to have inhabited Browns Creek. The species has been extirpated from the LSR, with the last reported catch of a bull trout in Wickiup Reservoir in 1957.

Bull trout has very strict environmental requirements. Very cold water temperatures, abundant instream large woody material, and spawning gravels relatively free of fine sediments are habitat features conducive to viable populations. Browns Creek is considered potential habitat. The degradation of water quality in the Deschutes River from historic conditions precludes it from being potential habitat.

The redband trout, an inland group of rainbow trout, historically inhabited the watershed. Over the last several decades there have been several stocks of rainbow trout stocked within the Browns Mountain LSR and adjoining waters. These stocks may have interbred with the native redband. Presently, there is a wild reproducing stock within the Browns Mountain LSR, but the genetic status is unknown at this time.

The redband trout also requires high water quality and clean spawning gravels, but can tolerate a wider range of environmental conditions than bull trout. Browns Creek and the Deschutes River are both potential habitat.

As with the mollusks, connectivity for fish species to upstream reaches of the Deschutes River is eliminated by Crane Prairie Dam. Fish can pass through Wickiup Dam to downstream areas, but connectivity from downstream areas are eliminated by Wickiup Dam, as there is no fish passage.

See Chapters III and IV for more information.

Amphibians

The Northwest Forest Plan, Appendix J2, lists potential habitat within the Browns/Round Mtn. LSRs for the riparian dependent black salamander, Cascade torrent salamander, Columbia torrent salamander, Cope's giant salamander, and the tailed-frog. These species are generally found in cold, clear streams and seeps, which is representative of the headwaters of Browns Creek. The following habitat descriptions and ranges were derived from Corkran and Thoms, 1997:

The black salamander is fully terrestrial, but little is known of it's habitat requirements. It is found in forests, open woodlands, moist talus and streamside areas with wood or rock debris. The known range in Oregon is within a small area in the south (outside of Browns/Round Mtn. LSRs).

The Cascade and Columbia torrent salamanders live in very cold, clear springs, seeps, headwater streams and waterfall splash zones. In Oregon, the known range of the Cascade torrent salamander is in the central and northern Cascade Mountains, including Browns/Round Mtn. LSRs, and the range of the Columbia torrent salamander is the northwest corner of the state (outside Browns/Round Mtn. LSRs).

Cope's giant salamander is found in small, steep-gradient, permanent streams with clear, cold water, relatively free of silt. The known range includes the northwest tip of the state and the northern tip of the Cascade Mountains (outside of Browns/Round Mtn. LSRs).

The tailed-frog lives in fast, small, perennial forest streams with clear, cold water. The preferred substrate is composed of cobble and boulder substrates, with little silt. The known range in Oregon is the west coast, the Cascade Mountains, and portions of the Ochoco and Blue Mountains (within Browns/Round Mtn. LSRs).

The Clouded salamander lives in forests, including burned, second-growth, and rocky areas, primarily with large logs. They inhabit the decaying logs and stumps, and occasionally in moist rock outcrops. The known range in Oregon includes the western part of the state and the west slopes of the Cascade Mountains (outside of Browns/Round Mtn. LSRs).

The Oregon Slender Salamander lives in forests, primarily old-growth Douglas fir stands, and younger stands with numerous downed trees. They inhabit the decayed logs or woody debris piles. They also occur in moist talus with abundant woody debris. The known range in Oregon is the west slope of the Cascade Mountains (outside of Browns/Round Mtn. LSRs).

The spotted frog (federal Candidate status) prefers slow moving streams, marshes, lakes, and ponds, usually where there is abundant aquatic vegetation. Spotted frogs are widespread and common in many areas of the Cascade Range and Coast mountains but populations have diminished in parts of its western range. Although potential habitat exists within many areas of Browns Mountain LSR, the only documented sightings of the spotted frog were at the base of Wickiup dam on the Deschutes River and Crane Prairie Reservoir (Hayes, 1997), both outside of the watershed/LSR boundary.

No surveys specific to amphibians have been conducted within the Browns and Round Mtn LSRs. All other known ranges of other amphibian species not listed or described above are well outside of both Browns and Round Mtn. LSRs.

Riparian Reserves/Connectivity

There are no Riparian Reserves within the Round Mountain LSR. The Riparian Reserves within the Browns Mountain LSR generally follow the recommendations of the NWFP. Reserves are 300 feet on either side of Browns Creek and the Deschutes River, i.e.150 feet from the high water mark of Wickiup Reservoir, 150 feet from wetlands greater than 1 acre, and 100 feet on either side of intermittent channels (See the Aquatic Conservation Strategy in Chapter VI). The Riparian Reserve of Crane Prairie Reservoir was recommended to be extended to 300 feet from the high water mark in the Cascade Lakes Watershed Analysis.

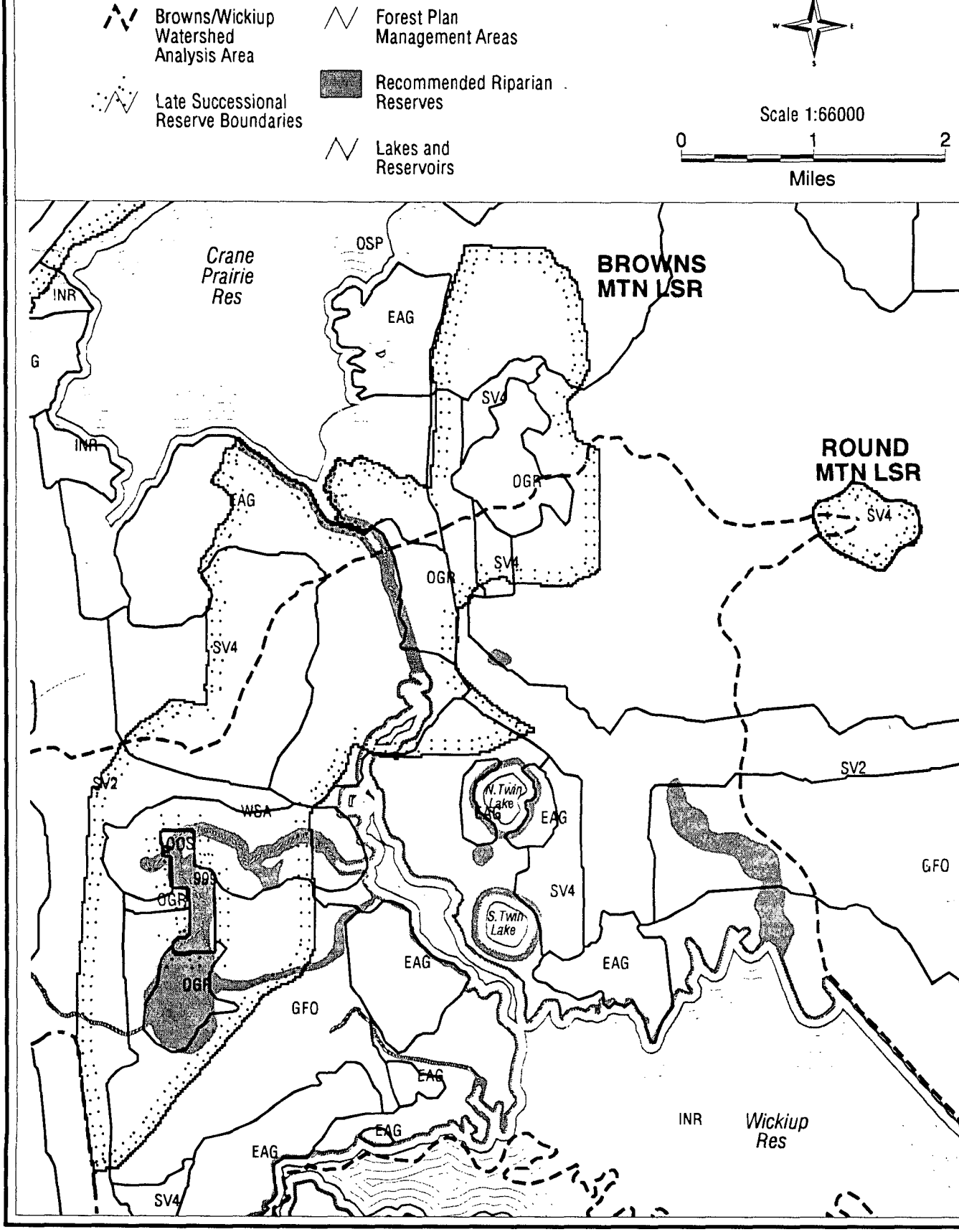
There are 595 acres of Riparian Reserves within the Browns Mountain LSR, exclusive of water bodies including 119 acres associated with reservoirs, 168 acres associated with fish-bearing streams, 261 acres incorporating wetlands, and 47 acres adjacent to intermittent channels (Figure 7-4, Riparian Reserves and Forest Plan Management Areas in LSRs).

The riparian vegetation within the Reserves is generally a narrow band along the waterbodies, with the exception of the Browns Creek meadow/wetland. The recommended widths should provide adequate protection for present and potential late-successional aquatic and riparian species to disperse along these corridors.

Fig. 7-4

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Riparian Reserves and Forest Plan Management Areas



Management Strategy Area Descriptions

Existing and Desired Conditions

Twelve individual Management Strategy Areas (MSA) have been designated with the Browns/ Round Mtn. LSRs (Figure 7-5). The purpose of the MSAs is to provide both a description of Desired Condition (DC) and its spatial location with the LSRs. The Desired Conditions are specific to the needs of late-successional species as directed by the Northwest Forest Plan. The MSAs are built upon the capability of the land to support the Desired Conditions. Thus, the basic foundation of this system of stratification of the landscape is the Plant Association Group (PAG). The PAGs are assemblages of similar potential plant associations and reflect the site's capability to support recognizable plant communities that are products of the site characteristics (e.g. soil type, precipitation, slope, aspect, and elevation). The associations are classified by the site's potential or predicted vegetative climax stage. Current conditions may be significantly different than the potential.

The following narratives describe each MSA in terms of Desired Conditions together with a brief account of current condition in order to establish the overall context of the LSRs. The existing condition of the MSAs are summarized in Table 7-3, and the Desired Condition attributes are summarized in Table 7-4. Refer to Figures 7-6 through 7-17 for the individual MSA designations. The Desired Condition attributes are analogous to the "treatment criteria" that are required by the NWFP to identify restoration/maintenance needs within the LSR. The treatment criteria and their application are addressed later in this chapter. It is important to note that the needs of an individual species may be met in several of the designated MSAs (e.g. spotted owls may use bald eagle MSAs for foraging). Some MSAs are very similar for Desired Conditions between species, but the size of the designated unit has been an important consideration as related to a species home range (e.g. American marten with a large range and the black-backed woodpecker with a small range). Species mobility is another variable that has been considered.

Several MSAs are incapable of supporting LSOG species because of their habitat type (e.g. wet meadow) or have different management emphasis (e.g. General Protection MSA). The wildlife section of the Browns/Wickiup Watershed Analysis together with the Wildlife Appendix section on wildlife guilds provide the applicable details for each MSA's capability. In particular, the LSOG guilds should be reviewed for documentation of major and minor species by PAG.

Table 7-3 includes an assessment of snag levels by MSA. Overall, the majority of the LSR area is providing adequate snag habitat for dependent species. Past regeneration harvest units generally have low snag numbers, however they are often within a forest matrix which provides them.

Fig. 7-5

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

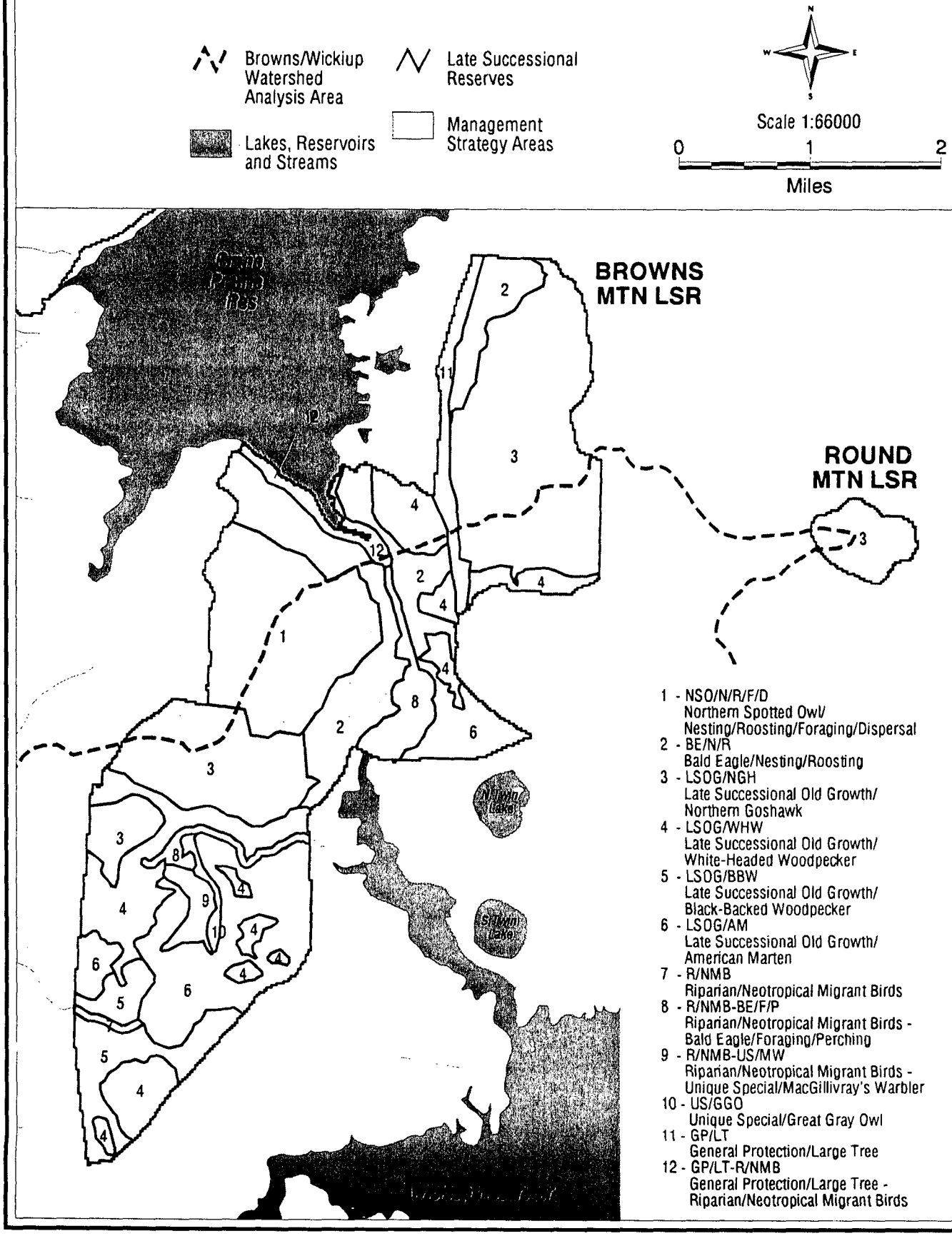


Table 7-3 Browns/Round Mtn. LSR Management Strategy Areas-- Summary of Existing Conditions

Management Strategy Areas	Acreage	Dominant PAGS	Dominant Structure	Area by Snag Category (%)**			Road * Density mi./sq.mi.	Riparian Reserves	Comments
				Low	Mod.	High			
#1- NSO/N/R/F/D N. Spotted Owl	980	MCD 100%	Late 81% Mid 2% Early 17%	1%	15%	84%	5.1	0%	Fragmented by past harvest units. Nest trees may be limiting.
#2 - BE/N/R Bald Eagle	1,050	MCD 70% PPD 24%	Late 86% Mid 11% Early 3%	27%	64%	10%	7.2	0%	Three active nest sites in 1997.
#3 - LSOG/NGH Goshawk	2320	MCD 96%	Late 50% Mid 30% Early 19%	20%	27%	53%	4.6	0%	Fragmented by past harvest units. Prey base habitats may be limiting. The entire Round Mt. LSR (223 ac.) is within this MSA.
#4 - LSOG/WHW White-Headed Woodpecker	1,050	PPD 84% MCD 7%	Late 66% Mid 28% Early 6%	17%	65%	18%	6.8	1%	Stand understory is overly dense and snags may be limiting.
#5 - LSOG/BBW Black-Backed Woodpecker	405	LPD 97%	Late 14% Mid 54% Early 33%	14%	68%	17%	4.7*	11%	Stand density and snags are limiting
#6 - LSOG/AM American Marten	1,030	LPD 66% LPW 32%	Late 30% Mid 56% Early 14%	1%	52%	47%	3.5	26%	Coarse Woody Material may be limiting
#7 - R/NMB Neotropicals	20	LPD 81%	Late 5% Mid 57% Early 38%	83%	17%	0%	--	100%	Very small intermittent channel.

Management Strategy Areas	Acreage	Dominant PAGS	Dominant Structure	Area by Snag Category (%)**			Road * Density mi./sq.mi.	Riparian Reserves	Comments
				Low	Mod.	High			
#8 - R/NMB-BE/F/P Neotropicals - Bald Eagle	270	Ripar. 37% LPD 32% LPW 13% MCD 10%	Late 36% Mid 27% Early 5% Unk 32%	49%	32%	19%	4.5*	67%	High quality habitat along the Deschutes River.
#9 - R/NMB-US/MW Neopropicals - MacGillivray's Warbler	90	Mdw 71% LPD 17%	Late 7% Mid 18% Early 4% Mdw 71%	40%	60%	0%	--	97%	Wet meadows with lodgepole pine invasion.
#10 - US/GGO Great Grey Owl	40	LPD 95%	Late 0% Mid 54% Early 41%	0%	0%	100%	1.0*	0%	Maintenance of open early-structural habitats is important.
#11 - GP/LT General Protection Large Tree	190	PPD 78% MCD 16%	Late 95% Mid 1% Early 4%	0%	82%	18%	11.7*	0%	High use rec areas to the west along Crane Prairie Res pose a hazard.
#12 - GP/LT-R/NMB General Protection Large Tree Neotropical	110	MCD 70% PPD 11%	Late 52% Mid 34% Early 1% Unk 13%	4%	0%	96%	13.1*	9%	High rec use area within an established BEMA.

Note: Refer to Figure 7-5 for locations. *Road densities can be misleading on areas of small size, i.e. less than one square mile (gross road mileage ignoring seasonal closures). The MSAs cover former LRMP Management Areas which range from 2-10 areas each (refer to analysis files for detailed summary). Data has been combined for both Browns and Round Mtn. LSRs.

** Where:

Snag Category	12" + dbh Snags (Other Than LP)	Lodgepole Pine Snags 8"+
Low	<4 per acre	<6 per acre
Moderate	4-8 Per Acre	6-10 Per Acre
High	8+ Per Acre	10+ Per Acre

Summary:

- Brown Mountain LSR (7,213 ac.): Early-structural = 14%, mid-structural = 28%, late-structural = 58%. Road density 5.7 mi./sq. mi.
- Round Mountain LSR (222 ac.): Early-structural = 4%, mid-structural = 25%, late-structural = 71%. Road density 4.0 mi./sq. mi.
- Spotted owl NRF habitat: Browns Mountain = 1856 ac. or 26%, Round Mountain = 102 ac. or 46%.

Management Strategy Area Codes

1 = Northern Spotted Owl/Nesting/Roosting/Foraging/Dispersal (NSO/N/R/F/D)
2 = Bald Eagle Nesting/Roosting Habitat (BE/N/R)
3 = Late Successional Old Growth/Northern Goshawk (LSOG/NGH)
4 = Late Successional Old Growth/White-Headed Woodpecker (LSOG/WHW)
5 = Late Successional Old Growth/Back-Backed Woodpecker (LSOG/BBW)
6 = Late Successional Old Growth/American Marten (LSOG/AM)
7 = Riparian/Neotropical Migrant Birds (R/NMB)
8 = Riparian/Neotropical Migrant Birds-Bald Eagle Foraging/Perching Habitat (R/NMB-BE/F/P)
9 = Unique-Special Habitats/MacGillivray's Warbler (U-S/MW)
10 = Unique-Special Habitats/Great Gray Owl (U-S/GGO)
11 = General Protection/Large Tree (GP/LT)
12 = General Protection/Large Tree-Riparian/Neotropical Migrant Birds (GP/LT-R/NMB)

Table 7-4 Late-Successional Reserve Management Strategies For Browns/Round Mtn. LSRs

Browns /Round Mtn. LSRs								
MSA	Dominant PAGs	Stand Level Desired Conditions Guides*					LSR level Desired Conditions Guide	Comments
		CC min/opt	TPA/BA per ac.	Spp.	Layers	Snags/ CWM per ac. (min.)		
NSO/N/R/F/D Northern Spotted Owl/Nesting/Roosting/Foraging /Dispersal	MCW, MCD (nw, n & ne aspects). Climatic climax. Rotation (150-250+ yrs)	50/70%	218-357/ 218-270	DF, PP, WF, SRF	2-3	11-21 snags 10-22 logs	Minimum of 1,000 ac. of suitable core habitat on north/nw/ne aspects of Browns Mtn. within 1920 ac. owl area (62%).	Goal—establish one NSO pair within LSR.
NSO/D/F Northern Spotted Owl/Dispersal/Foraging [combined with N/R/F on MSA map]	MCD (se, s, & sw aspects), PPW/D, LPW/D. Climatic or fire climax as applicable. Rotation 60-150 yrs).	30/50%	35-218/ 144-216	WF, PP, DF, LP	1-2	4-11 snags 5-14 logs	All areas not meeting suitable habitat within owl area. All movement corridors between Browns and other LSRs.	Corridors width variable but no less than 1000 ft. contiguous dispersal habitat at any point at any time.
BE/N/R Bald Eagle/Nesting/Roosting	MCD, MCW, PPD, PPW. Fire or climatic climax as applicable. Rotation 200 yrs+.	na	35+/ 144+	PP, DF	1	3-5 snags 7-15 logs	Promote large diameter (30" dbh+) trees within ½ mi. of perennial water. Open large limbed crowns are desirable.	Maintain/improve existing road closures. Place emphasis on up slope sites away from heavy dispersed rec.
BE/F/P Bald Eagle/Feeding/Perching	MCD, MCW, PPD, PPW. Fire or climatic climax as applicable.	na	na	PP, DF	na	2- 6 snags	Promote large diameter trees and snags within 300 yds. Of perennial water.	Retain/protect snags, broken topped, dead topped trees near foraging areas.
LSOG/NGH Late-Successional Old Growth Habitat. Management Indicator species—MIS Northern Goshawk, pileated woodpecker	MCD, MCW. Climatic climax. Including forested lavas.	40-70%	200+/ 144+	DF, WF, PP, WP	2-3	11-21 snags 10-22 logs	Manage for viable pair territories per NGO guidelines for nest stands and post-fledgling areas (500-600 ac. each). Incorporate prey base spp. habitat needs.	Maintain a diversity of large trees scattered through the stands especially near canopy gaps. Include patches of different structural stages. Minimize open roads.
LSOG/WHW MIS White-headed Woodpecker, flammulated owl, olive-sided flycatcher,	PPD, fire climax. PPW, climatic climax. Including forested lavas.	30-50%	35+/ 144+	PP	1	2-6 snags 2-5 logs	Provide patches of late seral at least 100 ac. each.	Maintain semi-open understory with scattered large diameter PP.
LSOG/BBW MIS Black-backed Woodpecker	LPD, fire climax.	30-50	360/83	LP, PP	1		Provide patches of various age classes of LP.	Retain patches of burned snags for foraging.

Note: Table codes are identified on the following page. Mapped MSAs include several combinations of MSA types which results in a greater number of on-the-ground designations than reflected in this table.

Table 7-4 Late-Successional Reserve Management Strategies For Browns/Round Mtn. LSRs, continued

Browns Mt/Round Mt. LSRs								
MS	Dominant PAGs	Stand Level Desired Conditions Guides*					LSR level Desired Conditions Guide	Comments
		CC min/opt	TPA/BA per ac.	Spp.	Layers	Snags/ CWM per ac. (min.)		
LSOG/AM MIS American Marten, black-backed woodpecker	LPD, LPW. Climatic climax.. Including forested lavas.	30-50%	300-370/ 83-159	LP, WF, SS, SAF	1-2	4-27 snags 19-62 logs	Provide connected patches with 50% of PAGs in suitable condition.	CWM is very important to marten. Burned snag patches are important to BBW.
R/NMB Riparian Habitat. MIS Neotropical Migrant Birds, mink, waterfowl, downy woodpecker, Townsend's big-eared bat, spotted frog	All types including Engelmann spruce.	0-70%	0-218/ 0-216	WF, ES, LP, aspen, shrubs, sedges, etc.	0-3	0-27 snags 0-62 logs	Maintain both riparian zone and adequate buffer on all intermittent and perennial water sources.	Provide a diversity of vegetation spp. and structural stages. Place emphasis on hardwoods, deciduous shrubs and large confers.
U-S/GGO/MW Unique-Special Habitats. MIS Great Gray Owl (dry meadows), MacGillivray's warbler (wet meadows),	Meadows, alpine, other types where feature is embedded in matrix, e.g. talus, cliffs, caves, etc.	na	na	variable-- shrubs, forbs, sedges, etc.	na	na (see comments)	Restore degraded meadows along upper Browns Creek (LP invasion).	Retain existing snags and larger conifers within/ adjacent to meadows.
GP /LT General Protection for LSR/ Large Tree culturing	na	TBD	TBD	TBD	TBD	TBD	Protect LSR areas from risk to a landscape level loss from fire, disturbance or other agents that would destroy, harm or impair LSR function.	May be applied within or adjacent to the LSRs.

Management Strategy Area Codes:

BE/N/R = Bald Eagle Nesting/Roosting habitat
R = Riparian habitat
BBW = Black-Backed Woodpecker
BE/F/P = Bald Eagle Foraging/Perching habitat
U-S = Unique-Special habitats
AM = American Marten
NSO/N/R/F = Northern Spotted Owl Nesting/Roosting/foraging habitat
GP/LT = General Protection/Large Tree habitat

Codes (continued):

NMB = Neotropical Migrant Birds
NSO/D/F = Northern Spotted Owl Dispersal/Foraging habitat
NGH = Northern Goshawk
GGO = Great Gray Owl
LSOG = Late Successional Old Growth habitat
WHW = White-Headed Woodpecker
MW = MacGillivray's Warbler

Guides Codes :

CC = Canopy Coverage (trees)
PP = Ponderosa Pine
MH = Mt. Hemlock
TPA = Trees Per Acre
DF = Douglas-fir
WP = White Pine
Spp. = Dominant and co-dominant trees (ranked priority)
LP = Lodgepole Pine
ES = Engelmann Spruce
Snags = Standing dead trees (condition classes 1-3)
WF = White Fir
SRF = Shasta Red Fir
CWM = Coarse Woody Material (3" diameter or >)
SAF = Subalpine Fir
Layers = Tree canopy layers w/minimum of 20% of total canopy each
TBD = To Be Determined

* References: Cultus/Sheridan LSR Assessment, Table IV-1 (DNF 1996; see Appendix); Interior Columbia Basin Ecosystem Management Project (FS/BLM 1997).

(#1) Northern Spotted Owl/Nesting/Roosting/Foraging/Dispersal (NSO/N/R/F/D)

This MSA is allocated to 980 acres or about 13% of the Browns Mountain LSR (Figure 7-6). There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSA has been designated that predominantly occupies the north and east aspects of Browns Mountain. The conditions are generally very good. The most significant effect has been fragmentation from past timber harvest units.

Existing Condition: This MSA is dominated by late/old-structural stages (80%), interspersed with young plantations (20%), on mesic north aspects mixed conifer plant associations. White fir stands dominate the overstory, with ponderosa pine and Douglas-fir losing representation in the absence of disturbance events. Diversity of tree species is the greatest of all MSAs within these LSRs, with pockets of western white pine, chinkapin, lodgepole pine and occasionally mountain hemlock scattered on the north and east slopes of Browns Mountain. Stand densities are chronically high throughout the late/old-structural stage stands, and occasionally high in the developing plantations. Snags and coarse woody material (CWM) are generally abundant through most of the undisturbed stands.

Desired Condition: Provide an uneven-aged forest of mature and old-growth seral stages with a diversity of tree species (Irwin, 1986). Douglas-fir and ponderosa pine should be overstory dominants in order to meet nesting habitat needs of the spotted owl. White fir, western white pine and lodgepole pine will contribute to the multi-storied structure and canopy cover. Small canopy gaps together with abundant snags and coarse woody material will be important to the maintenance of owl prey base species. Fragmentation and its associated edge effects will be reduced as the forest matures. This MSA's size is adequate to meet the **core nesting area** needs of the spotted owl (i.e. approximately 1,000 acres in eastside habitats). However, at least 3,000 acres of **home range** habitat (including the core area) is needed to support a breeding pair of owls. Therefore, the adjacent MSAs will have modified Desired Conditions to meet both their primary featured species objectives as well as provide foraging and dispersal habitat for spotted owls. Specifically, the MSAs for bald eagle/nesting/roosting and late-successional old growth/northern goshawk will be managed to meet these dual needs. The long-term goal is to establish an owl pair on Browns Mountain and to provide suitable habitat as long as possible before succession, insect/disease and/or wildfire change the conditions of habitat suitability.

Representative Stand Condition (Summary):

For each MSA, a representative stand is displayed of conditions that are currently existing. Although many stands generally comprise an individual MSA, the representative stand is used to give the reader an understanding of the common forest stand conditions found in each MSA. As there are approximately 200 unique stands mapped within the LSRs, the representative stand is used to portray a simpler image of each MSA, and is not intended to be a comprehensive listing of on-the-ground conditions.

(#1) Representative stand and existing conditions within NSO/N/R/F/D MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
164	MCD	CWH111	6	WF	DF/PP	166	45	360 H	11 tpa	---

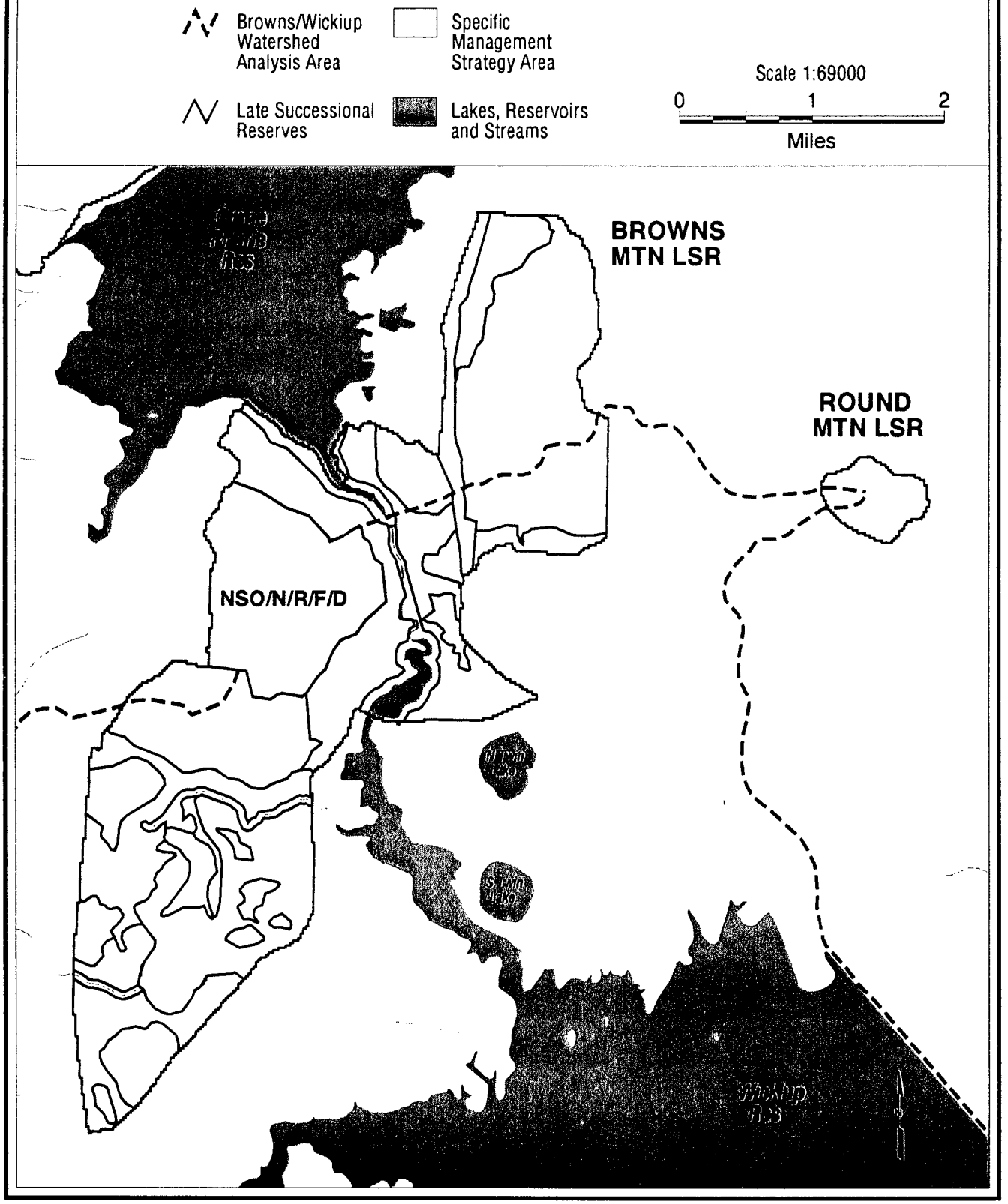
Note: Browns Mountain LSR stand. See Table A-3 for details on plant associations and Table A-5 for definitions of seral stage located in the Appendix.

Fig. 7-6

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Northern Spotted Owl/Nesting/Roosting/Foraging/Dispersal



(#2) Bald Eagle/Nesting/Roosting MSA (BE/N/R)

This MSA is allocated to 1,050 acres or about 14% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Three individual MSAs are designated with one adjacent to Crane Prairie Reservoir and west of the Deschutes River, the second east of the Deschutes River, and the third east of Crane Prairie Reservoir in the extreme northern end of the LSR. Currently these MSAs are in good condition because about 86% is classified in the late seral stage, and they are supporting four active eagle nests.

Existing Condition: This MSA is predominately comprised of late-old multi-storied stands on mixed conifer dry sites. Existing fuel loads and stand densities are relatively high, a direct result of active fire exclusion efforts of the past several decades. Approximately 30% of the stands in this MSA currently meet the desired structural composition of 6-10 large diameter trees (32"+ dbh) per acre, with the majority of stands only slightly lacking these conditions. Multi-canopied, high density stand conditions currently limit future attainment of the desired structural size classes for the majority of these stands.

Desired Condition: Provide large (32"+) Douglas-fir and/or ponderosa pine trees at a density of 6-10+ trees per acre across 50% of the MSA at all times (DNF, 1996). Clumps of large trees with substantial sized limbs at mid-canopy are also required for potential winter roosting (USDA Forest Service 1991). Understory and mid-story stocking and species composition should be adequate to ensure that overstory objectives are maintained through time. Snags and dead topped trees are a necessary component in the MSA for perching.

(#2) Representative stand and existing conditions within BE/N/R MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
163	MCD	CWS1 15	6	WF	PP/DF	222	65	444 H	3 tpa	---

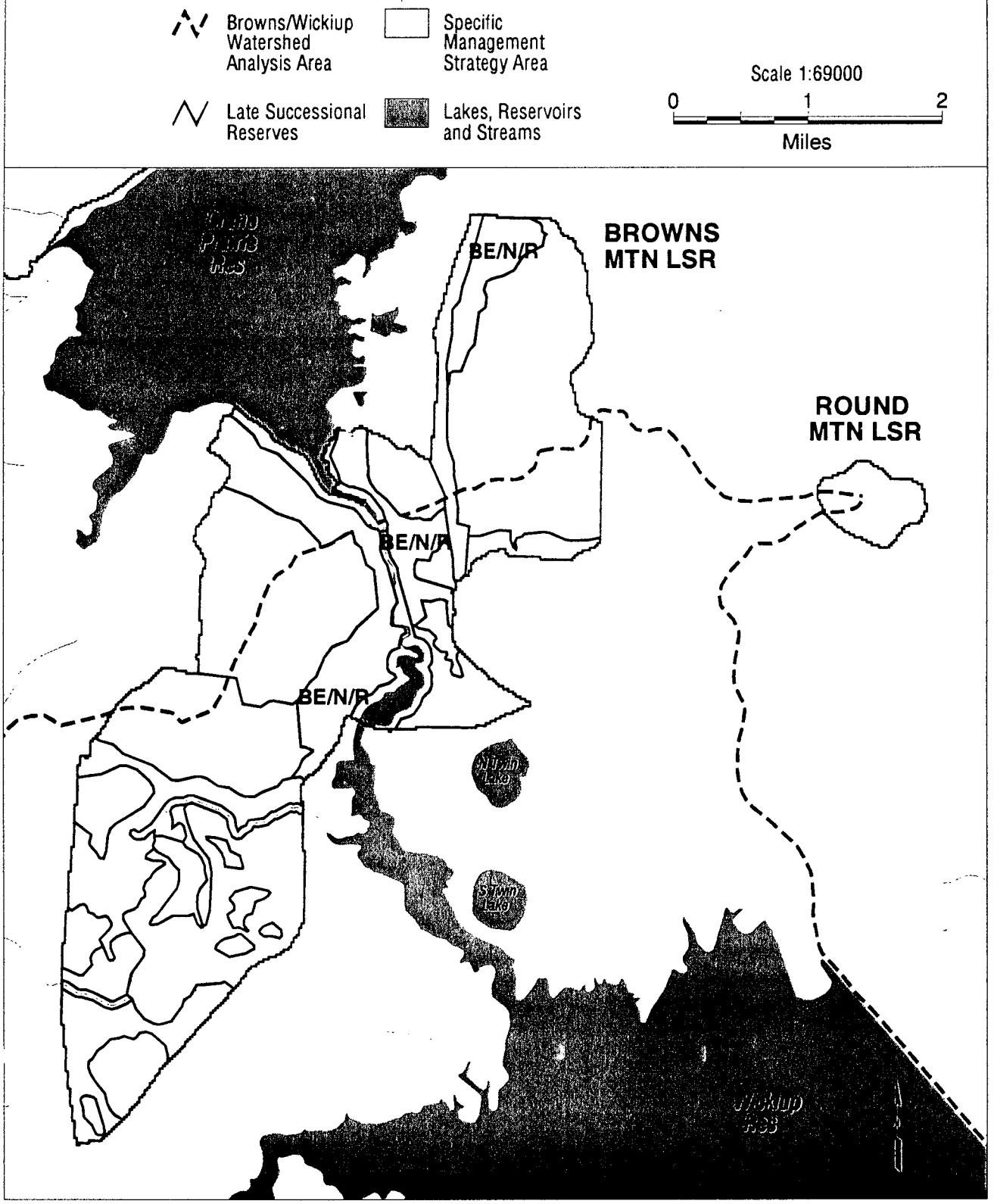
Note: Browns Mountain LSR stand

Fig. 7-7

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Bald Eagle/Nesting/Roosting



(#3) Late Successional Old-Growth/Northern Goshawk (LSOG/NGH)

This MSA is allocated to 2,320 acres or about 31% of the combined area of both LSRs. The entire Round Mountain LSR is in this MSA allocation (224 acres). Four individual MSAs have been designated that are located in the south central portion of the Browns Mountain LSR (2 MSAs), the northern portion of Browns, and at Round Mountain. The condition of this MSA is variable due to its large size and spatial distribution. The most significant negative condition is lack of late-seral forest patches in some areas of the MSA and the general low levels of snags and CWM, which reduces prey base abundance.

Existing Condition: This MSA is comprised almost entirely of mixed conifer dry plant associations, with late/old structural stages represented on about 52% of the MSA. Mid-structural stages occupy about 30% of the area, and early-structural stages fill in about 19% of the area. The existing conditions currently provide a mosaic of seral/structural stages for horizontal diversity, with most stands at high relative stand densities. Snags and coarse woody material is variable throughout most of this MSA, with low amounts in the early- and mid-structural stages, and higher amounts in the late/old multi-storied stand structures.

Desired Condition: Provide a mosaic of forested age classes with a predominance of mature and old-growth forest stands for nesting. Large trees within heavily canopied stands are required for nesting (Bull 1992). Nesting habitats should be maintained in stands at least 30 acres in size with a preference for north slopes and areas near water sources. Post-fledgling areas should surround the nest areas and average 400 acres. A mosaic of seral stages is especially important for protective cover for fledglings and prey species, which are very diverse. Foraging areas are the third habitat component and should have high horizontal diversity with small patch sizes. About 40% should be in the mature/old-growth stages (Reynolds et al. 1991).

(#3) Representative stand and existing conditions within LSOG/NGH MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
057	MCD	CWS 115	6	WF	PP/LP	149	48	314 H	21 tpa	2 tpa

Note: Browns Mountain LSR stand

(#3) Representative stand and existing conditions within LSOG/NGH MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
156	MCD	CWS 115	6	PP	WF/ DF	219	60	396 H	2 tpa	---

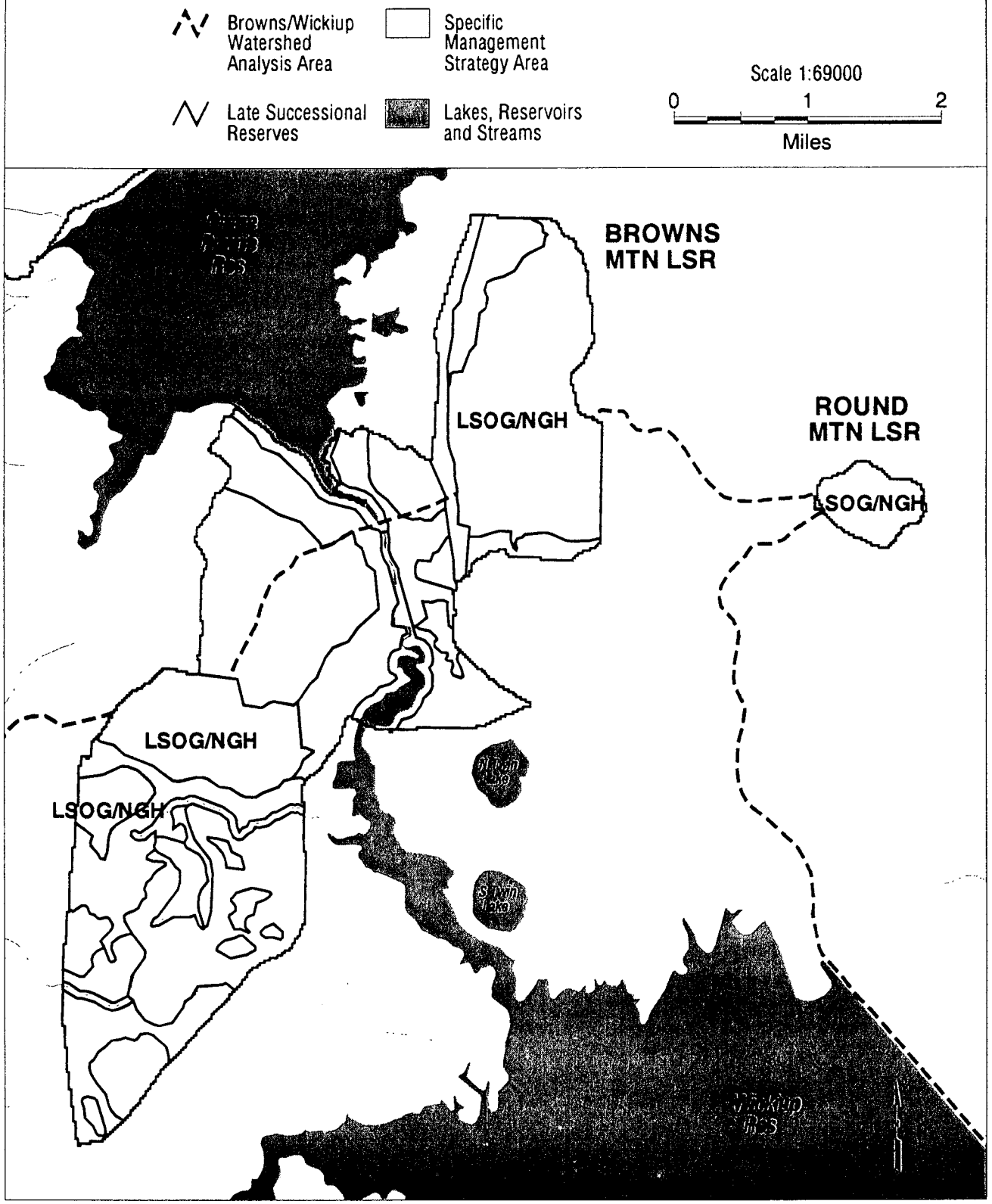
Note: Round Mountain LSR Stand

Fig. 7-8

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Late Successional Old Growth/Northern Goshawk



(#4) Late-Successional Old Growth/White-Headed Woodpecker (LSOG/WHW)

This MSA is allocated to 1,050 acres or about 14% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Ten individual MSAs have been designated that are scattered throughout the LSR where ponderosa pine dry PAGs are dominate. The conditions are highly variable due to the spatial distribution. The most significant negative effect has been the suppression of the natural fire cycle.

Existing Condition: This MSA is dominated by late/old-structural stages (66%) that lie predominantly on ponderosa pine dry plant associations. Ponderosa pine stands dominate the overstory, with lodgepole pine and white fir gaining representation in the absence of disturbance events. Stand densities range from moderate to high, and existing fuel loads are highly variable due to the broad spatial distribution of this MSA. Snags and coarse woody material ranges from low to moderate through most of these areas.

Desired Condition: Provide a semi-open late-successional forest where thick barked, fire resistant species such as ponderosa pine and Douglas-fir are dominant in the overstory. Large diameter mature ponderosa pine are a key feature (Dixon, 1995). Generally, a single storied stand, but inclusions of regeneration patches, pole stands and shade intolerant species are present to provide diversity and niches for dependent species. Snags and CWM will occur in a patchy distribution with some areas below minimum standards and some at optimum levels. Fire will be a significant disturbance element in these stands.

(#4) Representative stand and existing conditions within LSOG/WHW MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
111	PPD	CPS 214	6	PP	LP/WF	101	32	252 H	2 tpa	4 tpa

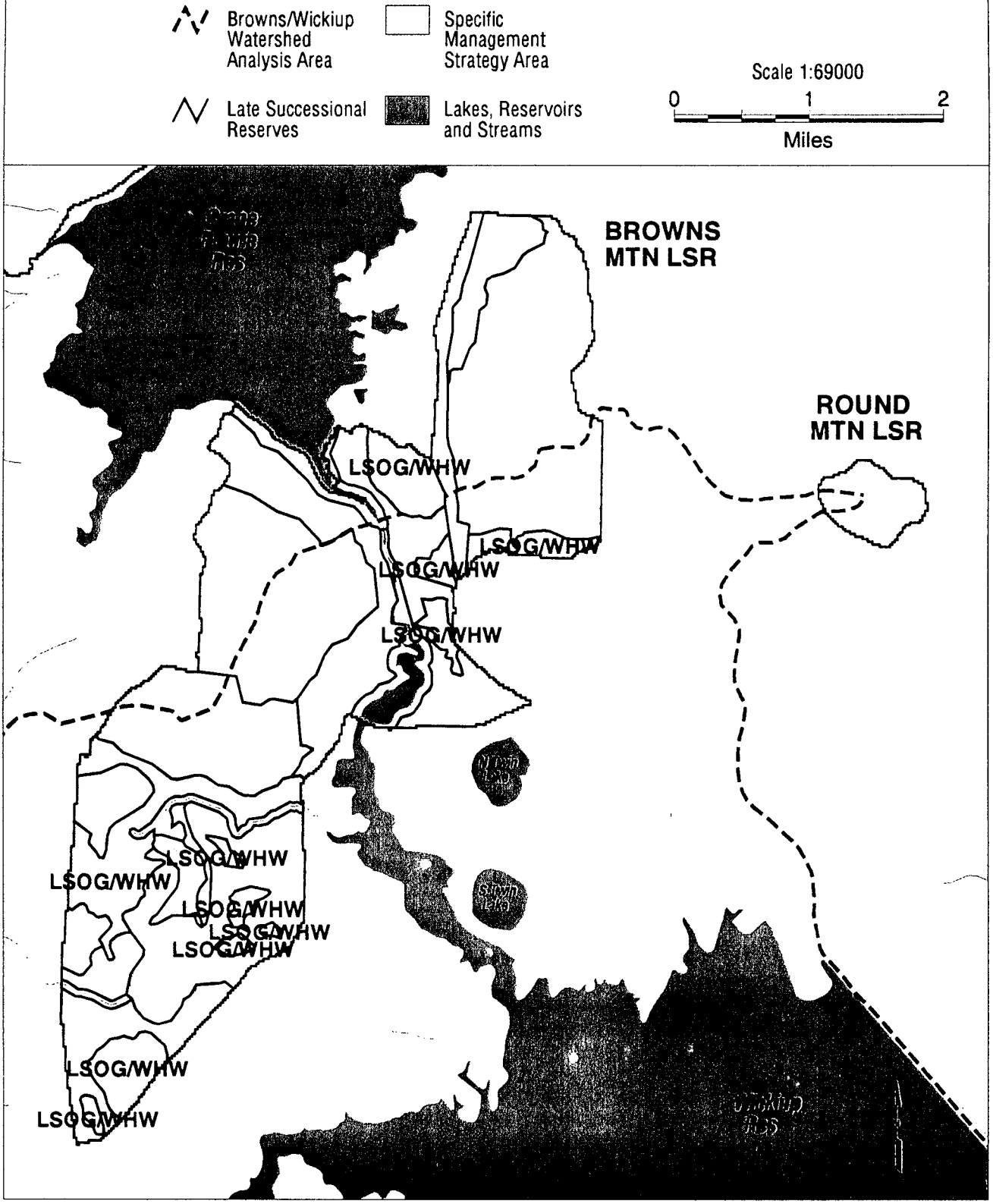
Note: Browns Mountain LSR stand

Fig. 7-9

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Late Successional Old Growth/White-Headed Woodpecker



(#5) Late-Successional Old Growth/Black-Backed Woodpecker (LSOG/BBW)

This MSA is allocated to 405 acres or about 5% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Two individual MSAs have been designated that are in close proximity in the extreme southern end of the LSR. The condition of this MSA is poor due to the lack of late-seral lodgepole pine and snags.

Existing Condition: This MSA is dominated by lodgepole pine dry plant associations, with mid-structural stages the predominant condition. Canopy cover ranges from 10% to 70% (average of about 30%), and existing fuel loads range from low to moderate, a result of salvage harvest efforts following recent mountain pine beetle epidemics. Snags and coarse woody material is typically low through most of this MSA, with very little late/old lodgepole pine stand structures.

Desired Condition: Provide mature and old-growth forest conditions within the capability of the PAGs, which are dominated by the lodgepole pine dry type. Snag density and recruitment is an important stand feature. This MSA is of marginal size for the home range requirements of a breeding pair (956 ac.; Marshall 1992), however the black-back utilizes mixed conifer and spruce forests. Thus, the adjacent MSAs and habitat outside the LSR should meet the home range need. This species is closely associated with bark beetles, which is why mature and over mature stands are critical.

(#5) Representative stand and existing conditions within LSOG/BBW MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
013	LPD	CLS 211	5	LP	PP	55	24	143M	---	3 tpa

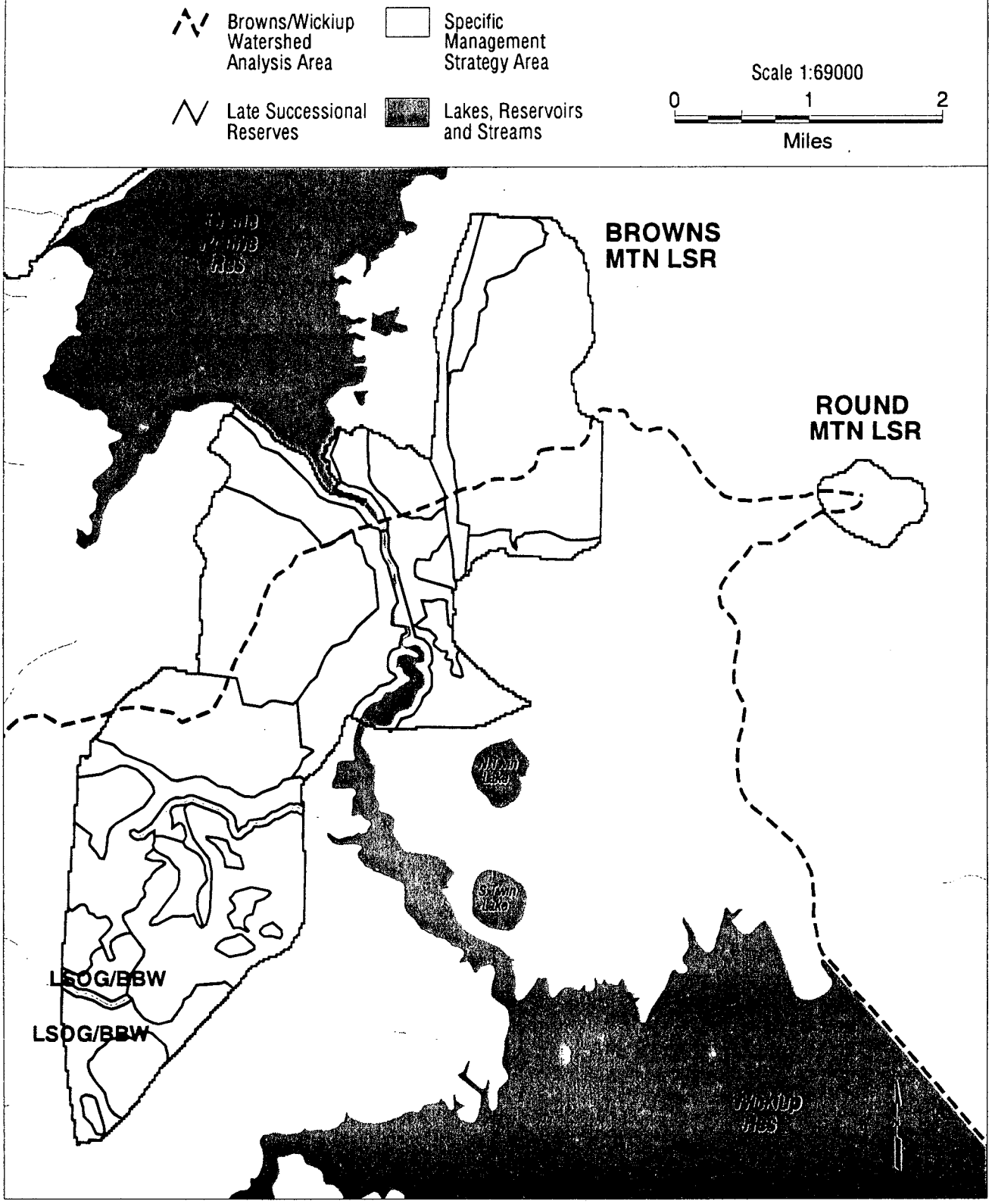
Note: Browns Mountain LSR stand

Fig. 7-10

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Late Successional Old Growth/Black-Backed Woodpecker



(#6) Late-Successional Old Growth/American Marten (LSOG/AM)

This MSA is allocated to 1,030 acres or about 13% of the Browns LSR. There is no allocation of this MSA in the Round Mountain LSR. Three individual MSAs are designated with two in the extreme southern portion of the LSR and one in the central portion on the east side. The condition of this MSA is variable with excellent habitat in the extreme southern designation and the others only fair due to dominance by early- and mid-seral forest stages.

Existing Condition: This MSA is dominated by lodgepole pine dry and wet plant associations, with mid-structural stages the predominant condition. Canopy cover ranges from 10% to 70% (average of about 35%), and existing fuel loads range from low to moderate, a result of salvage harvest efforts following recent mountain pine beetle epidemics. Snags and coarse woody material is generally low through most of this MSA, with one area of excellent habitat conditions within the extreme southern portion (stand number 012, 130 acres).

Desired Condition: Provide mature and old-growth forest conditions within the capability of the PAGs, which are dominated by lodgepole pine dry and wet types. Canopy cover and CWM levels should be near optimum for marten and are more important attributes than tree sizes. Canopy gaps and other openings should not have widths greater than commonly traversed by marten. Horizontal heterogeneity of the stands is important (Ruggiero, L.F. ed., et al., 1994). Snags will be managed at optimum levels in order to provide steady inputs to CWM levels through time.

(#6) Representative stand and existing conditions within LSOG/AM MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
074	LPD	CLS 211	5	LP	PP	38	31	111 L	3 tpa	2 tpa

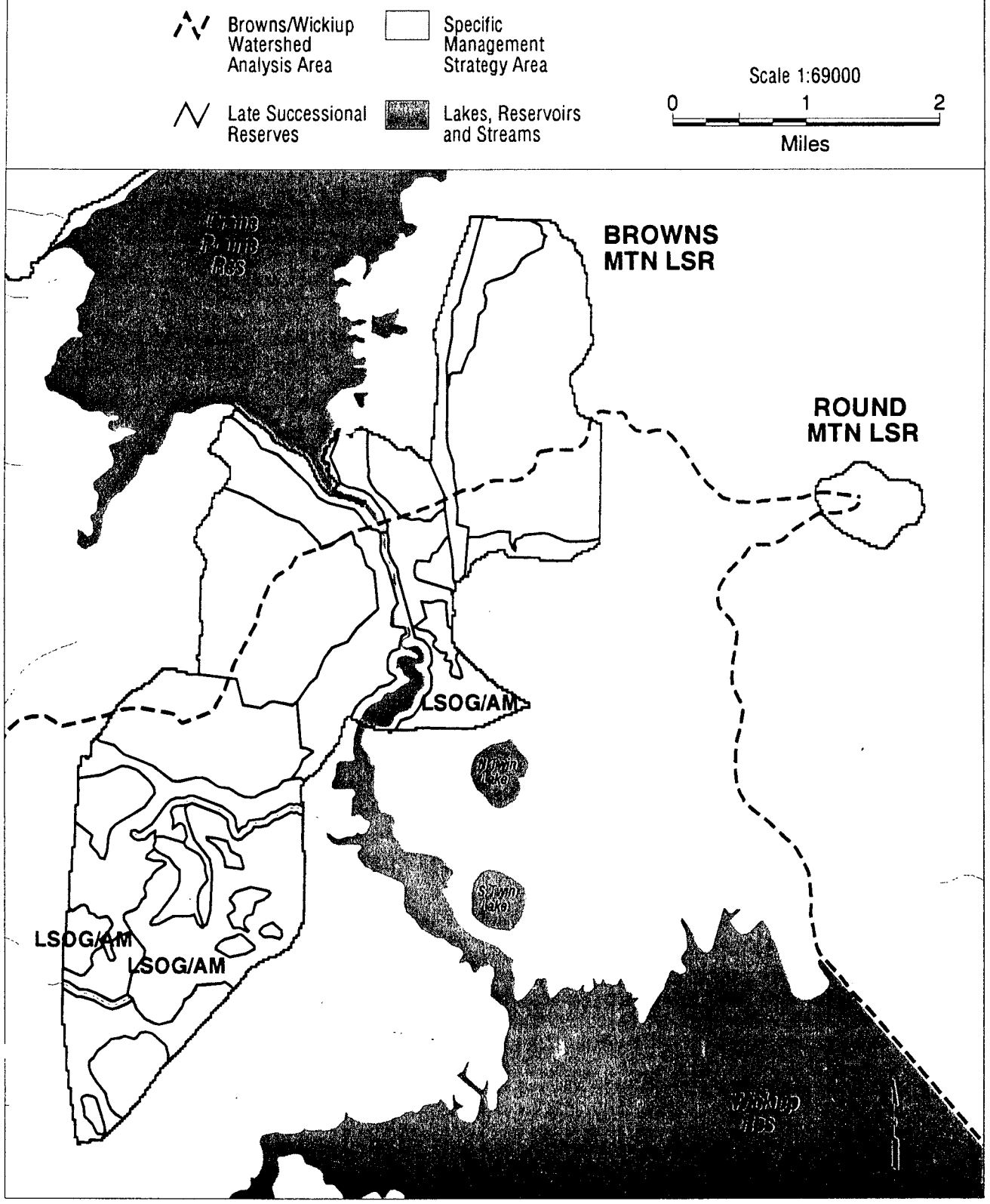
Note: Browns Mountain LSR stand

Fig. 7-11

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Late Successional Old Growth/American Marten



(#7) Riparian/Neotropical Migrant Birds (R/NMB)

This MSA is allocated to only 20 acres or less than 1% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSR has been designated that is an intermittent channel (upper Browns Creek) in the southern portion of the MSA near the Cascades Lakes Highway. The MSA is in poor condition due to past timber salvage activities and a cinder pit. Approximately 100% of the area will be in designated Riparian Reserves.

Existing Condition: This small MSA is comprised of previously harvested lodgepole pine mid-structural stages, interspersed with a cinder pit. Lodgepole pine and ponderosa pine are present. Crown closure is relatively open, but is slowing filling in following salvage harvest disturbance during the past decade. Stand densities are moderate throughout. Snags and coarse woody material are at low levels.

Desired Condition: Provide coniferous cover within the capability of the PAG (lodgepole pine dry) to meet the needs of neotropical species requiring forested cover (Hejl et al., 1995). Evaluate the potential for willows and other species that would be desirable for neotropical migrant birds (Guenther et al., 1978).

(#7) Representative stand and existing conditions within R/NMB MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
013	LPD	CLS 211	5	LP	PP	55	24	143 M	---	3 tpa

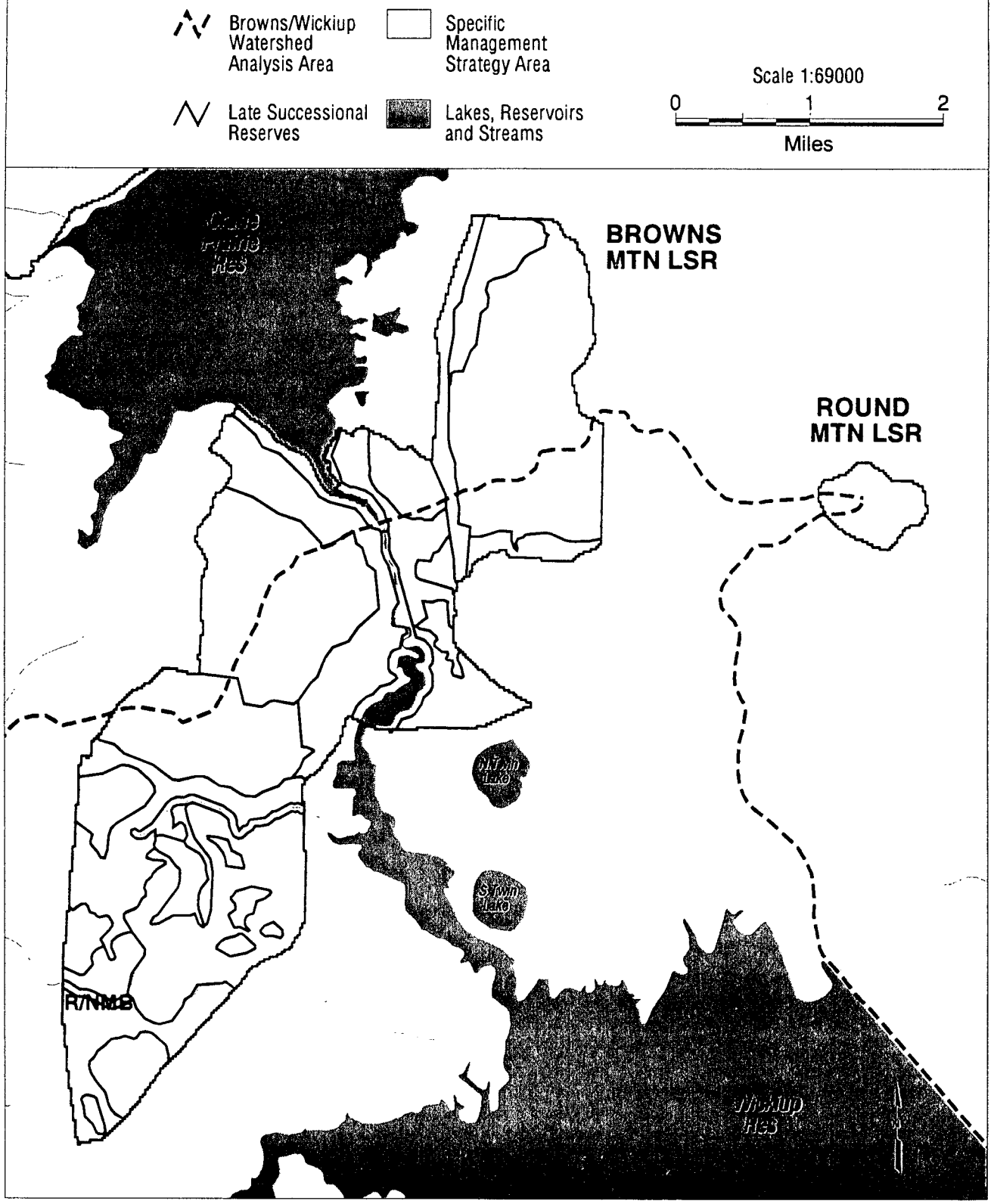
Note: Browns Mountain LSR stand

Fig. 7-12

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Riparian/Neotropical Migrant Birds



(#8) Riparian/Neotropical Migrant Birds-Bald Eagle Foraging/Perching (R/NMB-BE/F/P)

This MSA is allocated to 270 acres or about 4% of the Browns Mountain LSR. There is no MSA allocation in the Round Mountain LSR. Two individual MSAs are designated with one in the upper end of the Deschutes Arm of Wickiup Reservoir and the other along lower Browns Creek. Currently these MSAs are in good condition. Approximately 67% of the area will be in designated Riparian Reserves.

Existing Condition: This MSA is comprised of a mix of stand conditions and biophysical environments. Stands are an even mix of early, mid, and late/old structures, residing on ponderosa pine, lodgepole pine, meadow, and riparian plant communities. Existing fuel loads and stand densities are generally high, resulting from active fire exclusion efforts of the past several decades. On the drier sites (PPD, LPD), multi-canopied, high density stand dominance is stressing the health and vigor of large diameter perch trees. On the wetter sites, lodgepole pine and Engelmann spruce appear to be functioning along more native disturbance regimes.

Desired Condition: Provide large diameter Douglas-fir and ponderosa pine including snags and dead-topped trees for perching of eagles (Gerrard et al., 1988). Within the Riparian Reserve provide an emphasis on the maintenance of willows and other riparian associated deciduous species. Maintain adequate populations of fish forage species in the Deschutes River and lower Browns Creek to meet eagle needs.

(#8) Representative stand and existing conditions within R/NMB-BE/F/P MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
068	LPW	CLS 212	6	LP	PP/WF	101	35	248 H	---	4 tpa

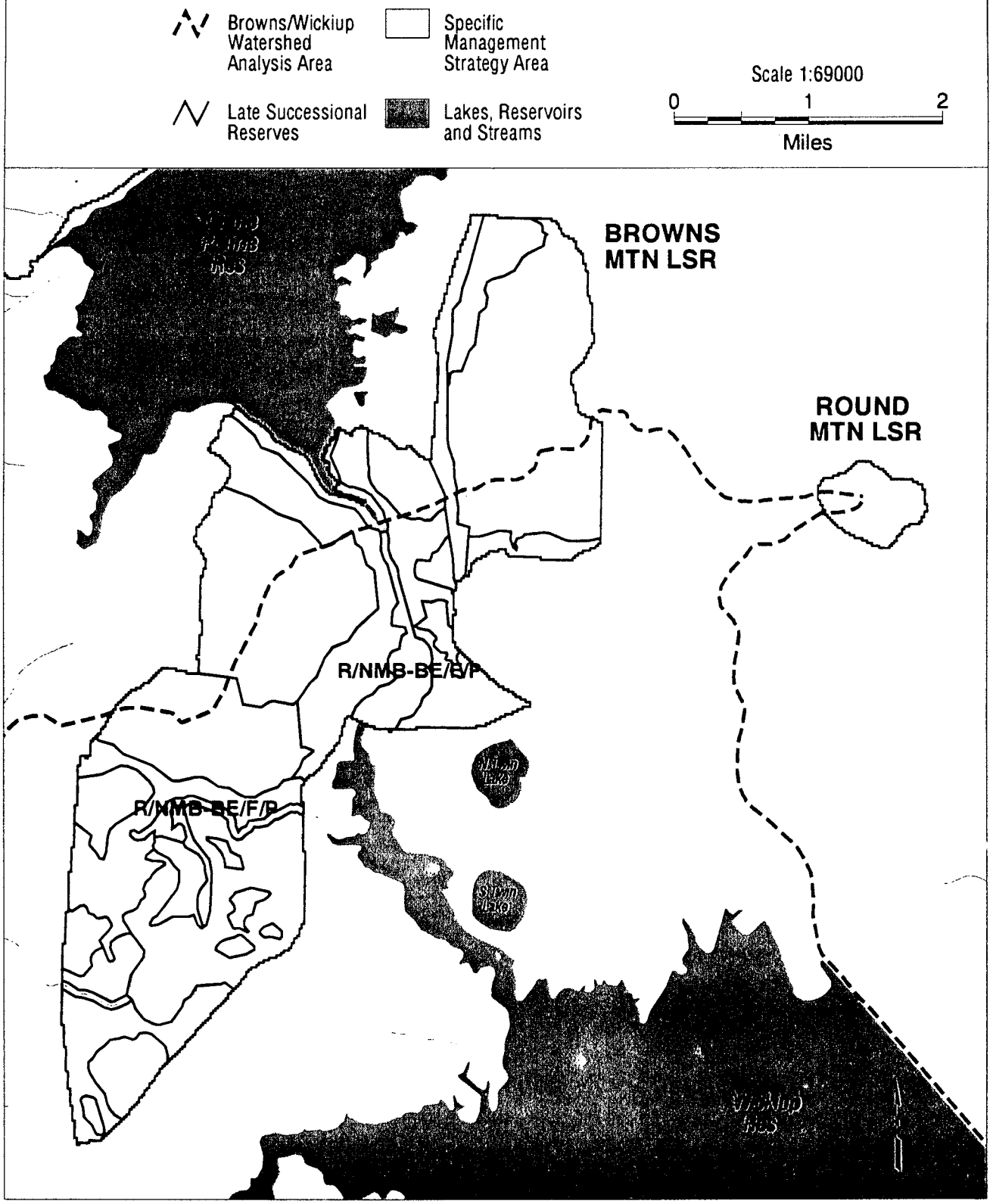
Note: Browns Mountain LSR stand

Fig. 7-13

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Riparian/Neotropical Migrant Birds - Bald Eagle/Foraging/Perching



(#9) Riparian/Neotropical Migrant Birds - Unique Special/MacGillivray's Warbler (R/NMB-US/MW)

This MSA is allocated to 90 acres or about 1% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSA is designated that is located in the upper reaches of Browns Creek. Currently this MSA is in very good condition. The principal concern is the slow invasion of the meadow habitats by lodgepole pine.

Existing Condition: This MSA is predominately comprised of early and open stages on meadow and meadow-fringe habitats. Existing fuel loads are moderately high, yet stand densities are typically low to moderate for the site conditions, a result of mountain pine beetle events. Meadow encroachment by tree species (LP, ES, WF) continues, in the absence of fire and periodic flooding disturbances. Snag and coarse woody material are generally at adequate levels throughout this MSA.

Desired Condition: Provide natural early-seral meadow habitats that meet the needs of dependent species with an emphasis on neotropical migrant birds. Promote shrubs with an emphasis on willows (Sharp, 1992). The retention of lodgepole pine is acceptable provided that the primary objective is met. Lodgepole trees, snags and logs are meeting the needs of a variety of species including elk in the area. Approximately 97% of the area will be in designated Riparian Reserves.

(#9) Representative stand and existing conditions within R/NMB-US/MW MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
024	MDW	MW	0	LP	SP/WF	47	25	126 L	---	10 tpa

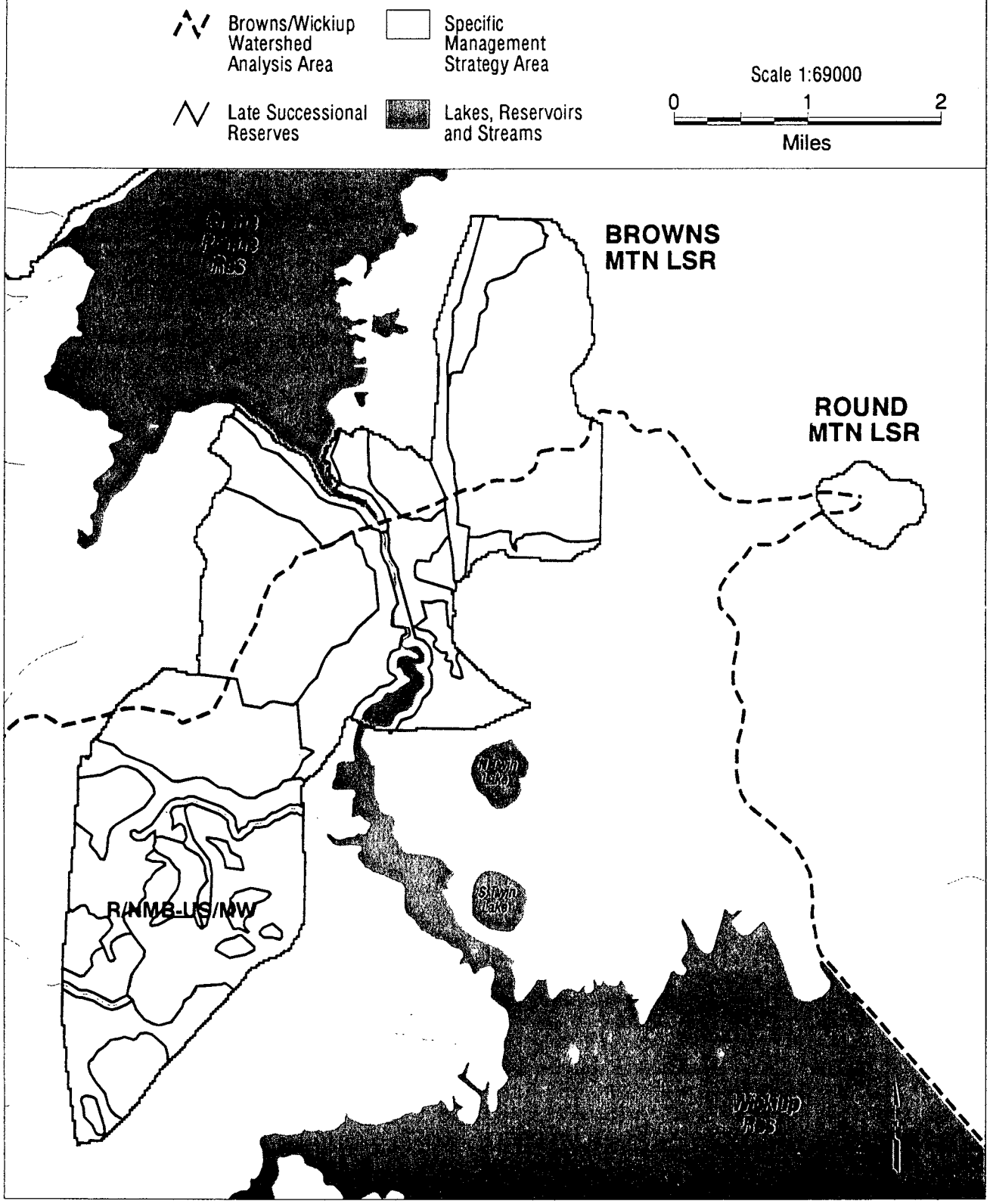
Note: Browns Mountain LSR stand

Fig. 7-14

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Riparian/Neotropical Migrant Birds - Unique Special/MacGillivray's Warbler



(#10) Unique Special/Great Gray Owl (US/GGO)

This MSA is allocated to 40 acres or less than 1% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSA is designated that is located adjacent to upper Browns Creek's Riparian Reserve on the east side. Currently the MSA is in fair condition. The principal concern is the loss of early-seral owl foraging habitats to lodgepole pine plantation growth.

Existing Condition: This small MSA is comprised entirely of early- to mid-structural stages on lodgepole pine plant associations. Existing fuel loads are variable, and stand densities are at moderate to high levels, a result of increasing stand densification. Approximately 40% of the area is in an established lodgepole pine plantation, which is successionally advancing from early-seral to mid-seral stages, in the absence of disturbance. Snag and coarse woody material are generally at adequate levels throughout this MSA.

Desired Condition: Provide open patches of early-seral habitat at all times across at least 50% of the MSA. Favor grasses and forbs in the openings and suppress conifer re-establishment or harvest conifer trees to set succession back. Ensure that adequate nesting habitat is available in the adjacent MSAs that is within the great gray owl's potential home range area (Duncan, 1994).

(#10) Representative stand and existing conditions within US/GGO MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									>12"	LP>8"
020	LPD	CLS 211	4	LP	PP	109	30	262 H	---	16 tpa

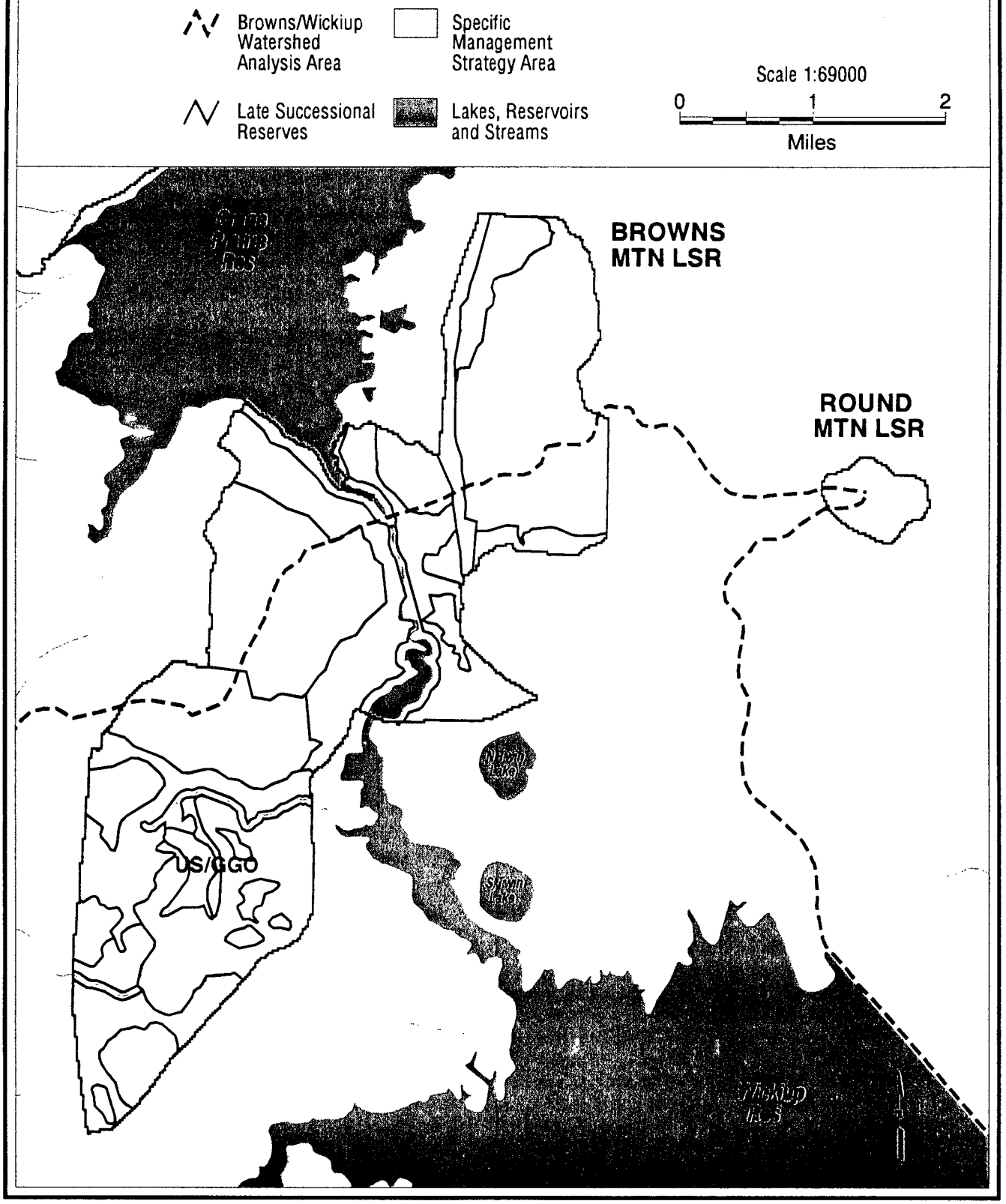
Note: Browns Mountain LSR stand

Fig. 7-15

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

Unique Special/Great Gray Owl



(#11) General Protection/Large Tree MSA (GP/LT)

This MSA is allocated to 190 acres or about 3% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSA has been designated that parallels the east side of road #4270, which is east of Crane Prairie Reservoir. The condition of this MSA is variable but generally poor due to fuel loading.

Existing Condition: 94% of this MSA is comprised of late-old multi-storied stands on ponderosa pine dry sites. Existing fuel loads and stand densities are relatively high, a direct result of active fire exclusion efforts of the past several decades. Adjacent stands are of very high stand-replacing fire risk, which compromises the long-term management futures of this MSA. All of the stands in this MSA currently meet or exceed the structural composition of 6-10 trees per acre greater than 24" dbh. Multi-canopied, high density stand dominance, and generally poor health and vigor limits the future stand growth into larger structural size classes.

Desired Condition: Manage tree and shrub densities together with other fuel components to reduce the risk of wildfire that could threaten adjacent LSR lands. The MSA may have a maximum width of 300 feet. Large Douglas-fir and/or ponderosa pine will be promoted within this MSA where feasible. Snags and logs will be managed at near minimum levels or in strategic patches. Note that the area immediately to the west of the MSA is in a very high risk condition for a landscape level loss from wildfire, but it is outside of the LSR boundary.

(#11) Representative stand and existing conditions within GP/LT MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
140	PPD	CPS 214	6	PP	LP	103	33	240 H	3 tpa	---

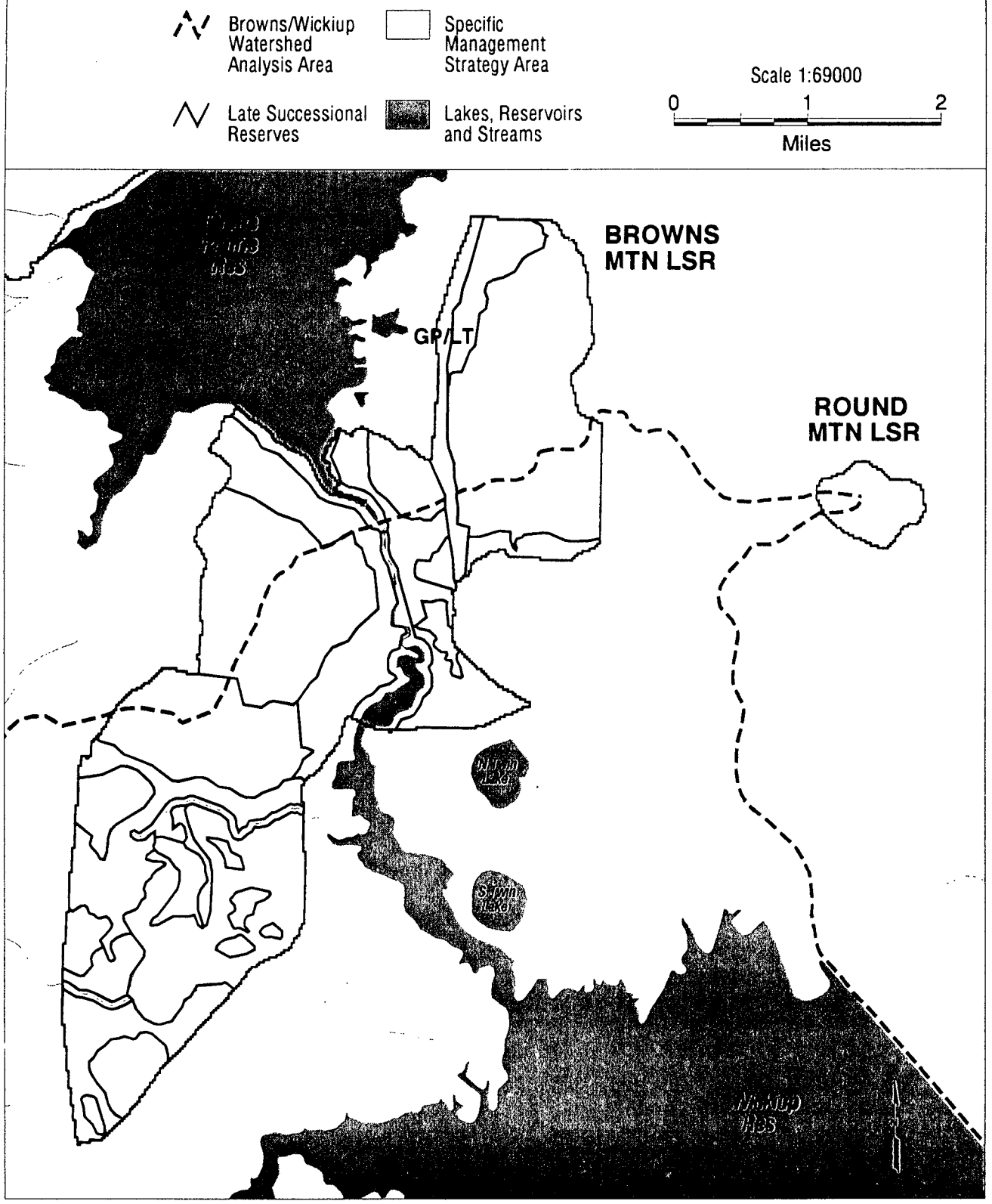
Note: Browns Mountain LSR stand

Fig. 7-16

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

General Protection/Large Tree



(#12) General Protection/Large Tree-Riparian/Neotropical Migrant Birds (GP/LT-R/NMB)

This MSA is allocated to 110 acres or about 2% of the Browns Mountain LSR. There is no allocation of this MSA in the Round Mountain LSR. Only one individual MSA has been designated along the shoreline of Crane Prairie Reservoir and both sides of the Deschutes River arm of the reservoir. The condition of this MSA is typically poor for the general protection objective and fair for the neotropical bird objective.

Existing Condition: This MSA is predominately comprised of late-old multi-storied stands on mixed conifer dry sites. Existing fuel loads and stand densities are generally high, resulting from active fire exclusion efforts of the past several decades. Multi-canopied, high density stand dominance is limiting the general protection strategy for stands located adjacent (and on the upper slopes) to this MSA.

Desired Condition: Manage tree and shrub densities together with other fuel components to reduce the risk of wildfire that could threaten adjacent LSR lands within that portion of the designation outside of the Riparian Reserve area. The fuels management portion will generally not exceed a maximum width of 300 feet. Within the Riparian Reserve the emphasis will be to provide habitats for riparian dependent bird species, e.g. willows. Throughout the entire MSA large lodgepole pine and/or ponderosa pine will be promoted where feasible. Snags and logs will be managed near minimum levels outside the Riparian Reserve and at higher levels within it.

(#12) Representative stand and existing conditions within GP/LT-R/NMB MSA

Stand #	PAG	Plant Assoc.	Seral Stage	Major spp.	Minor spp.	Basal area	Crown class %	SDI rating	Snags per acre	
									> 12"	LP > 8"
113	MCD	CWS 115	6	WF	DF/PP	231	71	470 H	6 tpa	6 tpa

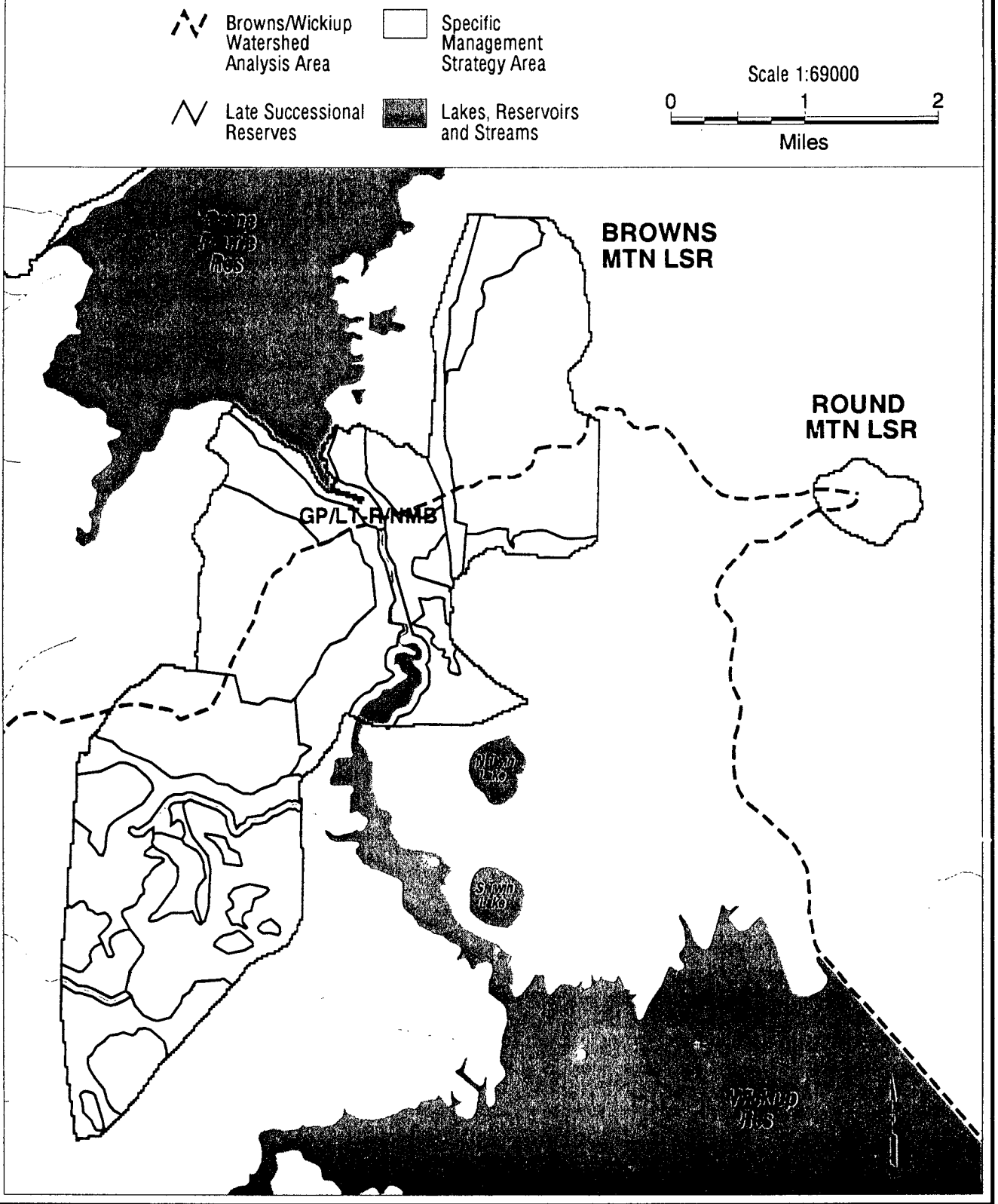
Note: Browns Mountain LSR stand

Fig. 7-17

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Management Strategy Areas for Late Successional Reserves

General Protection/Large Tree - Riparian/Neotropical Migrant Birds



Criteria For Developing Appropriate Treatments

Three Treatment Criteria have been developed for application to the Browns/Round Mtn. LSRs. Included are: 1) Habitat Quality, 2) Ecological Function, and 3) Human Safety/Resource Values. The Habitat Quality criteria is used to evaluate each individual Management Strategy Area (MSA) using the following attributes: canopy cover, canopy layers, structural stage, tree density, tree species, snags, coarse woody materials, horizontal (alpha) diversity, understory conditions, and special features (sensitive soils, riparian, aquatic, unique habitats). The Ecological Function criteria is used to evaluate each MSA using the following attributes: change in dominant disturbance regime (fire or climatic), stand sustainability, spatial relationship to sensitive features (rarity, special attributes), landscape function (connectivity/flows), size/influence and spatial distribution. The Human Safety/Resource Values criteria is used to evaluate each MSA using the following attributes: public safety, firefighter safety, fuel characteristics (volume, type, arrangement, canopy cover, topographic position, slope, aspect, etc.), intrinsic value of the MSA, and value of nearby resources (streams, rare habitats, facilities).

The MSAs were individually rated using the Treatment Criteria and the described attributes. The results are summarized in the following Table 7-5. The attributes are used to compare the current condition of each MSA to the Desired Condition. The attributes data are very diverse as described and have variable levels of completeness and precision. As an example, all the stands within the LSRs have had formal stand exams and this data has been summarized in the vegetation sections of the watershed analysis portion of this report. The detailed exam data is in the analysis files for future use at the project level. Refer to the preceding Table 7-3 for a review of the general existing conditions of the MSAs.

The treatment criteria and their attributes are, however, only the first coarse filter used to identify restoration opportunities. There is a great deal of stand variability within the MSAs. The following section describes a means to evaluate stand conditions as well as management risk to a landscape level loss from events such as insect/disease and/or wildfire.

Desired Late-Successional Forests

This section summarizes methods to provide a quantitative estimate of LSR conditions, desired suitable habitats, and sustainability risks to each MSA. It describes the thought process for establishing how suitable habitat and sustainability (or stability) would be provided by dominant plant association groups for each MSA, in the present, and over time. This last step is a critical part of a long-term management strategy. This discussion is intended to identify land management risks associated with managing vegetation for late-successional habitat needs which will aid in the development of broad-scale vegetation management scenarios.

Table 7-5

Management Strategies: Assessment of Current to Desired Conditions

Attributes	Management Strategy Areas/Ratings											
	1 (NSO)	2 (BE/N)	3 (NGH)	4 (WHW)	5 (BBW)	6 (AM)	7 (R/NMB)	8 (R/NMB-BE/F)	9 (R/NMB-MW)	10 (GGO)	11 (GP/LT)	12 (GP/LT-R/NMB)
Habitat Quality												
canopy cover	+*	0	-/+*	0	0	-*	-	0	0	0	0	0
canopy layers	+	0	-/+	0	0	0	-	0	0	0	0	+*
structural stage	+*	0	-/+*	+	-*	-*	-*	0	+*	-	+	+*
tree density	+	0	-/+	0	-	-	-	0	-	0	0	+
dominant tree spp.	0	+*	0	+*	+*	0	0	-	0	0	+	+
large trees	+*	+*	-/+*	-	0	0	-	+*	0	-*	+*	+
coarse woody	+	0	-	-	-	-*	0	0	0	-	0	0
snags	+	+	-	-*	-*	-	-*	+	+	-*	-/+*	-*
understory comp.	0	-	+	0	0	0	-	-	+*	0	-	-
Alpha diversity	+	0	+*	-	-	0	+*	0	+	+	0	+
special features	0	0	0	0	0	0	-	+*	+*	+*	+	+*
Overall Sub-Rating	+	+	+	-	-	-	-	+	+	-	+	+
Ecological Function												
disturbance regime	0	-	-	-*	0*	0	0	0	-/+	0	-	+
stand sustainability*	-	-*	-*	-*	0	0*	0*	+	-/+	0	-	0
spatial relationship	+	+*	+	+	0	+	0	0	+	+*	0	+*
landscape function	-*	0	+	+	0	+	0*	+*	+*	0	0/+	+*
size/influence	0	+	+*	+	-	-	-*	0	+	-	0	+
spatial distribution	0	+	+	+	0	-*	-	+	-	-	+*	0
Overall Sub-Rating	**0**	+	+	**0**	**0**	**0**	**0**	+	+	**0**	+	+
Human Safety/ Resource Values												
public safety	+	-	0	+	0	0	0	0	+	+	-	-
firefighter safety	0	0	0	+	0	-	0	0	0	+	-	+
fuel characteristics	-	-	-	0/-	+	-	+	0	-/+	+	-*	-
intrinsic value	+*	+	+	+	0	0	0	+*	+*	+*	0/+	+
adjacent values	+	+	-	0/-	-*	-	+	0	0	0	-*	-*
Overall Sub-Rating	**0**	-	-	**0**	**0**	-	**0**	+	**0**	+	-	-

* The attribute of stand sustainability is more fully developed relative to management risk vs. suitability at a later time.

Note: Refer to the following page for codes and other explanatory information. See Figure 7-5 for locations of MSAs.

Table 7-5 continued
Codes:
Ratings for Desired Condition (DC):

- = Below DC
0 = Neutral to DC
+ = Meets DC
* = significant attribute
dual ratings, e.g. 0/+, denote variability

Definitions (partial):

alpha diversity = horizontal diversity or vegetation patchiness (type or structure).
special features = sensitive soils, aquatic, riparian, caves, other unique habitats.
stand sustainability = stability through time, uses SDI, normalized density, insect/disease occurrence/risks.
disturbance regime = change in the natural system, e.g. fire climax normally vs. suppression by humans.
spatial relationship = juxtaposition, proximity, location relative to other resources and its influence.
landscape function = flows, connectivity, linkage function, rarity, critical function, importance to system.
size/function = significance of acreage, dominance, importance due to proportion of area.
spatial distribution = number of polygons with designation, overall influence, location influence.
fuel characteristics = total loading, type, arrangement, flammability, aspect, slope, ladder fuels, crown cover, etc.
intrinsic value = resource value of individual allocation, economic, social or ecological.
adjacent values = adjoining resource values that may be at risk if the individual MSA has a risk of wildfire or insect/disease. A negative rating indicates that the allocation area poses a threat to valuable adjacent resources, e.g. high fuel loadings and risk of wildfire may damage sensitive visual area.

General Desired LSR Conditions

It is well recognized that forest conditions east of the Cascade Mountains in Oregon are more susceptible to a host of stand disturbances than those forests west of the Cascades (ICBEMP, 1997 and NWFP, 1994). This becomes particularly apparent when assessing watershed and LSR conditions, when the realization is that on most eastside forest communities, suitable late-successional habitat conditions are generally not sustainable indefinitely (Cultus/Sheridan Mtn. LSRAs, 1996; Big Marsh LSRA, 1997).

It is also understood that the need for habitats for threatened and endangered species is both

desired and required by statute, and that public land managers will tolerate higher risk in managing vegetation in late-successional reserves, than in other land allocations. This is an attempt to answer the question: What is the appropriate level of risk management for the Browns/Round Mtn. LSRs?

Methods for Assessing Vegetation Risk Management

Part of the vegetative condition and trend assessment was to look at management of risk, as identified by several descriptive factors. Criteria used to measure existing stability and resiliency of vegetation include: stand density, fuel loads, insect and disease levels, and overall stand vigor (Cochran, et al., 1994). To initially classify stands according to their general stress levels, a risk rating was developed using broad categories of stand density index (SDI), using an ecology concept of upper management zone (UMZ), lower management zone (LMZ), and the relationship of stands to those zones (see Vegetation Appendix Table A-8). SDI figures were calculated for each of the roughly 200 unique stands, and then each stand was assigned a category of low, moderate, or high density, based on the absolute SDI value, as related to "threshold" values established for each plant association group. These density categories are also synonymous with stand risk to disturbance or stress level.

To summarize, low density stands are those that are below the lower management zone (LMZ), moderate density stands fall between the lower management zone and the upper management zone (UMZ), and high density stands are well above the upper management zone, an indicator of high, long-term stand instability. The following table lists those SDI thresholds by PAG.

Table 7-6

Stand Density Index (SDI) and General Density Categories

PAG	Low	Moderate	High
LPD PPD	<120 SDI	121-200 SDI	>200 SDI
MCD LPW PPW	<150 SDI	151-250 SDI	>250 SDI
MH MCW	<200 SDI	201-300 SDI	>300 SDI

Rotating Habitat Conditions Over Time

To establish and maintain long-term management goals of suitable and sustainable habitat conditions for each MSA, a methodology for describing those conditions (or states) is necessary. For the Browns/Round Mtn. LSRs, a "template" was developed to classify the existing and desired conditions (where known) for each MSA. In essence, the template attempts to compare and contrast the habitat suitability of a given MSA, with the stability (or "sustainability") of the vegetation, as determined by species, structure, and density of stands of trees. By way of example, two MSAs were developed to show the generic template approach (Tables 7-7 and 7-8).

Habitat "suitability" is classified into **suitable** or **not suitable** conditions for each MSA within the context of the desired conditions. Vegetation "stability" is classified into low, moderate, or high risk ratings. Each condition is then expressed on separate axes, and then existing data sources are used to populate the fields. See Table 7-9, "Existing LSR Conditions (EC) for Vegetation by MSA and PAG Verses Desired Condition (DC)".

Note that the results in Tables 7-7 and 7-8 are quite different, indicating that suitable habitat conditions and sustainability parameters will often differ greatly by MSA. Due to pressing time limitations, the other MSAs were not classified. However, this template approach offers a conceptual basis for classifying stands into MSAs, to use in establishing: 1) existing conditions; 2) as compared to desired conditions (i.e., long-term); and 3) leading to management recommendations for action, where and when appropriate. See Table 7-10, Existing LSR Conditions as Compared to Recommended LSR Conditions: Upper Management Zones.

Table 7-7

(#1) NSO-N/R/F/D MSA 980 acres, Example 1

Stand Density Risk Rating	Existing Habitat Conditions		Desired Habitat Conditions*	
	Suitable	Not Suitable	Suitable	Not Suitable
High 74%	73%	1%	10-25%	
Moderate 7%	5%	2%	50-60%	
Low 19%	2%	17%	25-30%	
All 100%	80%	20%	80-100%	0-20%

* Note: As there are many criteria comprising suitable habitat for northern spotted owl, not all conditions can be reached and sustained everywhere, over extended durations. The long-term goal is to establish and maintain NSO habitat on the majority of acres, for as long

as possible. This will necessitate acceptance of much higher vegetation collapse risk than in other, less-demanding habitat zones. However, this MSA has a relatively high site potential (i.e., mesic north aspect) that mitigates competitive stresses.

Existing Condition - The existing condition of stands within the MSA NSO-N/R/F/D are: 74% at high stand density (73% is suitable habitat; 1% is not suitable); 7% at moderate density (5% is suitable and 2% is not suitable); and 19% at low density (2% is suitable and 17% is not suitable). In summary, 80% of existing stands are suitable and 20% currently unsuitable habitat for this MSA.

Desired Condition - It is desired to have at least 80% of the stands in a suitable habitat condition, with no more than 25% of the stands at high density and 60% at moderate density levels. The remainder of stands would be at low density levels (25-30% of total is desired).

Fig. 7-18

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Northern Spotted Owl/NRF/D Management Strategy Area

Stand Density Ratings

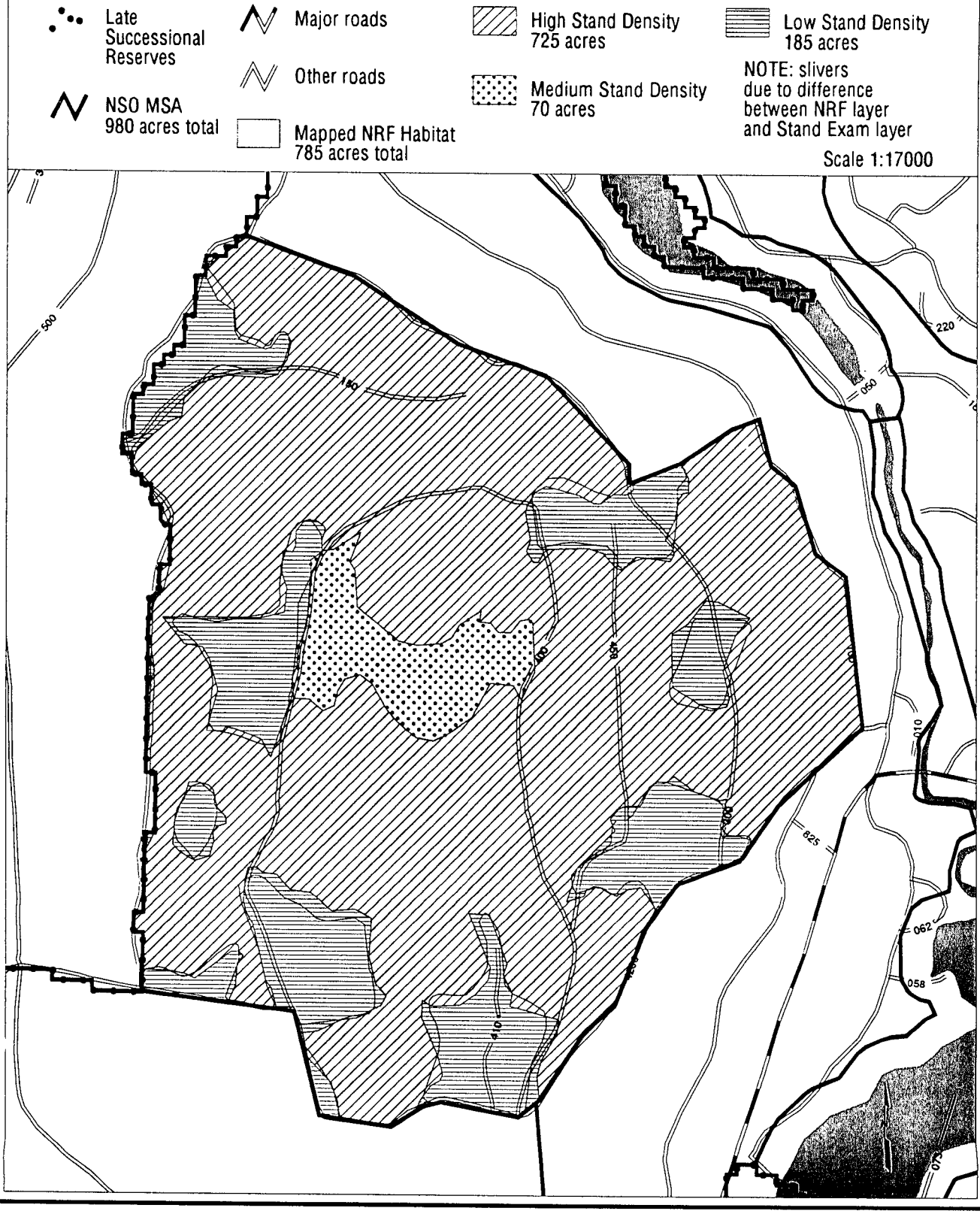


Table 7-8

(#4) LSOG/WHW MSA 1050 acres, Example 2

Stand Density Risk Rating	Existing Habitat Conditions		Desired Habitat Conditions*	
	Suitable	Not Suitable	Suitable	Not Suitable
High 62%	50%	12%	|____20%____|	
Moderate 35%	20%	15%	|____60%____|	
Low 3%	0%	3%	|____20%____|	
All 100%	70%	30%	50%	50%

* Note: The white-headed woodpecker offers a sharp contrast to the northern spotted owl in habitat requirements (i.e., fire climax site conditions verses climatic climax).

Fig. 7-19

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

LSOG White-Headed Woodpecker Management Strategy Area

Stand Density Ratings

Late Successional Reserves

WHW MSA
1070 acres total

Major roads

Other roads

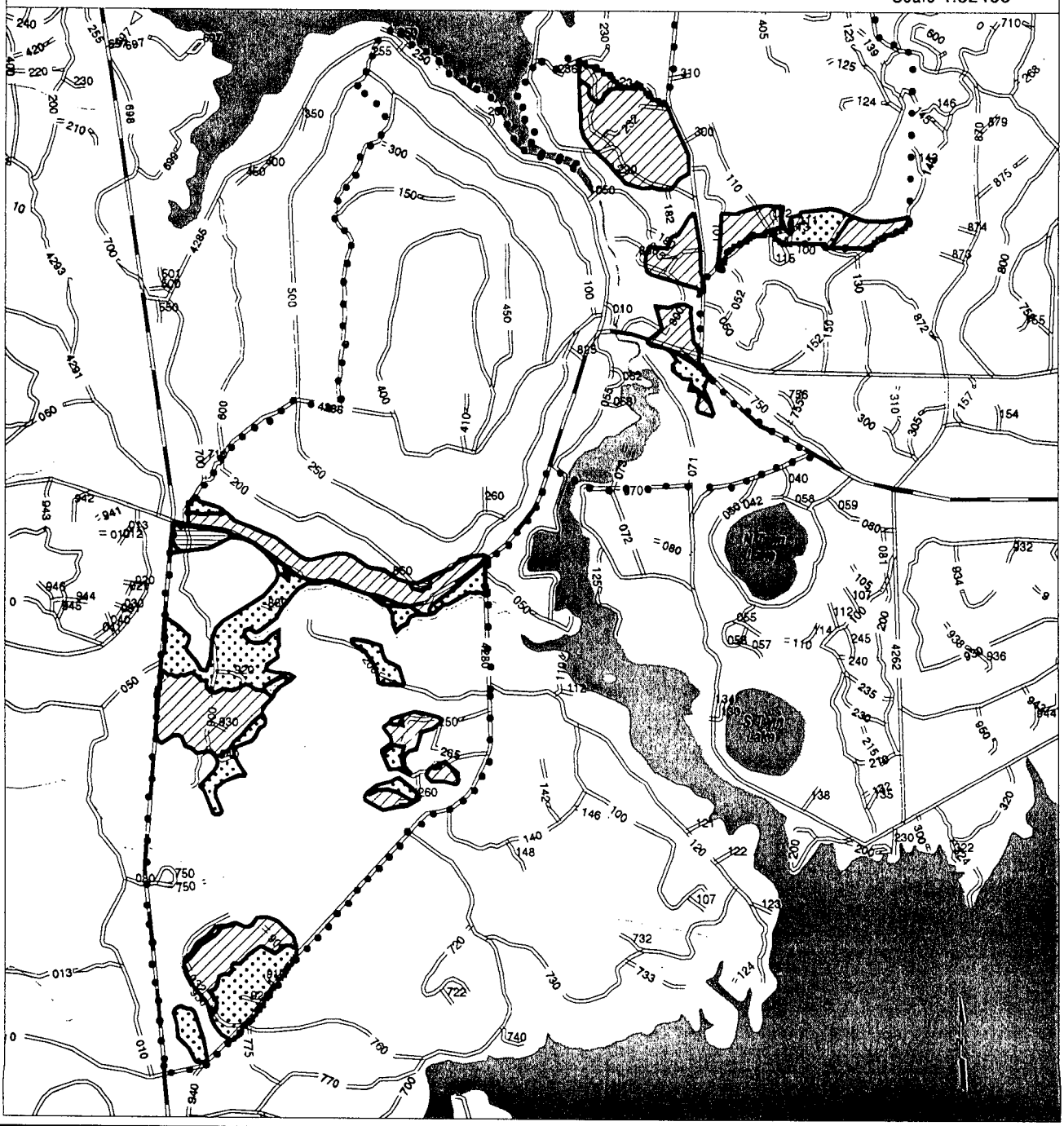
Mapped NRF Habitat
0 acres total

High Stand Density
650 acres

Medium Stand Density
370 acres

Low Stand Density
30 acres

Scale 1:52400



To meet long-term desired conditions for the LSRs, a strategic habitat management plan should be developed to guide all treatments. This would include a strategy for rotating habitat conditions over time. The plan should be developed at the site-specific scale prior to any vegetative manipulation projects and adjusted as needed through monitoring and completion of data gaps.

Table 7-9, "Existing LSR Conditions (EC) for Vegetation by MSA and PAG verses Desired Condition (DC)" summarizes recommendations for maintaining suitable habitat conditions, sustainable stands, and existing conditions for LSRs (from Gerdes, Maffei, and Booser, 1996, as cited in Big Marsh LSRA). These were developed for other LSRs, and can by applied to the Browns/Round Mtn. LSRs.

Table 7-9

Existing LSR Conditions (EC) for Vegetation by MSA and PAG verses Desired Conditions (DC)

MSA	Acres	Dominant PAG	Existing Stands by Density Class*			Desired Condition and Treatment Opportunities		
			Low	Moderate	High	Maximum High Density**	Difference EC - DC	Potential Treatment Acres ***
(1) NSO/N/R/F/D	980	MCD/MCW	7%	19%	74%	25%	49%	480
(2) BE/N/R	1,050	MCD/PPD	3%	13%	84%	30%	54%	550
(3) LSOG/NGH	2,320	MCD	9%	30%	60%	30%	30%	675
(4) LSOG/WHW	1,050	PPD	3%	35%	62%	30%	32%	340
(5) LSOG/BBW	405	LPD	20%	55%	26%	20%	6%	25
(6) LSOG/AM	1,030	LPW	12%	42%	47%	20%	27%	275
(7) R/NMB	20	LPD	33%	56%	11%	20%	0%	0
(8) R/NMB-BE/F/P	270	LPW	8%	29%	63%	20%	43%	110
(9) R/NMB-US/MW	90	MDW	4%	96%	0%	N/A	0%	0
(10) US/GGO	40	LPD	0%	43%	57%	20%	37%	15
(11) GP/LT	190	PPD	6%	6%	88%	30%	58%	110
(12) GP/LT-R/NMB	110	MCD	5%	0%	95%	30%	65%	50
Total	7,560		8%	30%	62%	26%	36%	2,630

* = TSE Summary, Vegetation Appendix

** = Table A-9, Vegetation Appendix. This number corresponds to the maximum high density stands retained (percent)

*** = Potential treatment acres indicate the gross amount of acres that exceed the upper threshold of stand density risk for forest vegetation.

The principal challenge in the management of eastside habitats is their sustainability in an ecosystem where wildfire is a prominent disturbance agent. Table 7-10, "Existing LSR Conditions as Compared to Recommended LSR Conditions: Upper Management Zones (UMZ)" displays recommended vegetative conditions to meet the various desired condition goals, as well as reducing risks of epidemic insect/disease events and stand-replacing fires. The guidelines that were originally developed by the Science Team for the Deschutes National Forest are also displayed for comparison.

Table 7-10

Existing LSR Conditions as Compared to Recommended LSR Conditions: Upper Management Zones

MSA	Dominant PAG	Proportion of MSA at/above Suitable Habitat Levels*			Existing Proportion of MSA above UMZ (Stands That Exceed 100% Normal Density)
		At suitable Habitat (Stand Replacing and Non-Stand Replacing)	Suitable habitat (Above UMZ)	Below Suitable Habitat (Below UMZ)	
(1) NSO/N/R/F/D	MCD/MCW	50-60%	10-25%	25-30%	74%
(2) BE/N/R	MCD/PPD	50-60%	20-25%	20-25%	84%
(3) LSOG/NGH	MCD	50%	25%	25%	60%
(4) LSOG/WHW	PPD	60%	20%	20%	62%
(5) LSOG/BBW	LPD	50%	10%	40%	26%
(6) LSOG/AM	LPW	50%	10%	40%	47%
(7) R/NMB	LPD	50%	10%	40%	11%
(8) R/NMB-BE/F/P	LPW	50%	10%	40%	63%
(9) R/NMB-US/MW	MDW	N/A	N/A	N/A	0%
(10) US/GGO	LPD	50%	10%	40%	57%
(11) GP/LT	PPD	60%	20%	20%	88%
(12) GP/LT-R/NMB	MCD	50%	25%	25%	95%

* adapted from Science Team summary, as found in *Big Marsh LSRA* (draft, 1997)

Treatment Implementation Schedule and Recommendations:

Site-specific recommendations are not typically part of assessments. However, for this assessment, examples of integrated MSA treatments are recommended and listed below, after Table 7-11, "List of Restoration Actions". The purpose of these recommendations is not to describe "how-to" fixes, but instead to focus future project teams on the most important restoration needs within the LSRs, without a broad scale re-assessment of conditions.

Table 7-11
List of Restoration Actions

Restoration Action Number	Which Indicates
1	Reintroduce prescribed fire
2	Salvage/reduce fuel loads
3	Close roads; improve existing closures
4	Thin trees to reduce density stress
5	Release & culture individual trees
6	Plant trees
7	Control noxious weeds
8	Restore channel/fish habitat entrance
9	Create snags
10	Patch Cut
11	Plant riparian vegetation
12	Restore meadows

The overall rating of each MSA is used in Table 7-12, "MSA Recommendations and Restoration Treatment Priorities" to rank them by need for treatment. Both short term (0-10 years) objectives and long term (10+ years) goals are considered in restoration actions. The short-term actions are listed before long-term actions, in terms of their relative priority. In some cases, the short term action must precede the long-term action (e.g. reduction of fuels before reintroduction of prescribed fire). The recommended treatments are indicated in the table, but they are generalized and not stand specific.

Table 7-12

MSA Recommendations and Restoration Treatment Priority

Key:
- = does not meet desired condition criteria, 0 = neutral, + = meets desired condition criteria

MSA	Habitat Quality*	Ecological* Function	Human Safety* and Resource Values	Relative Need for Restoration		Restoration Action in Descending Priority**
				Short Term (0-10 Years)	Long Term (10+ Years)	
(1) NSO/N/R/F/D	+	0	0	Moderate	High	4,5,3
(2) BE/N/R	+	+	-	High	Moderate	5,4,3
(3) LSOG/NGH	+	+	-	High	Moderate	5,10,6
(4) LSOG/WHW	-	0	0	Low	Moderate	4,5,9,2,1,10
(5) LSOG/BBW	-	0	0	Low	Moderate	4
(6) LSOG/AM	-	0	-	Low	Moderate	4
(7) R/NMB	-	0	0	Moderate	Low	8,5,11,4
(8) R/NMB-BE/F/P	+	+	+	Moderate	Moderate	5,4,11,7,3
(9) R/NMB-US/MW	+	+	0	Low	Moderate	12
(10) US/GGO	-	0	+	Low	Moderate	2,1,10
(11) GP/LT	+	+	-	High	Moderate	4,5,2,1
(12) GP/LT-R/NMB	+	+	-	High	Low	5,4,11,3

* Summarized from Table 7-5, "Management Strategies: Assessment of Current Conditions to Desired Conditions".

** See Table 7-11 for a listing of restoration actions and numbers.

(#1) NSO/N/R/F/D MSA: For this MSA, the long-term goal is to establish a spotted owl pair when habitat conditions have been restored to a suitable condition. It is estimated that it will take 20-30 years to develop the habitat to a state that is acceptable. The present limitations include: 1) lack of nest trees and 2) fragmentation. The MSA should be managed to have a relatively uniform stand of mature forest. Therefore, the present plantations must be managed to provide a diverse community of species and to promote rapid juvenile growth. The present late-structured stands in the MSA must be maintained by controlling the mid and understory densities and composition of trees with an emphasis on promoting Douglas-fir trees for potential nest sites.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#1) NSO/N/R/F/D	3) Reinforce road closures	Provide solitude	TBD (miles)
	4) Thin plantations	Build uniform MSA conditions	10% (acres)
	5) Culture PP/DF trees	Release stress in big trees	50% (acres)

TBD = To be determined

(#2) BE/N/R MSA: For this MSA, the long-term goal is to maintain large diameter ponderosa pine and/or Douglas-fir trees across one-half of the MSA at all times for bald eagle nesting habitat. The mid and understory tree densities and composition must be managed to ensure 1) regeneration of ponderosa pine and Douglas-fir and 2) control competition with potential nest trees. This MSA is also important to the success of re-establishing a spotted owl on Browns Mtn. Therefore, stand structural elements such as canopy layers, cover, CWM, etc. should be addressed at the site scale to provide foraging, dispersal and roosting habitat for owls.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#2) BE/N/R/MSA	3) Reinforce road closures	Provide solitude	TBD (miles)
	4) Thin young stands	Grow large PP/DF faster	10% (acres)
	5) Remove understory	Release large diam. PP/DF	50% (acres)

(#3) LSOG/NGH MSA: The long-term goal is to maintain large diameter nesting trees on about 40% of the area, with a mosaic of stand structures, patch sizes, and densities throughout the MSA for northern goshawk nesting/rearing habitat. Nesting patches of about 30 acres should be identified throughout the MSA, where large trees and high canopy cover objectives will be the objective. The portion of this MSA on Browns Mountain is also important to the re-establishment of a spotted owl pair in the area and its management strategy should be adopted as necessary to meet objectives for foraging, dispersal and roosting.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#3) LSOG/NGH	5) Culture large trees	Release large diam. PP/DF	20% (acres)
	10), 6) Patch cut stands and plant trees	Grow large PP/DF faster	10% (acres)

(#4) LSOG/WHW MSA: For this MSA, the long-term goal is to provide a semi-open late-successional forest where thick-barked, fire-resistant ponderosa pine and Douglas-fir are dominant in the overstory for white-headed woodpecker habitat. Patches of seedling, saplings and pole sized trees in the understory are also desirable. Snags are a critical element for this species, as well as spike (dead) topped trees.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#4) LSOG/WHW	2), 1) Reduce fuel loads	Prepare for fire reintroduction	TBD (acres)
	4), 5) Thin/culture PP/DF	Release large diam. PP/DF	20% (acres)
	9) Create snags	Provide replacement snags	TBD (snags)
	10) Patch cut LP/WF	Provide more open conditions	10% (acres)

(#5) LSOG/BBW MSA: The goal is to provide mature and late/old forest conditions, with recruitment of snags an important stand feature for black-backed woodpecker habitat. This species is closely tied to the cycles of insects, disease and fire in lodgepole pine. The retention of patches of dead is important.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#5) LSOG/BBW	4) Thin LP thickets	Provide larger future snags	10% (acres)

(#6) LSOG/AM MSA: For this MSA, the long-term goal is to provide mature and late/old stand conditions, with canopy cover and coarse wood/snags at near optimum conditions for American marten. Connectivity with other suitable marten habitats is another important consideration.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#6) LSOG/AM	4) Thin LP thickets	Provide larger CWM	20% (acres)

(#7) R/NMB MSA: The long-term goal is to maintain coniferous tree cover at sustainable levels, investigating the potential for hardwood species over time for a variety of species with an emphasis on neotropical migrant birds. The promotion of large trees and snags near water sources is important to several species (e.g. bald eagle and osprey).

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#7) R/NMB	4), 5) Thin, culture trees	Reduce stress on individuals	TBD (acres)
	8) Re-create intermittent stream channel	Realignment of Browns Creek to original stream flow	Entire length
	11) Riparian plantings	Establish desired species	TBD (miles)

(#8) R/NMB-BE/F/P MSA: The long-term goal is to provide large diameter Douglas-fir and ponderosa pine trees, including snags/dead-topped trees for eagle perches and roosts for other species (e.g., swifts, bats). Where Riparian Reserves are designated and sites are capable, hardwoods, shrubs and other habitat attributes favorable to neotropical birds will be emphasized.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#8) R/NMB-BE/F/P	3) Reinforce road closures	Provide solitude for nesting bald eagles	TBD (miles)
	4) Thin young stands	Grow larger trees faster	10% (acres)
	5) Culture overstory	Release large diam. PP/DF	20% (acres)
	7) Control noxious weeds	Restore/maintain habitat for native species	TBD along Deschutes river below Crane Prairie Reservoir
	11) Riparian plantings	Species diversity (willows)	TBD (miles)

(#9) R/NMB-US/MW MSA: The goal is to provide early-successional meadow habitats, deciduous shrubs where appropriate and retention of nearby trees and snags with an emphasis on the MacGillivray's warbler.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#9) R/NMB-US/MW	18) Remove encroaching LP trees from meadow	Retain open meadow condition	20% (acres)

(#10) US/GGO MSA: The long-term goal is to provide open patches of early-successional habitat on one-half of the MSA over time for great grey owls. Management of adjacent MSAs should consider the owl's nesting habitat needs.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#10) US/GGO	16), 1) Patch cut advancing LP stands; Rx burn	Retain 50% in openings, favoring grasses/forbs	40% (acres)

(#11) GP/LT MSA: The goal is to manage this MSA to reduce the risk of wildfire that could threaten adjacent LSR lands and to promote large trees and snags for use by raptors and other species as perches, or nesting habitat.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment	Rationale for Treatment	Extent/Units
(#11) GP/LT	2) Treat fuels by mowing, burning shrub cover	Reduce shrub fuels build-up	TBD (acres)
	5), 6) Release individual PP overstory trees and thin understory	Relieve stress on old PP; reduce multi-canopy fuels	60% (acres)

(#12) GP/LT-R/NMB MSA: The goal is to manage this MSA to reduce the risk of wildfire that could threaten adjacent LSR lands. Where Riparian Reserves are designated promote deciduous trees and shrubs where sites are capable to promote neotropical migrant birds. Promote large trees and snags near the shoreline for perches.

Short-term restoration actions recommended (0-10 years):

MSA	Treatment Example	Rationale for Treatment	Extent/Units
(#12) GP/LT-R/NMB	3) Close roads as needed	Reduce risk of ignitions and disturbance to foraging eagles	TBD (miles)
	5), 6) Release overstory PP/DF trees; thin understory clumps to reduce density	Relieve stress on old PP/DF, reducing multi-canopy fuels	60% (acres)
	17) Riparian plantings	Promote deciduous shrubs	TBD (miles)

Fire Management Plan

The purpose of this plan is to provide general information about the Browns/Wickiup Watershed Analysis area and the Browns/Round Mtn. Late-Successional Reserve (LSR) planning area from a Fire Management perspective. It may be used as a tool to identify actions necessary to implement fire management direction in the Browns/Round Mtn. LSRs.

Fire management planning has been identified as a critical component of Late-Successional Reserve Assessment planning east of the Cascade Mountains (Record of Decision or ROD, Standards & Guidelines). Large-scale disturbance has the potential to eliminate old-growth and late-successional habitat on hundreds or thousands of acres by setting back the critical structural components of east-side successional habitat. Furthermore, the alteration or the elimination of fire as a natural process in fire-dependent ecosystems (i.e. applicable MSAs in Browns/Round LSRs) is known to threaten the safety of firefighters and the existence of plant and animal species adapted to such conditions (Swanson 1994). For these reasons, fire management planning becomes a significant issue in many late-successional and old-growth management areas.

Introduction/Background

Fuel is a primary factor influencing the intensity, distribution, and size of fire on the landscape. Intensity, distribution and size is directly associated with the physical size of the individual fuel components, the total amount of fuel (i.e., fuel load), the linear arrangement of the fuel bed, and the vertical structure of live fuel. Alteration of these fuel characteristics subsequently changes how fire functions on the landscape.

Changes in species composition and structure, and increases in the associated insect and disease populations, is the consequence of altering fire as a natural disturbance process (Hessburg et. al. 1994). Situations identified within the Browns/Wickiup watershed which significantly alter fuel characteristics include accumulations due to fire suppression and insect/disease tree mortality.

All forest ecosystems have their own unique associations of native insects and diseases. When even a single ecosystem attribute, such as plant species composition, tree density, or canopy structure change, the associated insect and disease complexes may be modified. Each successional pathway generally presents in a different insect and disease response.

Modifications in tree species composition by management that promote preferred host species, potentially lead to a significant increase in insect and pathogen population levels. Increases in these population levels contribute to increases in dead and dying fuel and thus, the total amount of fuel accumulation. Increased fuel accumulation directly increases the risk of landscape level disturbances.

Fire Ecology/History

A detailed discussion is provided in Chapters III and IV of the watershed analysis portion of this report. In summary, the role of fire has been significantly altered from it's historic function in the Dry Forest types.

There are approximately 6,740 acres (or 89% of the LSRs) presently classified as dry types. However, field evaluations suggest that native fire return intervals are longer on north aspects (e.g. Browns Mountain). Additionally, cycles and seasonal variations in the climate have a profound effect upon fire frequency and behavior.

Climate

At the Wickiup Dam weather station (4,360 feet in elevation) operated by the State of Oregon meteorological department, the average maximum temperatures range from mid 40s in winter to the 70s in the summer (degree Farenheight). Average minimum temperatures range from near 40 in the summers to the high teens in the winter. Precipitation at Wickiup Dam is around .7 inches (total) in the summer months and averages 21 inches for the year (Oregon Climate Zone Summary, 1993).

There is a remote automated weather station on Round Mountain at an elevation of 6,400 feet. The weather data collected from the station indicates average temperatures range from the winter lows in the low 20s to the summer highs in the mid 80s. Precipitation means for 31 years of data at Round Mountain is at 42 inches a year. The wind speeds in the summer average about 7 to 10 miles per hour and are quite windy during the winter months of January, February, and March. The primary wind direction is from the south-southeast in the beginning of the year and average west-southwest during the summer months. The average means for herbaceous fuel moisture shows mid-March to be representative of a quick green-up with fuel moisture at 200% and then dropping in late May below 30%.

The Browns/Wickiup Watershed Analysis area has a relatively mild climate with a high probability of thunderstorms and lightning during the months of July and August. More than 70 percent of recorded lighting starts within the watershed occurred during this period. The combination of these factors contribute to the area's inherent fire-susceptibility. Drought trends, as experienced during the late 1800s, 1920s, 1980s, and the 1990s, induce higher intensity, larger scale burning, as well.

Large Fire Risk - A Statistical Probability Overview

A statistical probability of large fire risk was calculated for the Browns/Wickiup Watershed Analysis area, including the Browns/Round Mtn. LSRs using National Fire Management Analysis (NFMAS) information derived for the Deschutes National Forest on the Bend-Ft. Rock Ranger District. This analysis was done using a program called PROBACRE, a computer model for predicting wildfire risk based on past annual fire frequency and associated levels of fire intensities. The following table (7-13) summarizes the PROBACRE analysis results which display the probability of wildfires exceeding size thresholds within a 20, 50, and 100 year period for the area.

Refer to Chapters III and IV together with information in the Fire/Fuels Appendix for a discussion on fire occurrence rates and the history of large fires in the assessment area. In summary, only two fires exceeding 1,000 acres have occurred in the watershed since 1908 (Figure A-4). Neither affected the LSR areas, however the Four Corners Fire of 1994 occurred adjacent to the northern boundary of both Browns and Round Mountain LSRs.

Table 7-13

Fire Probability in the Browns/Wickiup Watershed and Browns/Round Mtn. LSRs

Fire Size (acres)	Probability of Occurrence (%)		
	20 years	50 years	100 years
50 acres	18%	53%	89%
100 acres	18%	40%	70%
1,000 acres	18%	39%	63%
5,000 acres	<1%	1%	8%
10,000 acres	<1%	<1%	<1%

Note: These estimates assume that the expected size to which a fire expands its perimeter at any time of occurrence is independent of both the number of fires and burned acres that have preceded it within the analysis area.

Crown Fire as a Disturbance Element

Eight criteria are described as being favorable conditions for a crown fire: dry fuel, low relative humidity, high temperature, heavy surface fuel accumulations, ladder fuels, slope, winds, atmospheric instability, and a continuous forest canopy.

For more information on crown fires, see the Fire Appendix, Figure 7-20, "Crown Fire Susceptibility" and Figure 7-21, "Fuel Models". The following table displays crown fire susceptibility within the Browns/Wickiup Watershed Analysis Area and Browns/Round Mtn. LSRs:

Table 7-14

Crown Fire Susceptibility Within the Browns/Wickiup Watershed and Browns/Round Mtn. LSRs

Crown Fire Susceptibility	Total Acres Within Browns and Wickiup Watershed	Total Acres Browns Mountain LSR	Total Acres Round Mountain LSR
Extreme	2,836	646	57
High	9,536	1,866	53
Moderate	7,701	1,173	4
Low	23,597	3,328	107
Other (H2O, lava, rock, & other sparse veg.)	12,950	227	3

Risk Factors

Risk is defined as the possibility of suffering harm or loss. Fire risk is the probability of a fire occurrence based on ignition sources (human vs. lightning).

Though fire occurrence probabilities can be calculated from past records on any given watershed or district, there are certain factors which must be addressed when assessing current situations concerning changing (or changed) conditions for the areas examined. Calculations can provide an accurate baseline when assessing risk but the following elements cannot be ignored when attempting to provide an overview of fire occurrence and the risk of a large-scale disturbance.

1. The increase of urban-interface situations have naturally increased fire risk due to the sheer presence of human activity in the analysis area, private landholding activities, and people wanting to move into the woodlands away from suburban areas. However, there is no urban-interface and little private land in-holdings (1.5 acres) within the LSRs.

2. A rapid accumulation of fuels has occurred in forested areas due to insect and disease infestations, the general absence of fire, and other factors such as recent drought conditions. This increases the risk of a major disturbance now and cumulatively in the

future though it is difficult to display this factor mathematically.

3. Recreational use in the forest is increasing but this is not necessarily a new factor as fire occurrence figures have shown increased human-caused ignitions over the last several years. Recreational use is an important factor, however, it should be directly associated with the changing fuel load situations in the forest as both combined will increase the risk of a major fire. The greatest risk from ignitions by humans is in the Crane Prairie Reservoir area including high use sites outside the LSR boundary.

4. Increased use of forest roads can be a factor for risk of an ignition. Currently there are 64 miles of open, gated, and/or seasonally closed roads in the Browns/Round Mtn. LSRs. This factor should be directly associated with changing fuel load situations in the forested areas as access to these areas will increase the risk of a major fire disturbance.

Air Quality/Smoke Management

The primary air quality concerns identified for the Browns/Wickiup Watershed Analysis area and the Browns/Round Mtn. LSRs are PM 10 smoke emissions that could result from natural wildfires, smoke intrusions from adjacent forests/agencies and prescribed burning. These intrusions also could affect visibility in the adjacent airsheds including the Class I Three Sisters Wilderness Boundary and residential areas such as Sunriver, LaPine basin, and the city of Bend. State air quality and visibility enhancement strategies should be considered. Burning when smoke advection and dispersion conditions are favorable. All burning would be approved by the State of Oregon in compliance with their smoke management plan to minimize adverse effects on air quality.

Fire Suppression Recommendations

Suppression strategies and tactics should be selected and implemented in a such a manner that result in the least impact in the Browns and Round Mtn. LSR resource areas while maximizing firefighter safety. Each fire ignition suppression response selected should consider the most cost effective strategy for resource values at risk with consideration of firefighter safety. The course of action that should be considered in the Browns and Round Mountain LSR areas would be to employ suppression strategies and tactics which:

1. Maximize protection of human life and property with an emphasis on recreationists and nearby recreation developments.
2. Maximize protection of resource values (i.e. old-growth species areas, riparian zones, etc.) and needs within both of those areas.
3. Protect adjacent land management areas that may be affected by the impact of wildfire (i.e. special areas of concern such as Crane Prairie Resort).
4. Minimize the expenditures of suppression costs when feasible.
5. Minimize the impact to the environment resulting from suppression actions.

To achieve the above, a combination of suppression strategies and tactics may need to be utilized. Strategies may vary depending on fire intensity, resource value priorities, the values at risk, predicted and observed fire behavior, and other fires that may be draining resources within the region. The suppression strategies should continually monitored and re-evaluated to determine if they require any modification to best meet the objectives for the individual Management Strategy Areas (MSAs).

As situations become more critical, more restrictive suppression responses will be used. The opposite is also true, if the situation allows, less restrictive suppression responses should be considered. Suppression strategies that should be used in the Browns and Round Mtn. LSRs area are:

1. **Confine:** To limit the fire spread within a predetermined area principally by the use of natural or preconstructed barriers or environmental conditions. Suppression actions may be minimal and limited to surveillance under appropriate conditions.

2. **Contain:** To surround a fire, and any spot fires there from, with control line as needed which can be reasonably expected to check the fire's spread under prevailing and predicted conditions.

3. **Control:** To complete the control line around a fire, and any spot fires there from, any interior islands to be saved; burn out any unburned areas adjacent to the fire side of the control line; and cool down all hot spots that are immediate threats to the control line, until the line can reasonably be expected to hold under foreseeable conditions.

It would be appropriate to accept moderate risk associated with the use of confinement/containment strategies provided that do not jeopardize safe wildland fire operations. The effects of fire are most often more acceptable than the adverse affects on the resources of a control strategy or direct attack. The key is to balance suppression impacts with risk and costs, which will vary in each fire situation (seasonal severity, threat to firefighter safety, potential cost/loss).

Fire Management Goals and Objectives

The **goals** of fire management in the Browns and Round Mtn. LSRs are:

1. Significantly reduce hazardous fuel conditions that could compromise public safety and safe wildland fire operations.

2. Restore fire as a natural process by developing and implementing prescribed fire plans on a strategic scale.

The **objectives** for the Browns and Round Mtn. LSRs are:

1. Implement fire suppression strategies that protect human life and property while sustaining late-successional habitats and protecting other resource values.

2. Identify current hazard and risks to the LSRs.

3. Recommend fire hazard reduction strategies that reduce fuel hazards and the potential for landscape scale, high intensity wildfires while meeting desired amounts of vegetative conditions as needed by the management objective(s) for the areas being managed.

4. Advise actions that will expedite the reintroduction of fire into fire-adapted ecosystems.

Fuels Management and Prescribed Fire
The following MSAs will receive priority for fuels management activities in order to reduce present risks which would allow the use of prescribed fire in the future:

- #2 Bald Eagle/Nesting/Roosting (areas without spotted owl secondary habitat goals)
- #3 Late-Successional Old growth/Northern Goshawk (where applicable xeric forest types are present)
- #4 Late-Successional Old growth/White-headed Woodpecker
- #11 General Protection/Large Tree
- #12 General Protection/Large Tree - Riparian/Neotropical Migrant Birds

Additionally, fuels management actions are strongly recommended in the area between the northeast portion of the Browns Mountain LSR and the shoreline of Crane Prairie Reservoir (i.e. west of road #4270). It must be stressed in most local situations that understory thinning, piling, and burning will be required prior to the reintroduction of prescribed fire. Fuel accumulations are too great to use prescribed fire on most sites at this time. Portions of the Round Mountain LSR are at risk from fire ignitions on lower slopes, particularly on south and west aspects where ceanothus shrub cover has become established. However, this area is a lower priority for fuels management activities than the shoreline of Crane Prairie Reservoir which has higher fuel loadings and a greater risk of ignition.

Summary: Desired Condition goals for many MSAs within the LSRs will require a higher degree of risk management for both insect/disease and wildfire processes in order to attain them (e.g. northern spotted owl habitat). The General Protection MSAs are designed to reduce the risks to these areas and to protect lives and property/resource values. Other actions have been described to further reduce wildfire risks from areas adjacent to the LSRs. Many of the recommended actions for stand density and species dominance control will also indirectly reduce risks to fire and allow re-introduction of prescribed fire to the stands, which will significantly reduce risks to the LSRs over time. The implementation of the recommendations will be totally dependent upon the available funding. The Desired Conditions described for the MSAs together with Treatment Criteria will provide a strategic, landscape level approach to guide local projects through time.

Fig. 7-20

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Crownfire Susceptibility

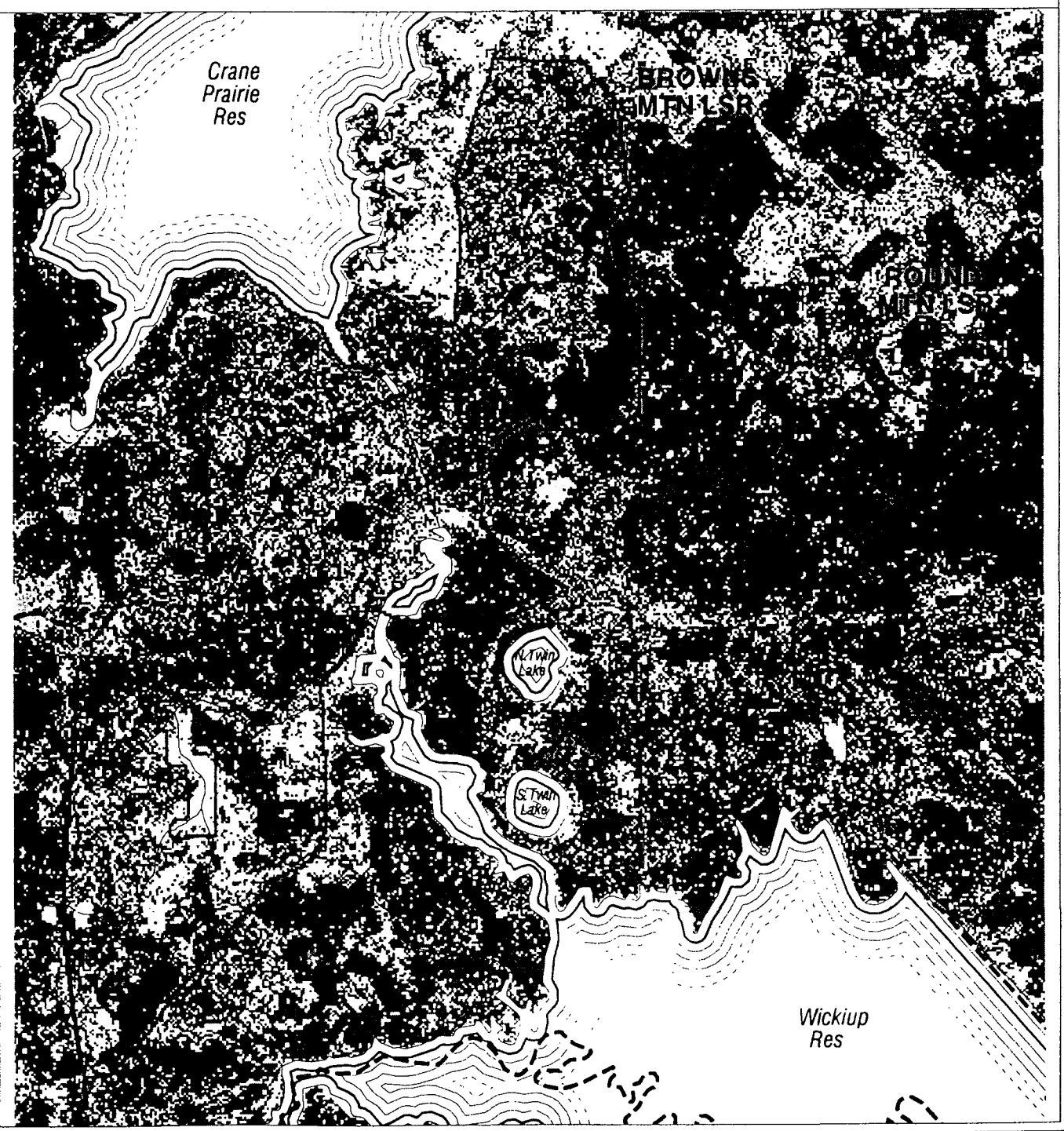
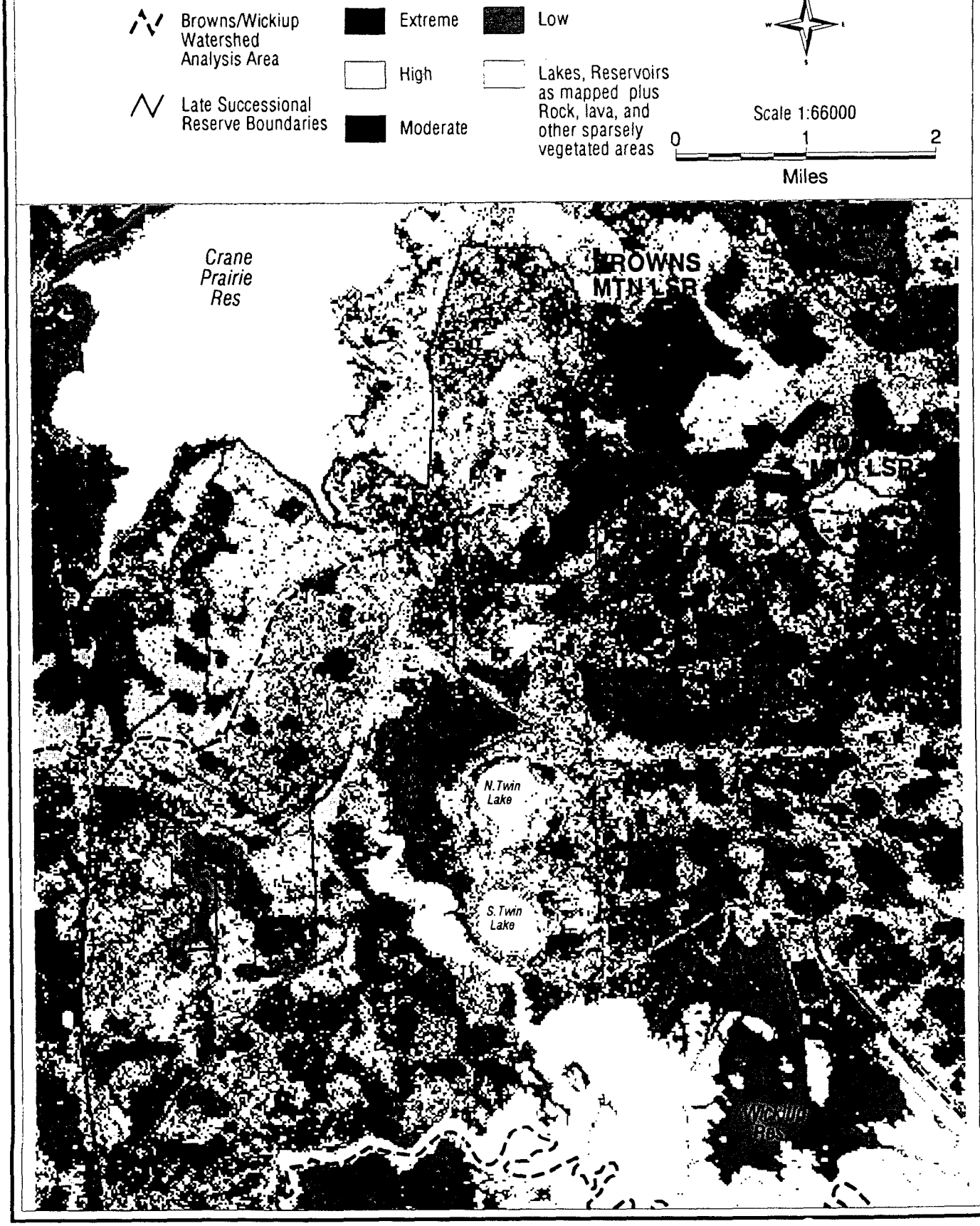


Fig. 7-21

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Fire Behavior Fuel Model



Monitoring and Evaluation of Management

Monitoring is an information-gathering and activity-observing task. Evaluation is the analysis and interpretation of information provided through monitoring. Each effort requires a different focus and has a distinctly different purpose.

Three levels of monitoring are discussed in this section. They are implementation, effectiveness and validation monitoring. Implementation monitoring determines if the proposed actions at the site scale are carried out as planned. This is geared to answering the question: **"Did we do what we said we were going to do?"**. Effectiveness monitoring is used to determine if the design and delivery of the management practices are correct or in need of adjustment. It answers the question: **"Do the management practices effectively produce the desired results?"**. Validation monitoring looks at the development of new scientific information using appropriate research techniques for issues and questions on the future management of Late-Successional Reserves. This focuses on answering the question: **"Are the scientific assumptions valid?"**.

Implementation Monitoring

For the Browns/Round Mtn. LSRs implementation monitoring will be designed and accomplished at the site or project scale. The following questions will receive priority consideration: **1) Were the prescribed vegetative treatment prescriptions accomplished as designed by the project (tree marking, timber sale harvest and administration, prescribed burn implementation, and other vegetative manipulation activities)?; 2) Were other habitat restoration actions accomplished as designed including riparian enhancement, fish habitat, road closure/obliteration, etc.?**

Effectiveness Monitoring

Effectiveness monitoring will answer the question of habitat sustainability for individual Management Strategy Areas, related to their respective desired conditions. The objective of this effectiveness monitoring is to determine how effective the management plan (LSRA) is. The priority MSAs will be the following: 1) Northern spotted owl, 2) White-headed woodpecker, 3) Bald eagle nesting, 4) Riparian, and 5) General protection. Conditions will be assessed on a five year interval in conjunction with project planning activities within the LSRs. The pre-treatment existing conditions will be compared to the post-treatment conditions to determine if there has been any progress towards the desired conditions, and to ask if the desired conditions are still attainable, if the original scientific assumptions and conclusions are still valid, or if adaptive management adjustments should be made at the site/project scale. If adequate funding sources are available, the effectiveness of the recommended connectivity corridors will be assessed. The summary evaluation will be documented in writing with supplemental maps, data, photos, etc. as appropriate. Adaptive management recommendations will be an emphasis item in the evaluation report and shall be brought to the attention of the line officer and appropriate staff at both the

District and Forest levels.

A specific effectiveness monitoring activity for vegetative manipulation will be the coordination of the monitoring with the broader Forest-wide program to assess the effects of individual tree culturing. This is a paired tree design with a target tree (e.g. ponderosa pine or Douglas-fir) having the competing understory trees removed (e.g. white fir) for one sample tree and a nearby tree of similar size being a control with no understory removed. All small trees within two crown widths would be removed from the treatment tree's understory. A related scenario would be the management of paired patches. The treatment patch would be managed at a density equaling the Upper Management Zone (UMZ) as determined by silviculture and wildlife professionals for the individual site conditions. The control patch would receive no treatment. This monitoring activity will be closely coordinated with Forest staff specialists.

The following list highlights some specific implementation and effectiveness monitoring tasks. The attainment of these items will depend upon the success of future projects in securing the necessary staffing and funding.

Habitat Enhancement

* Are the MSAs moving towards Desired Conditions as specified in the LSRA?
* Were the MSAs accurately mapped or are adjustments necessary?
* Were the Management Indicator Species or management objectives for individual MSAs accurate or are changes required?
* Is fragmentation and the effects of roads being reduced?
* Have spotted owls or other LSOG species occupied sites/areas where they were previously absent and why or why not?

Resource Sustainability

* Have the risks to insect/disease epidemics and/or wildfire increased or decreased and how does this potentially affect habitat sustainability goals for LSOG species?
* Have the vegetative manipulation activities been cost effective and have any unacceptable impacts occurred to other resources?
* What have been the effects of the re-introduction of fire to the ecosystem and are they moving habitats to the targeted Desired Conditions? Do the Desired Conditions need adjustment?
* Are there needed changes in the original vegetative classifications (e.g., plant associations, structural stages, etc.), and how significant is this information relative to future management decisions with the LSRs?
* Has the use of the area by people increased (e.g. recreational activities) and is it having any negative effect on goals for the LSRs?
* Identify any significant changes in the LSRs that would warrant revision(s) to the LSRA, e.g. wildfires, insect/disease epidemics, etc.

Validation Monitoring

Validation monitoring needs are to be addressed at regular intervals as a sub-set of the other monitoring activities. The objective of the validation monitoring will be to review the scientific foundation for current management practices. Typically, validation monitoring falls within the purview of researchers, yet administrative studies can be designed and administered by the local Science Team. If research is critical to the future management of the LSRs then it will be identified and presented as appropriate to decision makers. Risks to the future goals for the Late-Successional Reserves as related to not having the information will be identified. In addition, an effort will be made to determine if applicable research has been done elsewhere or planned that may be applicable to the identified questions. Alternatives to collecting the information via rigorous (and expensive) research will be explored, such as use of administrative studies.

It is recommended that a formal monitoring file be established for each of the LSRs and that its maintenance be assigned to a specific resource discipline (e.g., silviculture, wildlife, joint science team) by the Forest or District. Each future project within the LSRs should review the information and supplement it as appropriate. Many of the described activities will not be accomplished without adequate funding, therefore it is strongly recommended that where feasible the funding needs be addressed within individual projects. It is also recommended that interested agencies, e.g. Fish and Wildlife Service, be included in the monitoring program and the evaluation of the attainment of LSR goals.

"You can learn a lot just by looking"

--- Yogi Berra, famous sportsman and philosopher

Soils Appendix

Soils Appendix

Parent Materials

Soil development in the Browns/Wickiup watershed has been influenced by five primary parent materials located on a variety of volcanic or glacial landforms. The parent materials include, individually or in combination, glacial outwash, glacial till, igneous basaltic lava, gravel-sized cindery tephra, and fine ash and sand-sized pumice tephra.

Pumice and ash tephras located on the surface throughout the watershed were expelled from Mt. Mazama approximately 7,600 years ago. This material is present in 0.5 to 1.0 meter depths on a gradient from north to south and is the primary material in which roots of vegetation on site are active. Litter and duff on the soil surface also is found in variable depths throughout the watershed, primarily as a function of the aspect and plant association on which a given soil profile is located. Surface litter and duff is an important component of the productivity and resiliency of the soils present within the watershed.

Underlying glacial or volcanic materials within the watershed primarily affect the subsurface flow of water, but can also influence the availability and content of nutrients within the soil profile. Glacial outwash underlies the eastern portion of the watershed located in the LaPine Basin, an area where seasonally high water tables are present. Glacial till underlies much of the western portion of watershed, providing lateral subsurface flows into the LaPine Basin. Both of these elements contribute to the presence of riparian soils associated with high seasonal water tables.

Basaltic lavas underlie a mid-section of the watershed in an area bounding the eastern extent of the glacial till material. Soils in this area are highly variable in depth and include a residual soil layer weathered in place from the lavas. This layer provides a slightly higher water holding capacity than the Mazama ash and pumice, enhancing the productivity of the site in areas where tree roots reach this layer.

Cindery soils are found within the watershed on three small cinder cones and the top of Eaton (within the watershed) and Gilchrist (adjacent to the watershed) buttes. While able to support vegetation, the coarse nature of this material raises the erosive potential and reforestation difficulty of these soil types to a high level. These soil types have varying amounts of Mazama pumice and ash on the surface, with accumulated levels found on the toe slopes of these features. Surface accumulation of litter and duff on these soils is relatively low.

Landforms

Landforms within the watershed have influenced soil development and vegetative growth by providing a variety of elevations, aspects and micro-climates. The eastern portion of the watershed surrounding Wickiup Reservoir (landscape sub-area 4 and a portion of 2) is part of the LaPine basin, a low lying area that functions as a cold air sink throughout the year. Morning surface temperatures within the watershed are often below freezing, even during the summer months, shortening the period for biological activity within the soil profile. Soils in this area are generally moderate to very deep with a seasonal water table at or within five feet of the surface. Productivity of these sites is moderate due to the cold soil and air temperatures that limit biomass production in the course of a growing season.

The extreme western portion of the watershed (landscape sub-area 1) is located on the glaciated slope of the highest feature within the watershed, the 7,000 foot shield volcano called the Twins. The low elevation relative to the predominant volcanic features of the Cascade chain allows greater amounts of precipitation to cross over the crest and improve the site quality of much of the watershed. Soils above 5,400 feet are located on glacial till or volcanic andesites and have a low inherent productivity due to a very short growing season. Litter and duff depths of these soils was historically high due to slow microbial decomposition rates and long fire return intervals.

Topographic features are also associated with landscape sub-areas 2, 3 and 6, all of which have a variety of soils as a result. Browns and Davis Mountains, as well as Wickiup and Gilchrist Buttes, are older shield volcanoes that rise between 1,000 to 2,000 feet above the LaPine basin, while Round mountain and Pine, Shukash and Wuksi Buttes are slightly smaller cinder cones of a younger age. Soil depths, especially that of the mineral A horizon, varies on these features as a result of biomass production fluctuations on different aspects and elevations. Soils associated with these features are highly productive, with a slight reduction on the drier south slopes. Litter and duff accumulation was historically moderate in these areas due to regular fire return intervals and greater amounts of biomass production relative to higher elevation or basin locations.

Landscape features associated with much of the remaining portions of landscape sub-area 2 and 5 are primarily basaltic andesite lava flows younger than the shield volcanoes mentioned previously. Much of the areas in Landscape sub-area 2 are classified as forested lavas and contain enough pockets of soil from Mazama tephra deposition to support herbaceous shrub and tree growth at relatively high productivity levels. Landscape sub-area 5 contains a very small area that is not bare lava but contains enough coarse soil tephra to support herbaceous growth, although not at suitable growth rates for commercial production.

Water Appendix

Water Appendix

Table A-1

Selected Water Quality Parameters and Concentrations From Synoptic Surveys of Wickiup Reservoir

Parameters	July 11, 1984 Depth (ft.)		August 15, 1991 Depth (ft.)		
	3	10	3.3	9.9	16.5
Water temperature (°F)	72.5	71.2	68.2	67.8	67.5
DO (mg/L)	8.1	8.5	9.2	9.1	9.2
Field pH (SU)	8.7	8.8	8.1	8.1	8.1
Secchi disk transparency (ft.)	5.6	ND*	19.0	ND*	ND*
Field EC (μmhos/cm)	55	55	60	60	60
Total phosphate as P (mg/L)	0.025	0.052	0.024	ND*	0.041
Dissolved orthophosphate as P (mg/L)	0.004	0.003	0.006	ND*	0.006
Total Kjeldahl N (mg/L)	0.660	0.120	0.180	ND*	0.260
Dissolved NO_3 and NO_2 as N (mg/L)	0.1 K	0.1 K	0.01 U	ND*	0.1 U
Chlorophyll *a* (μg/L)	24.9	ND*	3.3	ND*	ND*
Fecal coliform (number/100 mL)	2 K	2 K	2 K	ND*	2 K
Total Hg (μg/L)	0.1 U	0.5	0.2 U	ND*	0.2
Total As (μg/L)	ND*	ND*	2 U	ND*	2 U
Total Se (μg/L)	10 U	10 U	2 U	ND*	2 U

*ND means no data; K indicates the actual analytical value was less than the given value; U indicates the actual value was less than the detection limit shown.

Reference: Upper Deschutes River Basin Water Conservation Project Surface Water Quality Study Report, November 1993, USDI BOR, Denver, Colorado.

Table A-2

Water Quality of Lakes

Parameters	Wickiup Reservoir	North Twin Lake	South Twin Lake	Found Lake	Johnny Lake
Date Surveyed	7/17/82	7/16/82	7/19/82	8/2/95	7/31/96
transparency (ft.)	26.2	31.5	27.9	11 (bottom)	21 (bottom)
Sample depth [1]	surface	surface	surface	5 ft.	11 ft.
pH	7.6	8.2	8.3	6.6	5.8
Cond (μmhos/cm)	51	143	116	15.5	3.4
Water temperature (°F)	66	66.6	69.3	66.9	55.4
DO (mg/L)	8.1	8.5	7.8	9.2	9.1
Alk.	16	73	56	170.7	36.77
Na	3.7	9.8	8.7	1.14	0.21
K	1.1	2.7	1.7	0.29	0.09
Ca	3.5	9.7	6.7	1.43	0.08
Mg	1.9	7.7	5.2	0.427	0.035
Cl	0.7	1.9	0.8	0.18	0.5
SO_4	0.1	0.1	0.8	0.01	0.11
Phos	0.033	0.010	0.017	0.006	0.003
NO_3 and NO_2	-	-	-	0.006	* [2]
Chla	1.8	1.8	1.0	-	-

Sources: Atlas of Oregon Lakes, Deschutes National Forest, Bend-Ft. Rock Ranger District

1. All temperature and DO readings taken within the first 3 feet of the surface.
2. Non-detectable

Vegetation Appendix

Water Appendix

Table A-1

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Parameters	July 11, 1984 Depth (ft.)		August 15, 1991 Depth (ft.)		
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Secchi disk transparency (ft.)	5.6	ND*	19.0	ND*	ND*
Field EC (μmhos/cm)	55	55	60	60	60
Total phosphate as P (mg/L)	0.025	0.052	0.024	ND*	0.041
Dissolved orthophosphate as P (mg/L)	0.004	0.003	0.006	ND*	0.006
Total Kjeldahl N (mg/L)	0.660	0.120	0.180	ND*	0.260
Dissolved NO_3 and NO_2 as N (mg/L)	0.1 K	0.1 K	0.01 U	ND*	0.1 U
Chlorophyll *a* (μg/L)	24.9	ND*	3.3	ND*	ND*
Fecal coliform (number/100 mL)	2 K	2 K	2 K	ND*	2 K
Total Hg (μg/L)	0.1 U	0.5	0.2 U	ND*	0.2
Total As (μg/L)	ND*	ND*	2 U	ND*	2 U
Total Se (μg/L)	10 U	10 U	2 U	ND*	2 U

*ND means no data; K indicates the actual analytical value was less than the given value; U indicates the actual value was less than the detection limit shown.

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Sample depth [1]	surface	surface	surface	5 ft.	11 ft.
pH	7.6	8.2	8.3	6.6	5.8
Cond (μmhos/cm)	51	143	116	15.5	3.4
Water temperature (°F)	66	66.6	69.3	66.9	55.4
DO (mg/L)	8.1	8.5	7.8	9.2	9.1
Alk.	16	73	56	170.7	36.77
Na	3.7	9.8	8.7	1.14	0.21
K	1.1	2.7	1.7	0.29	0.09
Ca	3.5	9.7	6.7	1.43	0.08
Mg	1.9	7.7	5.2	0.427	0.035
Cl	0.7	1.9	0.8	0.18	0.5
SO_4	0.1	0.1	0.8	0.01	0.11
Phos	0.033	0.010	0.017	0.006	0.003
NO_3 and NO_2	-	-	-	0.006	* [2]
Chla	1.8	1.8	1.0	-	-

Sources: Atlas of Oregon Lakes, Deschutes National Forest, Bend-Ft. Rock Ranger District

1. All temperature and DO readings taken within the first 3 feet of the surface.
2. Non-detectable

Assignment of Data

1) Assignments for areas with stand examination data: Areas with stand examination data were processed using the following "rulesets" for determining the classification scheme. Part of the data processing included the processing "order", that was used to set the structural/seral stages. This processing is for live trees only.

2) Assignments for areas without stand examination data: The following discussion summarizes how structural stage assignments were made, in the absence of stand examination data. In this case, satellite imagery data sources were used to establish structural composition of the landscape.

GIS-assigned Structure Stage to Browns/Wickiup outside of Stand Exams

Criteria for Structure Stage assignments from Crescent Ranger District was the starting point for the assignments made for the Browns/Wickiup Watershed Analysis and areas adjacent to the project area.

PMR (Pacific Meridian Resources ISAT data from 1988) was used, along with the Forest-wide Plant Association Group (PAG) mapping effort, and the forest-wide Large Tree mapping effort (completed 1996). This first run was then updated for recent harvest and fire activity and to reflect the Large Tree mapping. Where stand exams exist, the Structure Stage assignments derived from the actual data was assigned to those polygons.

For PPD, PPW, MCD, MCW, MHD Plant Associations
Stage 1 : PMR size 7, 8, 10 and PMR canopy closure CC ALL
Stage 2 : PMR size 35-38 and PMR CC ALL
Stage 3 : PMR size 11, 12, 14 and PMR CC 15, 18
Stage 4 : PMR size 11, 12, 14 and PMR CC 20, 23, 24
Stage 5 : PMR size 20, 21, 23, 24, 25 and PMR CC 15, 18, 20, 23, 24
Stage 6 : PMR size 26-34, 39 and PMR CC 15, 18, 20, 23, 24 and Large Tree density class = 1 and large tree tpa >= 10
Stage 7 : none

For LPD and LPW Plant Associations
Stage 1 : PMR size 7, 8, 10 and PMR canopy closure CC ALL
Stage 2 : PMR size 35-38 and PMR CC ALL
Stage 3 : PMR size 11, 12 and PMR CC 15, 18
Stage 4 : PMR size 11, 12 and PMR CC 20, 23, 24
Stage 5 : PMR size 20, 21 and PMR CC 15, 18, 20, 23, 24
Stage 6 : PMR size 26-34 and PMR CC 15, 18, 20, 23, 24 and Large Tree density class = 1 and large tree tpa >= 10
Stage 7 : PMR size 14 and PMR CC 15, 18, 20, 23, 24 and Large Tree

density class = 1 and large tree tpa >= 10

Structure Stage was re-set to 1 for recent fires

Structure Stage was re-set to 1 for REGEN harvests
2 for FINAL REMOVAL harvests
5 for SALVAGE harvests in LODGEPOLE PINE

Structure Stage was re-set to 6 where Large Tree layer density class = 1 or 2

Structure Stage for areas with Stand Exams was assigned from derived data

These individual structure stages were grouped for plotting and summarizing
Stage 1 = Early
Stage 2 - 5 = Mid
Stage 6, 7 = Late

3) Corrections to update activities (harvest, thinning, fire)

In order to update the 1988 satellite image (or stand exam coverage) to current conditions, the activities record database was used, in an adjustment of the previously-classified structural/seral stage. The following table lists the changes that were made for this update.

Table A-4

Structural Stages Used to Describe Forest Vegetation Structure Over Time

Structural Stage	Structural Stage Number	Definition	Also Referred to As
Stand Initiation	1	When land is reoccupied by trees following a stand-replacing disturbance.	Early-successional Early-seral Regeneration
Stem exclusion-open canopy	2	Forested areas where the occurrence of new trees is predominantly limited by moisture.	Mid-successional Mid-seral Young forest
Stem exclusion-closed canopy	3	Forested areas where the occurrence of new trees is predominantly limited by light.	Mid-successional Mid-seral Young forest
Understory reinitiation	4	When a second generation of trees is established under an older, typically seral, overstory.	Mid-successional Mid-seral Young forest
Young forest multi-story	5	Stand development resulting from frequent harvest or lethal disturbance to the overstory.	Mid-successional Mid-seral Young forest
Old multi-story	6	Forest areas lacking frequent disturbance to understory vegetation.	Late-successional multi-story Late-seral multi-story Old forest multi-story
Old single-story	7	Forested areas resulting from frequent non-lethal prescribed or natural underburning, or other management.	Late-successional single-story

Modified from ICBEMP DEIS (1997)

Table A-5

Development of Structural Stage Assignments

Major Species Code	Total Stand Basal Area (per acre)	Trees Per Acre >16" (7" LP)	Trees Per Acre >20" (10" LP)*	Trees Per Acre Seedlings	Canopy Closure (%)	Structural/ Seral Stage (Derived)
122	100+ sqft	15+	10+			6 (7)
015	100+	20+				6
108	80+	60+	30+			6
093	100+	25+				6
264	100+	20+				6
122	80+	10+	<10			5
015		10-20	5-10			5
108	50+	50+	<30			5
122	80+	<10		100+		4
015	100+	15+	<5	100+		4
108	80+	100+	<10	100+		4
122	50-80				40+	3
015	50-100				40+	3
108	50+	<100	<10		40+	3
122	50-80				<40	2
015	50-100				<40	2
108	50+	<100	<10		<40	2
122	<50	<10				1
015	<50	<10				1
108	<50	<40				1

*Numbers for LP (species code 108) are based on TPA of 7"+ dbh and TPA 10"+ dbh respectively
Structural stage definitions can be found in Table A-4

Table A-6

Existing Dominant Species by PAG Verses Structural Stage

PAG	Dominant Species	Structural Stage (Acres)				Total
		Early	Mid	Late	Not Assigned	
MCD/W	WF 55% PP 31% LP 12% DF 2%	2,140 13%	2,960 18%	11,760 69%	80 <1%	16,940 100%
PPD/W	PP 88% LP 11% WF 1%	1,190 11%	4,190 39%	5,400 50%	50 <1%	10,830 100%
LPD	LP 92% PP 7% ES 1%	2,200 20%	7,440 67%	1,130 10%	370 3%	11,140 100%
LPW	LP 95% WF 4% PP 1%	600 16%	2,350 64%	540 15%	210 5%	3,700 100%
MH	MH 100%	10 <1%	1,410 33%	2,730 64%	140 3%	4,290 100%
Total		6,140	18,350	21,560	850	46,900
Percent		13%	39%	46%	2%	100%

Table A-7

Activity codes since 1988 (or since Timber Stand Exam data capture)

Activity Code	Activity Group	Major Species	Initial Structural/Seral Stage	Change to Structural/Seral Stage	Rationale for this change
HSH, HCC, HCP, HCR, HCU	Regen Harvest	LP, PP, MH	All	1	No understory exists
HOR, HFR	Removal Cut`	All	All	2	Understory does exist
HTH	Commercial Thinning	All	All	No change	Same structure remains; only change is in a lower density
HPR	Partial Cut	All	All	No change	Typically is a light overstory harvest cut
HSV, HSA	Salvage cut	LP	All	5	Usually heavy LP mortality
HSV, HSA	Salvage cut	All others	All	No change	Light, LPP mortality
HSL	Selection cut	All	All	No change	Light harvest
SPC, SRL, RPL	Special mgmt cultural practices	All	All	No change	Stand advancing treatments
HSP	Special harvest	All	All	No change	Past harvest code which is unknown

Fig. A-1

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Harvest and Reforestation Activities

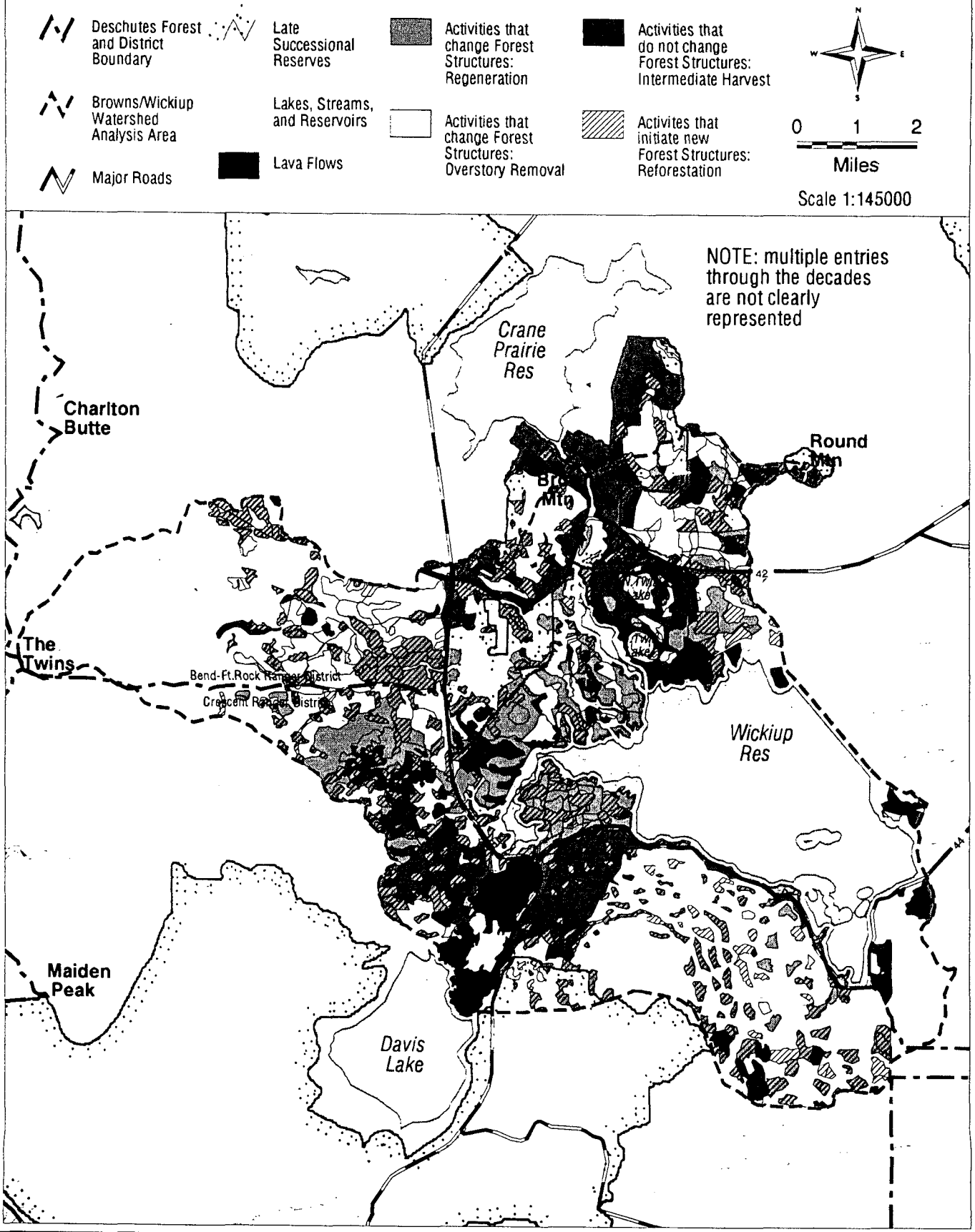


Fig. A-2

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

1993 Landsat Image
Thematic Mapper Image Bands 4, 3, and 2

Deschutes National Forest and District Boundaries

Stand Density Classifications

Calculation of Density Class for Stands

Formal stand examination (TSE) data was used to calculate stand density indices for inclusion in the watershed analysis. Stand density index (SDI, Reineke, 1933) was estimated for each stand where the following parameters existed: 1) trees per acre (tpa); 2) basal area per acre; 3) quadratic mean stand diameter (Dq); 4) plant association group (PAG).

The following formula was used to express the stand average SDI value (adapted from Cochran et al., 1994):

$$SDI = (tpa)(Dq/10)^{1.77}$$

Then "normal" SDI values, upper management zones (UMZ), and lower management zones (LMZ) were established for each PAG. A more refined process would be tailored towards individual stands, with relative density indices targeted towards the dominant species within each PAG, during site-specific project analysis.

In summary, the relative density classes were derived and given low, moderate, or high values. These equate to the following generalized density categories:

Table A-8

Classification of Density

Density Class/Risk	Generalized Representation
Low density/low risk	Stands that fall below the lower management zone
Moderate density/risk	Stands that fall between LMZ and UMZ
High density/high risk	Stands that fall above the upper management zone

Table A-9

Density Class by PAGs

PAG	SDI Normal	SDI UMZ	SDI Relative Values*		
			Low Risk	Moderate Risk	High Risk
PPD, LPD	225	170	<120	121-200	>200
PPW, LPW, MCD	265	200	<150	151-250	>250
MCW, MH	325	240	<200	201-300	>300

* where: low risk= <50% of SDI normal
moderate risk = 50-100% of SDI normal
high risk= >100% of SDI normal

Successional Pathways and Historic Range of Variability

In order to estimate the Historic Range of Variability (HRV) conditions that are currently thought to have existed within the Browns/Wickiup watersheds, successional pathway modeling was undertaken. The purpose of this modeling effort was to estimate the most likely structural and species composition on the watershed landscape, under fire-dominated conditions (circa 1850-1910).

Using the Vegetation Dynamics Development Tool (VDDT; Hann, Long, Keane et al, 1997), plant association groups found within the watershed were paired to similar Potential Vegetation Types (PVTs) model files. The model was run for each PVT file, under the "historic" scenario file, in order to generate a picture of most likely HRV conditions. Reports were run for 10, 50 and 100 year projections, and variations within simulations were noted. Mid-point values were interpolated and are summarized later in this appendix.

The following table lists the matches that were used in generating HRV (and midpoint) analysis results.

Table A-10

Matches Used in Generating HRV (and Midpoint)

Major PAG	PVT file (VDDT)	Species "Racks" Available (VDDT)
PPD	INTPP.PVT	Ponderosa pine
LPD	LPPB.PVT	Lodgepole pine
MCD	DGFWF.PVT	Douglas-fir, Ponderosa pine, Grand/white fir
LPW	SFWET.PVT	Lodgepole pine, Engelmann spruce/Subalpine fir, Douglas-fir, Western larch, Western white pine
MCW	GFWFE.PVT	Trees: Ponderosa pine, Western white pine, White fir, Douglas-fir, Lodgepole pine, (Western larch not included) Shrubs: Ceanothus
MH	MTHME.PVT	Trees: Mountain hemlock, Subalpine fir, Lodgepole pine, Douglas-fir, Western white pine Shrub: Mountain shrub (variable species)

Results: HRV report summaries

The following tables summarize results from VDDT model projection and analysis for the watershed in general. Mid-point estimates for HRV are rough averages thought to exist, and are found within VDDT runs.

Table A-11

Historic Range of Variability

PAG/Species/Structural Stage	Historic Range	HRV Mid-point
PPD*/PP/1 stand initiation	0-5%	Sum of structural stages 1-5 = 5%
/2&3 stem exclusion	0-5%	
/4 understory reinitiation	0-5%	
/5 young, multi-story	0-2%	
/6 late, multi-story	5-15%	10%
/7 late, single-story	60-90%	80%
/0 shrub stage	---	5%
*Assumed species coverage for PPD: PP = 95%; shrub = 5%		
LPD*/LP/1 stand initiation	27-45%	35%
/2&3 stem exclusion	13-20%	20%
/4 understory reinitiation	10-15%	10%
/5 young, multi-story	16-24%	20%
/6 late, multi-story	5-7%	5%
/7 late, single-story	N/A	0%
/0 shrub stage	---	10%
*Assumed species coverage for LPD: LP = 90%; shrub = 10%		
MCD*/PP/1 stand initiation	0-5%	Sum of structural stages 1-5 = 10%
/2&3 stem exclusion	5-10%	
/4 understory reinitiation	0-5%	
/5 young, multi-story	0-5%	
/6 late, multi-story	5-15%	10%
/7 late, single-story	60-90%	80%
/WF/1 stand initiation	0-15%	10%
/2&3 stem exclusion	0-15%	10%
/4 understory reinitiation	0-15%	10%
/5 young, multi-story	0-15%	10%
/WF/6 late, multi-story	40-80%	60%

PAG/Species/Structural Stage	Historic Range	HRV Mid-point
/7 late, single-story	N/A	0%
/Douglas Fir/1 stand initiation	0-15%	10%
/2&3 stem exclusion	0-15%	10%
/4 understory reinitiation	0-15%	10%
/5 young, multi-story	20-40%	30%
/6 late, multi-story	25-50%	40%
/7 late, single-story	---	10%
*Assumed species coverage for MCD: PP = 55%; DF = 35%; WF = 5%; shrub = 5%		
LPW*/LP/1 stand initiation	10-20%	15%
/2&3 stem exclusion	20-30%	25%
/4 understory reinitiation	5-15%	10%
/5 young, multi-story	0-5%	5%
/6 late, multi-story	30-40%	40%
/7 late, single-story	5-10%	5%
/0 shrub stage	---	N/A
*Assumed species coverage for LPW: LP = 15%; ES/SAF = 25%; DF = 14%; WL = 20%**; WWP = 21%; shrub = 6%		
MH*/all/1 stand initiation	10-20%	15%
spp/2&3 stem exclusion	30-40%	35%
/4 understory reinitiation	10-20%	15%
/5 young, multi-story	0-10%	5%
/6 late, multi-story	20-30%	25%
/7 late, single-story	0-10%	5%
/0 mtn shrub stage	---	N/A
*Assumed species coverage for MH: LP = 36%; MH = 33%; ES/SAF = 20%; DF = 1%; WL = 3%**; WWP = 0%; shrub = 6%		

PAG/Species/Structural Stage	Historic Range	HRV Mid-point
MCW*/all/1 stand initiation	5-10%	10%
spp/2&3 stem exclusion	15-20%	20%
/4 understory reinitiation	10-15%	10%
/5 young, multi-story	10-15%	15%
/6 late, multi-story	25-30%	25%
/7 late, single-story	5-10%	10%
/0 shrub stage	5-15%	10%
*Assumed species coverage for MCW: PP = 20%; GF/WF = 23%; DF = 20%; WL = 12%**; WWP = 6%; LP = 9%; shrub = 10%		

** WWP is missing from Brown's/Wickiup PAGs, so assume that WWP can be substituted as a similar ecological associate (i.e., intolerant species).

Silvicultural Treatment Priorities for Browns/Wickiup watersheds

The management objective is to develop forest stands that exhibit resiliency and stability to disturbance agents.

Table A-12

Silvicultural Priorities for Forested Vegetation Restoration and Management Opportunities

Plant Association Group (PAG)	Major Forest Species	General Symptom of Instability	Restoration or Management Opportunity	Priority for Stand Treatment
Ponderosa Pine Dry/Wet	Ponderosa Pine	Dense Understory	Thin Understory	1
		Dwarf Mistletoe	Thin/Prune/Select	3
Lodgepole Pine Dry	Lodgepole Pine	Mtn. Pine Beetle	Thin/Regenerate	2
		Dwarf Mistletoe	Regenerate Stand	5
		Dense Understory	Thin Understory	4
Mixed Conifer Dry	Ponderosa Pine	Conversion to Fir	Thin/Release	1
	Ponderosa Pine	Dwarf Mistletoe	Thin/Group Select.	3
	Lodgepole Pine	Mtn. Pine Beetle	Salvage/Thinning	5
	White Fir	Root Pathogens	Group Selection	6

Plant Association Group (PAG)	Major Forest Species	General Symptom of Instability	Restoration or Management Opportunity	Priority for Stand Treatment
Lodgepole Pine Wet	Lodgepole Pine	Mtn. Pine Beetle	Regenerate/Thin	5
	Ponderosa Pine	W. Pine Beetle	Salvage/Thin	9
	Eng. Spruce	Spruce Beetle	Salvage/Gp. Select	9
	White Fir	Fir Engraver	Salvage/Gp. Select	9
Mixed Conifer Wet	Ponderosa Pine	Stand Closure	Tree Culturing	8
	Douglas-Fir	Bark Beetle	Thin/Release	8
	White Fir	Fir Engraver	Sanitize/Salvage	9
	White Pine	Blister Rust	Plant Resistant Spp.	7
	Lodgepole Pine	Mtn. Pine Beetle	Sanitation/Salvage	9
Mountain Hemlock	Lodgepole Pine	Mtn. Pine Beetle	Regenerate/Thin	4
	Mtn. Hemlock	Dwarf Mistletoe	Sanitation	9
	White Pine	Blister Rust	Plant Resistant Spp.	7
	Douglas-Fir	Conversion to MH	Release Individual Trees	8
Riparian	All Species	All I&D Species	All Trtmt. Types	10

Table A-13

Summary of Treatment Opportunity Priorities

Priority #	Treatment Priority
1-3	High
4-6	Moderate
7-10	Low

Table A-14
Potential Habitat for Threatened, Endangered, and Sensitive Plant Species Within Browns/Round Mtn. LSRs

Name	Habitat	Probability of Occurrence
Tall Agoseris *Agoseris elata*	Nonforest and openings in ponderosa pine and rarely lodgepole pine. Dry edges of moist ecotones adjacent to moist meadows, lakes, stream courses, riverbanks.	Low
Shasta Arnica *Arnica viscosa*	A population containing several hundred plants was reported from the south slope of the South Sister, at approximately 6,400' in 1980; it has not been revisited. The range extends from Central Oregon to northern California, where it is considered "uncommon." Habitat is alpine or subalpine rocky sites, relatively steep scree and talus slopes above or at treeline, elevation 6,500' - 9,200'.	Low
Pumice Grapefern *Botrychium pumicola*	This Central Oregon endemic is known from alpine and montane habitats. It occurs in the pumice soils of lodgepole openings and frost pockets, and also at higher elevations in openings surrounded by whitebark pine. Known occurrence in the Cascades Lake Watershed to the north.	Low
Buxbaum's sedge *Carex buxbaumii*	Found in meadow habitat near the source of the Deschutes River, with tufted hairgrass in the narrow zone between riparian sedges and lodgepole forest.	Low
Estes' Artemisia *Artemisia ludoviciana* ssp. *estesii*	Occurs on planar to slightly undulating, moist riverbanks near the high water mark, in association with riparian vegetation such as rushes and willows. This Central Oregon endemic is known from 3 locations on the Forest.	Low
Gorman's Aster *Aster gormanii*	Endemic to the State of Oregon, in non-forest and forest openings, subalpine and alpine, dry exposures, open rocky slopes. Known so far from the west side and crest of the Cascades. 4,000' - 6,500'.	Low
Peck's Milkvetch *Astragalus peckii*	A Central Oregon endemic found in nonforest openings and open forest, deep pumice, loamy sand or sand soils, slope flat-gentle, associated with dry watercourses, lake basins and pumice flats. Typical habitat is sagebrush steppe, but it has also been found in lodgepole pine.	Low
Brewer's Reedgrass *Calmagrostis breweri*	Moist-dry alpine and subalpine meadows, open slopes, streambanks, and lake margins. 4,600' - 6,000'.	Low

Name	Habitat	Probability of Occurrence
Pale Sedge *Carex livida*	Sites with water tables above ground level for the majority of the growing season, peatlands. 2,000' - 8,000'.	Low
Green-tinged paintbrush *Castilleja chlorotica*	Numerous sites for this Central Oregon endemic have been discovered on the Bend-Fort Rock District, the closest being about 6 miles northeast of the planning area. Within the species' overall range, typical habitat includes open areas and forested openings of the ponderosa pine, lodgepole pine and mixed conifer zones, in very poor to moderately productive soils, often with sagebrush, at elevations ranging from 4,300' - 8,200'. The populations closest to the planning area are about 6 miles to the northeast.	Medium
Snowline Cymopteris *Cymopterus nivalis*	Scablands, rocky ridges, talus slopes from foothills to above timberline. 4,900' - 9,500'.	Low
Bolander Hawkweed *Hieracium bolanderi*	Open, exposed sites from montane foothills to alpine reaches of the southern Cascades, in unstable soils, rock crevices, ridgetops, and road cuts, in the 40"-80" precipitation zone. 1,100' - 8,700'.	Low
Ground Cedar *Lycopodium complanatum*	Moist, shaded conifer forest adjacent to streams, springs, wet meadows or lakes. 3,000' - 6,000'.	Low
Adder's Tongue *Ophioglossum vulgatum*	Moist to wet meadows among low shrubs (Spiraea douglasii), sedges (Carex amplifolia) and grape fern (Botrychium multifidum). Low elevation - 5,000'.	Low

Noxious Weeds

Please refer to the Deschutes National Forest Weed Environmental Assessment to be completed in the winter of 1997/98 for a complete listing of weed locations and control methods.

Wildlife Appendix

Wildlife Appendix

Introduction

The following narrative presents the most significant elements relating to present trends and ecological functions in the watershed and Late Successional Reserves (LSRs) as related to wildlife species and their habitats. The term "sensitive" includes all, as applicable, threatened, endangered, sensitive, survey and manage, and State listed species as previously described in this analysis. Effects of human and natural changes in the environment as related to wildlife are composite professional opinions from having utilized all the available information as appropriate to a large scale analysis. Special land management area designations from the Northwest Forest Plan (NWFP, 1994) and the Deschutes National Forest (DNF) Land and Resource Management Plan (LRMP, 1990) are noted if of significance to the wildlife resource.

Landscape Areas

Landscape Sub-Area 1a (High Elevation Unroaded)

- Direct impacts from humans are very low. Approximately 0% of this sub-area is in the early stage and 33% in the mid-structural stage. There are no roads but constructed trails exist. Trend is stable and at capacity for wildlife. Risk to a landscape level disturbance from fire is likely higher due to past fire exclusion efforts, however high elevation mountain hemlock forests have a relative long fire interval.
- Late-structural forest comprises approximately 59% of the sub-area.
- Ecological function is very good. This sub-area provides an important potential refuge for species that are sensitive to human disturbance that require large, unfragmented home ranges, e.g. fisher, wolverine, spotted owl, northern goshawk. It is also an important area for elk.
- There are no LSR (NWFP) lands within this sub-area, however it is designated as Matrix (NWFP) and provides important habitat and connectivity between LSRs for northern spotted owl and other species. This function remains intact and stable.
- Effects to sensitive species in this zone are very low.
- Approximately 8% of the sub-area is non-forested.

Landscape Sub-Area 1b (Roaded)

- Direct impacts from past logging activities and roading are moderate to high. Approximately 16% of the sub-area is in the early stage and 50% in the mid-structural stage. Trend is likely stable but capacity to support some species has been lowered. Large clearcuts have broken up fuel continuity but the area is likely at risk where lodgepole pine occurs in continuous blocks.
- Late-structural forest comprises approximately 31% of the sub-area.

• Ecological function is impaired but not significantly. Late seral habitats should be maintained on at least 15% of this landscape sub-area (NWFP, 1994).
• There are no LSR lands within this sub-area, however it is designated Matrix.
• Effects to sensitive species are likely low-moderate overall. Wolverine may be precluded from using the area due to human access. This sub-area provides forage for elk in clearcuts near the edges but, interiors of the larger units probably have low use. Road closures in the area appear to be effective. Snags and coarse woody materials (CWM) levels are below the minimums needed in harvest units but acceptable elsewhere.
• Approximately 3% of this sub-area is non-forested.

Landscape Sub-Area 1c (Johnny & Found Lakes)

• Direct impacts from humans are low. Trend is stable but may be below capacity due to effects of non-native fish introductions on life forms in the food chain. Disturbance by recreationists will likely increase and adversely affect a few of the more sensitive species.
• Late-structural forest comprises approximately 80% of this small sub-area. Approximately 20% is non-forested.
• Ecological function is slightly impaired for aquatic species but good for terrestrial riparian species.
• There are no LSR lands associated with these lakes, however the lands adjacent to the lakes are designated as Riparian Reserve (NWFP).
• Sensitive species that have likely been negatively affected include: northern spotted owl (low impact), spotted frog (low), bufflehead (low), Barrow's goldeneye (low), wolverine (moderate), fisher (low), and marten (low). Various warblers (e.g. yellow warbler) and other species that utilize riparian vegetation are potentially affected by human use near water, however it is unknown if there are conflicts in this sub-area.

Landscape Sub-Area 2a (Hwy 46)

• Direct impacts from humans are moderate to high. Approximately 12% of this sub-area is in the early stage and 52% in the mid-structural stage. Trend is slowly improving as the former harvest units grow replacement trees, however there has likely been soil compaction in the units.
• Late-structural forest comprises approximately 34% of the sub-area. A large (456 ac.) old-growth area, (i.e. Management Area 15, LRMP) is within it.
• Approximately 2% is non-forested.
• Ecological function is acceptable overall, however the edge effects of harvest units has likely decreased the amount of suitable core areas within the remaining late seral stands. Fire exclusion has resulted in the increase of stem density in the understories of many stands, e.g. mixed conifer dry PAG. Function may be at risk to future landscape level disturbance from wildfires.
• There are no LSR lands within this sub-area, however it is designated Matrix. This sub-area is important for habitat connectivity between LSRs.

• Effects to sensitive species are moderate to high due to fragmentation, roading and the reduction of late-structural forest. Elk and deer are likely more vulnerable to hunters because of the road densities and the open harvest units. Snags and CWM levels are variable and appear to be below the minimum amounts needed in past harvest units. There are three designated BEMAs and portions of two others within it. Road closures to protect the nesting areas have been ineffective in several locations. Often eagles establish their nests in trees adjacent to existing roads within the closure areas. When illegal entry is made later in the year by fishermen, campers, etc. they drive their vehicles by the established nests. Failures are common and are likely a consequence of this disturbance.

Landscape Sub-Area 2b (N. Wickiup)

• Direct impacts from humans are moderate to high. Approximately 19% of this sub-area is in the early stage and 63% in the mid-structural stage. Trend is slowly improving as the former harvest units grow replacement trees.
• Late-structural forest comprises approximately 17% of the sub-area.
• Approximately 1% is non-forested.
• Ecological function is acceptable presently, however impacts have occurred from fragmentation and roading. Fire exclusion has caused stand understories to become more dense, increased large tree mortality and increased fuel loadings within designated Bald Eagle Management Areas (BEMA, Management Area 3, LRMP). Reservoir construction may have increased windthrow by reducing surface roughness and exposing residual stands to stronger winds, which has caused losses of large trees within BEMAs.
• There are no LSR lands within this sub-area, however the western portion of it is designated Matrix.
• Effects to sensitive species are moderate to high due to fragmentation, roading and disturbance from recreationists who are using Wickiup Reservoir. Elk and deer are likely more vulnerable to hunters. However, some road closures in the area have mitigated these effects, i.e. several closures have been defeated. Snags and CWM levels appear to be below the minimum amounts needed.
• Forage base may be reduced as long as illegally-introduced bullhead dominate the fishery.

Landscape Sub-Area 2c (Eaton Butte)

• Direct impacts from humans are low to moderate. Approximately 18% of this sub-area is in the early stage and 52% in the mid-structural stage. Trend is slowly improving as the former harvest units grow replacement trees.
• Late-structural forest comprises approximately 28% of the sub-area and is confined primarily to the north end within a designated BEMA.
• Approximately 2% is non-forested.
• Ecological function is acceptable, but the low amount of late-structural habitat is of concern. Fire exclusion has caused stem densities and tree composition to change within the BEMA.
• There are no LSR or Matrix lands within this sub-area.

• Effects to sensitive species are moderate to high due to the reduction of late-structural habitat and current condition of existing late-structural stands. Road impacts have been mitigated by several closures to protect nesting bald eagles and appear to be effective. Snags and CWM levels are likely acceptable in the northern portion of this sub-area but not elsewhere.

Landscape Sub-Area 2d (Davis Arm)

• Direct impacts from past logging and roading are moderate to high. Additionally, there are both direct and indirect impacts to wildlife from recreationists using Wickiup Reservoir. Approximately 32% of the sub-area is in the early stage and 67% in the mid-structural stage. Trend is presently down. Extensive harvest activities (salvage) have likely compacted soils and exacerbated recovery of habitat.
• Late-structural forest comprises approximately 0% of the sub-area.
• Approximately 1% is non-forested.
• Ecological function is impaired due to the lack of late seral forest and impacts from dispersed recreation within riparian corridors, e.g. vegetation trampling and cutting.
• There are no LSR lands, however it is designated Matrix. These lands are not essential as movement corridors.
• Effects to sensitive species are moderate to high. The lack of large trees likely prevents potential bald eagle nesting in an area adjacent to high quality foraging habitat. The disturbance from recreationists is another potential adverse effect to eagles.

Landscape Sub-Area 2e (Forested Lavas)

• Direct impacts from humans are moderate due to past timber harvest and roading. Approximately 33% of this sub-area is in the early stage and 42% in the mid-structural stage. Trend is stable overall with some local declines in harvest units.
• Late-structural forest comprises about 25% of the sub-area.
• Ecological function is acceptable, however regeneration of harvested stands has been very slow.
• There are no LSR lands, however it is designated Matrix.
• Effects to sensitive species are moderate. Snags and CWM levels are below acceptable levels.

Landscape Sub-Area 2f (Wickiup Butte)

• Direct impacts from humans are moderate. Approximately 12% of this sub-area is in the early stage and 81% in the mid-structural stage. Road density is relatively high due to past timber harvest units and a cinder pit. Density was not calculated due to the small size of this sub-area. Trend is slowly improving.
• Late-structural forest comprises approximately 2% of the sub-area.
• Approximately 5% is non-forested.
• Ecological function is acceptable. However, fire exclusion is increasing the risk of wildfire

in the future in some areas (e.g. upper slopes). Many of the older shrubs are becoming decadent and have numerous dead stems. Late forest structure is significantly lacking.
• There are no LSR or Matrix lands within this sub-area. Effects to sensitive species are moderate. This sub-area is a designated BEMA. However, it is an alternate site that has not been occupied. The principal need is to re-establish large ponderosa pines for potential nest trees. Snags and CWM levels are below the minimum amounts needed.

Landscape Area 3 (Davis Mountain)

• Direct impacts from humans are moderate. Approximately 12% of this sub-area is in the early stage and 8% in the mid-structural stage. Open road density is about 3.81 mi./sq.mi. Trend is improving.
• Late-structural habitat comprises approximately 79% of the sub-area.
• Approximately 1% is non-forested.
• Ecological function is good. However, many stands have experienced a significant increase in understory tree density of shade tolerant species such as white fir. The increased competition is likely causing higher mortality of the overstory ponderosa pine.
• The majority of the sub-area is in Matrix. A small portion in the SW corner is in the Davis Mountain LSR. Only a small strip along the eastern edge is outside of NWFP allocations.
• Effects to sensitive species are low to moderate. Fragmentation from harvest units and roading is the principal effect as related to reduction of late-structural core areas from edge effects. This sub-area is likely used by nearby northern spotted owls for foraging and dispersal. Several large BEMAs are within the sub-area adjacent to Wickiup Reservoir and a portion of another occurs near Davis Lake. Fire exclusion may cause long-term negative effects on eagles by increasing the probability of crown fires. Road closures within the BEMAs are generally effective but could use improvement. Snags and CWM levels are variable and meet the minimum requirements only in the remaining late seral patches.

Landscape Sub-Area 4a (Shoreline/Reservoir)

• Direct impacts from humans are moderate to high. Approximately 11% of this sub-area (excluding reservoir surface) is in the early stage and 81% in the mid-structural stage. Road density was not calculated due to the limited, narrow zone around the shoreline of Wickiup Reservoir. Trend is downward due to impacts from dispersed recreation uses.
• Late-structural forest comprises approximately 7% of the sub-area.
• Approximately 1% is non-forested.
• Ecological function is impaired. Impacts are primarily related to soil compaction, vegetation destruction and disturbance to wildlife from recreationists. Additionally, in some areas understory tree densities have increased dramatically due to fire exclusion.
• There are no LSR lands within this sub-area. The entire shoreline of Wickiup Reservoir will be designated either Riparian Reserve under the NWFP or Riparian Habitat Conservation Area under INFISH.
• Effects to sensitive species are moderate. Bald eagles have likely been displaced from

potential nesting areas along the shoreline due to human disturbance. However, they appear to be successfully nesting in areas in the adjacent uplands. Snags and CWM appear to be below the minimum amounts needed in many areas. Eagle foraging has also likely been negatively affected but not proven. Overall effects of the reservoirs have been positive for many species, including a diversity of migrating waterfowl and shorebirds.

Landscape Sub-Area 4b (N. Twin Lake)

- Direct impacts from humans are moderate to high. Approximately 1% of this sub-area is in the early- and 2% in the mid-structural stage. Trend is stable.
- Late-structural forest comprises about 97% of the sub-area.
- Ecological function is acceptable. However, the understory tree component is changing due to lack of fire. Increased competition will affect the remaining overstory trees over time. Most of the area around the lake is designated BEMA, so retention and recruitment of large diameter ponderosa pine is of concern. Habitat has been permanently removed/altered by a developed campground.
- There are no LSR lands within this sub-area, however it is both Matrix and Riparian Reserve.
- Effects to sensitive species are moderate. The established BEMA is unoccupied. Potentially suitable nest trees are present, and the lake provides potential forage fish. Other forage areas are within reach of eagles if they were to nest in this sub-area. The effects of heavy recreational use of the lake and its small size may be the reason for birds not nesting there. Recent road closures on the south end of the lake will likely help reduce potential disturbance to wildlife. The entire west shore of the lack lacks solitude due to a developed trail there and the proximity of the area to a highway.

Landscape Sub-Area 4c (S. Twin Lake)

- Direct effects from humans are moderate to high. Approximately 0% of this sub-area is in the early- and 34% in the mid-structural stage. Road density was not calculated. Trend is declining.
- Late-structural forest comprises approximately 66% of the sub-area.
- Ecological function is acceptable, but at risk due to fire exclusion. Stand understories are becoming more dense and insect/disease vectors are increasing their impacts. Large overstory trees will become more stressed and vulnerable to these processes. Habitat has been permanently removed/altered by a campground and a resort. Hiking and biking trails surround the lake.
- There are no LSR lands within this sub-area, however it is both Matrix and Riparian Reserve.
- Effects to sensitive species are moderate. The principal problem is human disturbance.

Landscape Area 5 (Davis Lava Flow)

- Direct effects from humans are low. Lava flow surface accounts for about 79% of this sub-area. Approximately 22% of the vegetated area sub-area is in the mid-structural stage. Road density is very low and limited to the edges of the lava flow. Trend is stable.
- Late-structural forest comprises 78% of the vegetated sub-area and is confined to an "island" in the south-central portion of the flow. This area is a designated BEMA and has two other BEMAs proximate to it along the shores of Davis Lake.
- Ecological function is good. Fire exclusion within the described island is the principal concern. However, it was not field evaluated. Regeneration of trees is always an issue within forested lavas, so the role of fire must be placed in this context. There are no LSR lands within this sub-area, however it is both Matrix and Riparian Reserve.
- Effects to sensitive species are low. Bald eagles are not presently nesting in the area, but the potential is good given the proximity of high value foraging areas at Davis Lake.

Landscape Sub-Areas 6a, b, c, d (Browns Mountain LSR)

- Direct effects from humans are moderate to high. Approximately 14% of this sub-area is in the early stage and 27% in the mid-structural stage. Road density is about 5.7 mi./sq. mi. Trend is slowly improving.
- Late-structural forest comprises about 56% of the sub-area. There is one large BEMA and three old-growth areas within this sub-area. A portion of the LSR is also within Osprey Management Area #5 (LRMP).
- Approximately 3% is non-forested.
- Ecological function is variable across the LSR with the central portion around Browns Mountain being good and the other areas only marginally acceptable. Fire exclusion and past logging units are the principal causes of negative effects. Tree regeneration of units near Wuksi and Shukash Buttes has been retarded due to heavy ceanothus invasion.
- Effects to sensitive species are moderate to high. Human disturbance in the portion of the LSR adjacent to Crane Prairie Reservoir is a concern for effects on bald eagles. Past selective harvest of large ponderosa pine and Douglas-fir eliminated most of the potential nest trees for northern spotted owls. Timber harvest and roading in areas adjacent to the LSR have significantly eliminated dispersal habitat for spotted owls. Other late-successional old growth (LSOG) species may be negatively affected by edge effects from fragmentation of late-structural habitats throughout the LSR. Snags and CWM levels are below the minimums needed in many stands.

Landscape Sub-Area 6e (Round Mountain LSR)

- Direct effects from humans are moderate. Approximately 4% of this sub-area is in the early stage and 25% in the mid-structural stage. Road density is about 4.0 mi./sq. mi. Trend is stable.
- Late-structural habitat comprises about 71% of the sub-area.

• Ecological function is acceptable. Fire exclusion is primarily an issue on the western and southern aspects where ceanothus presently dominates many stand understories. A few stands adjacent to the LSR also have this problem. Habitat has been permanently removed/altered by the lookout facility and access road on the mountain. Removal of trees to accommodate helicopters and improve visibility from the lookout are also impacts. A seasonal road closure helps in retaining some solitude in the area. Edge effects are of high concern in this LSR due to its small size.
• Effects to sensitive species are moderate. Past harvest and edge effects are the principal concerns. Sub-adult bald eagles have been observed on the mountain, and it is considered to have nesting potential. Spotted owls could potentially travel thought this sub-area, but nesting is unlikely due the limited amount of late-structural forest present. Other LSOG species may be affected by edge effects around the perimeter of the LSR.

Summary

Overall, the watershed is in a marginally acceptable ecological condition presently. The principal threat is due to the exclusion of fire and the resultant increase in understory density of shade tolerant trees and shrubs. Fragmentation is significant in many areas of the watershed but is slowly being healed by the re-growth of stands. Roads also contribute to fragmentation and remain a significant negative impact in most of the sub-areas. Snags and CWM levels are generally below the minimum acceptable amounts across large areas. Disturbance from dispersed recreationists is a concern for some species, however it is limited primarily to those lands adjacent to the major water bodies in the watershed. The reservoirs have off-set some impacts by providing habitat for osprey, eagles, waterfowl, shorebirds and other species. The value of riparian habitats is highly variable with those in the Browns Creek area the most valuable. Human disturbance is comparatively low in the Browns Creek area.

Guilds

The following Habitat Guilds were composed in order to simplify the complexity of doing an assessment on the habitat conditions of over 260 species. Management Indicator Species (MIS) have been selected for each guild. The MIS may or may not be the same as the MIS that have been designated by the Deschutes National Forest (DNF) Land and Resource Management Plan (USDA, Forest Service 1990). Due to time and data limitations the following guilds do not assign each species in the watershed analysis area, but only the ones most typical of the habitat types designated. The primary data source for the assignments is included in the Official Analysis Files, which is a series of queries from the Forest's Wildlife Habitats Relationships database. A listing of species begins on page A-61.

Riparian/Aquatic Guild
Reference Conditions
• Representative species assigned-- 9. Management Indicator Species (MIS) designated-- 3. Approximately 78 total species on Deschutes National Forest.
• Historic population levels unknown
• Riverine aquatic habitat was the dominant type historically in the watershed.
• High lakes including Johnny and Found were in pristine condition and were important for breeding for some species, e.g. Barrow's goldeneye, bufflehead, etc.

Current Conditions

- Representatives include bald eagle (federal Threatened) and spotted frog (federal Candidate). At least 11 species have declining population trends.
- Reservoir construction significantly altered the riverine riparian habitats (i.e. flowing water) to reservoir aquatic riparian habitats
- Wickiup Reservoir ranks poor to fair for riparian habitat due to fluctuating water levels, which limits the establishment of stable aquatic vegetation. However, it does provide extensive shallow water and shoreline habitats for waterfowl and some shore birds. Crane Prairie Reservoir is more stable and has well established aquatic plant communities. It also provides extensive areas of flooded lodgepole pine forest snags, which are valuable for perching birds. Some areas have good willow communities. There is less open shoreline than at Wickiup.
- Overall, waterfowl, shorebirds, bald eagles and osprey have benefited from improved foraging conditions in the reservoirs. Riverine aquatic species (e.g. river otter, dipper) have been negatively impacted by the reservoirs.
- High elevation lakes in the watershed are in good condition but now have human recreation related disturbance and potential water quality impacts. Introductions of non-native fishes to these systems has likely negatively impacted amphibians.
- Browns Mountain LSR—Browns Creek provides nearly pristine aquatic habitat. The Deschutes River also has very good habitat but its flows are regulated by Crane Prairie dam. There are approximately 18 acres of water within the LSR, however there is over 1½ miles of Crane Prairie Reservoir adjacent to the LSR boundary. Round Mountain LSR - none present.

Riparian/Terrestrial Guild

Reference Conditions

- Representatives species assigned - 19. MIS designated - 3. Approximately 206 species on Deschutes National Forest.
- Historic population levels unknown.
- Riverine riparian zones was the dominant type historically in the watershed.
- Lake and spring riparian zones were limited.

Current Conditions

- Representatives include greater sandhill crane (TES, species of concern, Oregon listed), Preble's shrew (TES, species of concern), and Cascades frog (species of concern, Oregon listed). At least 20 species have declining population trends.
- Reservoir construction significantly changed high quality riverine riparian zones along the Deschutes River to fluctuating zones along the reservoir shorelines.
- Willows are presently the dominant reservoir shoreline riparian species because they are capable of surviving seasonal water inundation.
- The natural lakes and springs in the area continue to provide high quality riparian zones.
- Browns Mountain LSR - Browns Creek (3 miles of length) and the Deschutes River (1½ miles in length) provide a narrow but high quality riparian zone, which total 640 acres using the recommended Riparian Reserve boundaries. An additional 80 acres of Riparian Reserve is recommended within the LSR along the shore of Crane Prairie Reservoir. Large springs within the Browns Creek Riparian Reserve are providing high quality wildlife habitat and unique plant communities. Round Mountain - none present.

Marsh/Wet Meadow Guild
Reference Conditions
- Representative species assigned - 14. MIS designated - 3. Approximately 176 total species on Deschutes National Forest.
- Historic population levels unknown.
- Wet meadows were associated with the Deschutes River flood plain.
- Wet meadows likely burned during periods of drought in the past.

Current Conditions
- Representatives include long-billed curlew (TES), Preble's shrew (species of concern) and spotted frog (federal Candidate). At least 28 species have declining population trends.
- Reservoir construction inundated large wet meadows.
- Wet meadows in the area of upper Browns Creek have declined in quality due to invasion of coniferous trees. Fire exclusion in the area has likely contributed to conifer establishment.
- Browns Mountain LSR - contains about 71 acres of wet meadows in the southern portion along upper Browns Creek. Round Mountain LSR - none present.

Dry Meadow Guild
Reference Conditions
- Representative species assigned - 6. MIS designated - 2. Approximately 178 total species on Deschutes National Forest.
- Historic population levels unknown.
- Meadows in the area of Johnny Lake (Round meadow and Long meadow) are likely dry or only seasonally wet.

Current Conditions
- Representative include the great gray owl (species of concern, Oregon listed) and the mountain bluebird. At least 14 species have declining population.
- Limited habitat type (25 acres) within the watershed that is found primarily in the high elevation areas (landscape sub-area 1a).
- Meadow conditions were not evaluated but most are within a roadless area and are therefore, likely in good condition with the potential of some impacts from recreationists. There is also the potential for coniferous tree invasion of dry meadows where fire has been excluded for extended periods of time.
- Browns Mountain LSR - none present. Round Mountain LSR - none present.

Shrub Guild
Reference Conditions
- Representative species assigned—24. MIS designated—3. Total species on Deschutes National Forest undetermined.
- Historic population levels unknown.

Current Conditions—
- Representatives include the northern sagebrush lizard (species of concern) and the green-tailed towhee. Number of declining species populations undetermined.
- Shrub communities are predominantly in the understories of coniferous forest stands. Only a few are relatively pure shrub fields, which are confined to dry south slopes on buttes and rock, cinder and lava

areas.
• Fire exclusion has likely allowed shrub communities to become older and taller. However, shadi by tree canopy may reduce shrub density where timber harvest has not occurred for many years. La of fire has allowed shade tolerant trees such as white fir to become more densely established. Firs ha fuller crowns which affect shrubs more significantly than pines. Fire sensitive shrubs includi sagebrush and bitterbrush have likely increased on suitable sites. In some stands prescribed burning association with timber harvest has greatly increased the density of fire adapted shrubs such as *Ceanoth* spp.
• Browns Mountain LSR—extensive shrub communities in the xeric plant associations with most on t south and west slopes of Browns Mountain. Nearly pure ceanothus stands in old harvest units are prese in the northern portion of the LSR near Wuksi and Shukash Buttes. Round Mountain LSR—w established understories of shrubs are present on all but the northern aspect of Round Mount Ceanothus stands are very dense in some older harvest units on the west aspect with ponderosa pi overstory.

Alpine/Subalpine Guild
Reference Conditions
• Representative species assigned—10. MIS designated—2. Total species on Deschutes National For undermined.
• Historic population levels unknown.
• Very limited habitat type in the watershed.

Current Conditions
• Representatives include the wolverine (TES, species of concern) and the Clark's nutcracker. Declini species are undetermined.
• Habitat is limited to the extreme upper elevations near The Twins.
• Conditions were not evaluated, however they are likely good since the area is roadless. Fire frequen in the high elevation areas is long, however its exclusion by management has likely allowed trees increase in density and distribution in these areas (landscape sub-area 1a).
• Browns Mountain LSR—none present. Round Mountain LSR—none present.

Coniferous Forest—Early-Structural Guild
Reference Conditions
• Representative species assigned—14. MIS designated—3. Approximately 34-84 total species Deschutes National Forest with variance by PAG (lodgepole low, mixed conifer high).
• Historic population levels unknown.
• Early-structural conditions were produced by stochastic natural disturbances including wind, fire a insect/disease events. Patch sizes were variable and location was affected by a multitude of variab including large scale climatic conditions, e.g. drought.
• The extent of early-structural conditions could be predicted through an intensive analysis of wildf events. However, this was not done and presents many complications that could reduce accuracy. Oth factors such as windthrow can not be reconstructed.

Current Conditions
• Representatives include several neotropical migrant birds, e.g. western bluebird, Callio hummingbird, etc. At least 10 species in mixed conifer have declining populations.

• Presently there is a total of 6,196 acres of early-structure forest in the watershed. This is about 13% of the total forested area.
• Past timber harvest activities have created most of the present early-structural stands. Within the more intensely managed zones the early-structural stage ranges from 13-23%. Lodgepole pine PAGs have the highest proportion of early-structural stage forests. Landscape sub-area 2 has the greatest acreage in early-structural stage. Refer to Table 3-5, "Harvest Summaries" and Appendix Figure A-1, "Harvest and Reforestation Activities" for additional details. Natural meadows and edges with the meadows and lakes meet some of the needs of this group. Additionally, areas within extensive lava which have fewer trees, may provide early-structural conditions.
• Browns Mountain LSR-- 14% is in early-structural stands. Round Mountain LSR-- 4% is in early structural stands.

Coniferous Forest—Mid-Structural Guild
Reference Conditions
• Representative species assigned—11. MIS designated—2. Approximately 41-82 total species on Deschutes National Forest with variance by PAG (lodgepole low, mixed conifer high).
• Historic population levels unknown.
• The amount and distribution of mid-structural forest stages are unknown. The climatic conditions, fire frequency and intensity, and other stochastic natural events were the controlling agents historically. Many stands likely attained the more simple structure of middle aged stands where distinct stories and the establishment of shade tolerant species were just beginning.

Current Conditions
• Representatives include a variety of the more common forest dwelling species such as blue and ruffed grouse, red-breasted nuthatch, porcupine and mule deer. At least 12 species in mixed conifer have declining populations.
• Presently there is 18,486 acres of mid-structural forest in the watershed. This is about 40% of the total forested area.
• The mid-structure stage is the most dominant forest habitat within the watershed. In the heavier managed areas the proportion ranges from 60-74% on the more significant PAG acreages. Lodgepole pine PAGs have the largest proportion in the mid-structural stage. Landscape area 2 has the greatest acreage in mid-structural stage. Refer to Tables 3-9, 3-12 and Figure 3-2 for additional details.
• Browns Mountain LSR-- 28% is in mid-structural stage forest. Round Mountain LSR-- 25% is in mid-structural stage forest.

Coniferous Forest—Late-Structural Guild

Sub-Guild: LSOG/Ponderosa Pine Dry/Wet Plant Association Groups (PAG)
Reference Conditions
• Representative species assigned—17. MIS designated—3. Approximately 85 total species on Deschutes National Forest.
• Historic population levels unknown.
• Past wild fires likely created a mosaic of late-structural conditions. Stands on mesic north aspects and along riparian areas probably had multiple stories with relatively high canopy coverage. More xeric stands were likely dominated by very large ponderosa pine with open understories with patchy regeneration. Patch sizes probably ranged in size. Canopy gaps were created by windthrow and

pathogens like root rots. Mistletoe infections likely caused localized crown fires even with low intensi stand ground fires due to the brooming effect on branches and the build up of fuels in these sites.
• Species that are dependent upon large trees, snags and relatively open understories for foraging we probably plentiful.

Current Conditions

• Representatives include bald eagle (TES), flammulated owl (species of concern, Oregon listed Williamson's sapsucker (Oregon listed), pygmy nuthatch (Oregon listed), and silver-haired bat (surve & manage). At least 13 species have declining populations.
• Past timber harvest has removed or altered many late-structural ponderosa pine stands in the watershe No existing late-structured stands were observed that have not had at least single tree selection harve within them. Nearly all are affected by fragmentation of the landscape by units which have increase edge contrast and its associated effects on micro-site conditions within the adjacent stands.
• Fire exclusion has had a significant affect on the remaining late-structural pine stands. The understo tree component has greatly increased in density, and shade tolerant species such as white fir hav increased. Existing overstory ponderosa pine appears to be declining in vigor and becoming susceptib to pathogens such as western pine beetle due to the increased stress from competition for the availab resources of water and nutrients.
• Currently there is approximately 21,749 acres of late-structural forest in the watershed. This is abo 47% of the total forested area.
• Ponderosa pine PAGs comprise 4,521 acres or 25% of the total late-structure forest acreage. This about 10% of the total forested acreage in the analysis area. Landscape sub-area 2 has the greate acreage of late-structural ponderosa pine with areas 3 and 6 also being significant. Refer to Tables 3-9 3-12 and Figure 3-2, for additional details.
• Fragmentation is high in Landscape areas 2 and 3.
• Browns Mountain LSR— 14% of total area is in late-structural ponderosa pine (1,375 acres all stages Fragmentation is moderate to heavy in this type. Round Mountain LSR—none present.

Sub-Guild: LSOG/Mixed Conifer Dry/Wet PAGs

Reference Conditions

• Representative species assigned— 16. MIS designated— 3. Approximately 99 total species c Deschutes National Forest.
• Historic population levels unknown.
• The mixed conifer dry PAG likely had fairly frequent fire intervals depending upon slope, aspec topographic position, etc. Consequently, ponderosa pine and Douglas-fir were dominant overstory tre and thin barked firs were reduced by ground fires. The wet PAG had longer fire intervals and was ab to more fully develop multiple canopy layers, however this PAG is very limited within the watershe Patch sizes were likely variable with larger patches in the more mesic sites such as north slopes, or whe frequent fires kept fuel loadings low. Firs have a higher mortality rate, which would have contribute to within stand canopy gaps.
• Due to the greater plant species diversity and more complex structure in these PAGs, wildlife use woul have been expected to be greater than in the more simple associations, particularly for those species th require large trees, snags and semi-open understories.

Current Conditions

- Representatives include northern spotted owl (TES), northern goshawk (Oregon listed), and hoary bat (survey & manage). At least 17 species have declining populations.
- Past timber harvest has removed or altered many late-structured mixed conifer stands in the watershed. No existing late-structural stands were observed that have not had at least single tree selection harvest within them. Nearly all are affected by fragmentation of the landscape by units which have increased edge contrast and its associated effects on micro-site conditions within the adjacent stands.
- Fire exclusion has had a significant affect on the remaining late-structured mixed conifer stands. The understory tree component has greatly increased in density, and shade tolerant species such as white fir have increased. Existing overstory ponderosa pine appears to be declining in vigor and becoming susceptible to pathogens such as western pine beetle due to the increased stress from competition for the available resources of water and nutrients. Other species (white fir, lodgepole pine, Douglas-fir) have also shown increased mortality from insect and disease agents, e.g. root rots, mountain pine beetle, mistletoe, spruce budworm, etc.
- Currently there is approximately 21,749 acres of late-structured forest in the watershed. This is about 47% of the total forested area.
- Mixed conifer PAGs currently comprise 9,869 acres or 55% of the total late-structured forest acreage. This is about 22% of the total forested acreage in the analysis area. Landscape sub-area 3 has the greatest acreage of mixed conifer late-structure with areas 2 and 6 also being significant. Refer to Tables 3-9, 3-12 and Figure 3-2, for additional details.
- Fragmentation in landscape areas 2 and 3 is high.
- Browns Mountain LSR— About 60% of the total area is in late-structural mixed conifer (3,925 acres all stages). Fragmentation is low to moderate in this type. Round Mountain LSR— 71% of the total area is in late-structural mixed conifer (223 acres all stages). Within the Round Mountain LSR, fragmentation is low, however due to its small size there are low to moderate impacts from adjacent harvest units because of edge effects on interior forest conditions.

Sub-Guild: LSOG/Lodgepole Pine Dry/Wet PAGs

Reference Conditions

- Representative species assigned—11. MIS designated—2. Approximately 44 total species on Deschutes National Forest.
- Historic population levels unknown.
- The lodgepole pine PAGs are generally even-aged due to historic stand replacement fires. Patch sizes were variable depending upon climatic conditions, fuel continuity, topographic position, etc.
- The wet PAG has significantly better site productivity and produces larger trees with a longer biological age.
- Mountain pine beetle and other pathogens are normal control agents in lodgepole and contribute to fuel loadings and subsequent fires. Species such as black-backed woodpecker and American marten have adapted to the cycles of lodgepole that provide large amounts of snags and coarse woody material. However, due to the relatively simple stand structure, lower plant diversity and lower site productivity that is common to lodgepole sites, the associated wildlife community is also lower in diversity and abundance.

Current Conditions

- Representatives include black-backed woodpecker (Oregon listed), great gray owl (survey & manage, Oregon listed), and American marten (Oregon listed). At least 7 species have declining populations.

• Past timber harvest and salvage have significantly affected the age class proportions of lodgepole pine forest in the analysis area. Epidemic bark beetle populations have occurred in many stands. Fire exclusion has altered the natural rotation of age classes and patch sizes/shapes. Late-structural lodgepole stands are limited and primarily located within the roadless area or narrow riparian zones.
• Currently there is approximately 21,749 acres of late-structural forest in the watershed. This is about 47% of the total forested area.
• Lodgepole pine PAGs currently comprise 763 acres or 4% of the total late-structural forest acreage. This is about 2% of the total forested acreage in the analysis area. Landscape sub-area 2 has the greatest acreage of late-structural lodgepole pine with landscape sub-areas 3 and 4 also contributing. Refer to Tables 3-9, 3-12, and Figure 3-2, for additional details.
• Fragmentation in landscape sub-area 2 is high.
• Browns Mountain LSR-- 6% of the total area is in late-structural lodgepole pine (1,761 acres all stages). Fragmentation is moderate to high in this type. Round Mountain LSR—none present.

Sub-Guild: LSOG/Mountain Hemlock PAG
Reference Conditions
• Representative species assigned—14. MIS designated—2. Approximately 64 total species on Deschutes National Forest.
• Historic population levels unknown.
• The Mountain Hemlock PAG has a relatively long fire frequency. Fires were most likely stand replacement events after periods of drought. Fuel loadings and dense understories would develop between fire events. Snow loading, windthrow and insect/disease pathogens were also common stand disturbance agents. Patch sizes were likely very large with small canopy gaps due to the agents described. White pine blister rust is a mortality agent that is more prevalent in this PAG than the others.
• Wildlife communities in these PAGs are less rich than those in mixed conifer stands due to the higher elevations and lower site productivity. However, there are several unique species (e.g. wolverine, Clark's nutcracker) that use these habitat types. Some areas provide high value elk habitat because of the solitude, more abundant water, and uneven-aged structure of the stands.

Current Conditions
• Representatives include northern spotted owl (TES), northern three-toed woodpecker (species of concern, Oregon listed), northern goshawk (Oregon listed), and fisher (species of concern, Oregon listed). At least 11 species have declining populations.
• Past timber harvest has had minimal impact on these PAGs. Some road construction has occurred which has contributed to fragmentation. Recreation impacts have occurred as related to trail construction and use and dispersed camping. Present levels of insect/disease pathogens appear endemic and within the normal expected range of variability.
• Currently there is approximately 21,749 acres of late-structured forest in the watershed. This is about 47% of the total forested area.
• Mountain Hemlock PAGs currently comprise 2,683 acres or 15% of the total late-structured forest acreage. This is about 6% of the total forested acreage in the analysis area. Landscape sub-area 1 has the greatest acreage of late-structural mountain hemlock with only minor amounts in landscape areas 2 and 5. Refer to Tables 3-9, 3-12 and Figure 3-2 Plant Association Groups for additional details.
• Fragmentation effects in landscape sub-area 1 are low.
• Browns Mountain LSR— none present. Round Mountain LSR—none present.

Unique-Special Habitats Guild

Sub-Guild: Edge

Reference Conditions

- Representative species assigned—15. MIS designated—3. Approximately 38 total species on the Deschutes National Forest (partial list- limited to obligate/dependents).
- Historic population levels unknown.
- Natural (inherent) edges were created by wildfire, windthrow, insect/disease, etc. in the past. The ecotones associated with the contrast between different vegetative communities or different structured stages are important to many wildlife species. Resources for different life functions may be attainable within a relatively small area in ecotones as compared to forest interior habitats. The degree of edge contrast is also an important influence. For example, a recent wildfire could create a very open patch adjacent to late-structured forest for a high contrast edge. A low contrast edge could be between a mature stand and old-growth forest.

Current Conditions

- Representatives include great gray owl (survey & manage), pygmy owl (Oregon listed), hoary bat (survey & manage), and fringed myotis (survey & manage, Oregon listed). At least 3 of the obligate/dependent species have declining populations.
- Timber harvest, road construction, reservoir construction and other activities have greatly increased the amount of edge in the watershed. As an example, the patch sizes of vegetation in a managed landscape are generally much smaller than historic natural patches. Small patches have a much larger edge to interior ratio. The type of edge has also been significantly altered. Management created or induced edges generally have a much higher contrast than inherent edges. High contrast edges have a greater degree of influence on adjacent late-structured patches. Research has shown micro site influences from 400-600 feet on average. These subtle changes may influence vegetation, temperatures, snow loading, etc. that in turn affect wildlife species in either positive or negative ways.
- Within the watershed, landscape sub-area 1 has the lowest amount of edge, where sub-areas 2 and 3 have the highest amount due to harvest units and roading. Landscape sub-area 4 is primarily Wickiup Reservoir which both created edge (shoreline) and destroyed it (vegetation). Landscape sub-area 5 is a large lava flow below Davis Lake which provides a very unique ecotone between the lava field and mixed conifer forest.
- The amount and types of edges have not been quantified for the watershed analysis or for the LSRs. Refer to the previous discussions for the LSOG sub-guilds on fragmentation, which is a good indicator of the amount of edge.

Sub-Guild: Snags/Logs

Note: Many of the species in this sub-guild are members of other guilds. However, the majority are totally or significantly dependent upon snags/logs for a critical part of their life cycle. Snags and logs have an important role in ecosystem function, therefore it was determined that a evaluation of this group of species was essential.

Reference Conditions

- Representative species assigned—13 snags, 5 logs. MIS designated—4 snags, 3 logs. Approximately 57 total species use snags and 26 total species use logs on the Deschutes National Forest.
- Historic population levels unknown.

• Snags and logs were provided by natural tree mortality (old age), windthrow, wildfire, insect/disease vectors, ice storms, etc. Other than crown wildfires and epidemic insect infestations, most tree mortality occurred as individuals or in small patches. Windthrow rarely occurs in this area in large patches.
• Snags provide a variety of functions to the ecosystem. They have a role in lightning fires which are critical to natural processes. Hundreds of individual organisms have been documented to live in or upon standing snags. They all have a role in the functioning system. Wildlife species, as an example, use them for nesting, foraging and perching. Woodpecker (primary excavators) excavate nest and roost holes in them, which are very important to a number of other species (secondary nesters). Populations of woodpeckers provide an invaluable benefit to the forest by controlling the numbers of many destructive forest insect pests.
• Fallen trees/snags would remain on the site unless moved by water courses or by gravity down slope. They would undergo a natural process of deterioration which is critical to many invertebrates, fungal species and other organisms. They have a significant role in soil structure and chemistry, which affects all the living components of the system. Logs provide benefits to wildlife in numerous ways including: protective cover, travel ways, foraging sites, and nesting/reproduction sites.

Current Conditions

• Representative species include great gray owl (survey & manage), pileated woodpecker (Oregon listed), western bluebird (Oregon listed), silver-haired bat (survey & manage), and American marten (Oregon listed). At least 15 of the snag dependent species populations are declining and at least 1 of the log dependent species populations is declining.
• Timber harvest/salvage activities have had significant negative impacts upon snag/log densities and distribution. Fuelwood cutting, hazard tree removals, road construction, prescribed burning, brush piling and burning, and other activities have also reduced snags and logs. Fire exclusion has eliminated the recruitment of snags/logs in several ways. Direct and indirect mortality of trees as related to fire has been greatly reduced. Trees killed by fire are now quickly salvaged whereas they remained on site historically. Species such as the black-backed woodpecker are dependent upon fire killed trees. Trees that were injured (stressed) by fire often died later after attacks by insects/disease agents.
• Landscape sub-area 1 has the greatest number of snags and logs due to the large amount of roadless lands within it. Landscape sub-area 3 has low to moderate levels of snags depending upon the type and age of past harvest activities. Landscape area 2 has low snag levels with some local exceptions. Older harvest units that salvaged beetle killed lodgepole pine are particularly deficit. Currently about 6,500 acres within landscape sub-area 2 are open to public fuelwood cutting (i.e. southwest of Round Mountain and north of Pine Butte). However, several restrictions will mitigate the impacts. A snag analysis for areas of the watershed outside of the LSR boundaries was not done due to a lack of data.
• Browns Mountain LSR and Round Mountain LSR (combined analysis)-- Approximately 16% of the area is below the minimum acceptable snag/log densities (refer to Table 7-5 for a snag analysis by MSA).

Sub-Guild: Talus/Rock/Lava Flows

Reference Conditions

• Representative species assigned—12. MIS designated—3. Total species on the Deschutes National Forest undetermined.
• Historic populations unknown.
• Very stable habitat types that developed via geomorphic processes. Vegetation influences within or adjacent to these areas have been more transient but may significantly influence the value of these areas for wildlife species.

• Talus and rock are minor habitat components in the watershed. Lava flows, including cinder areas, are more prevalent. These areas provide a unique diversity within the forested ecosystem. Some plants are specialized for these environments. Precipitation is often funneled off rocks, which may improve site conditions for more water dependent plants, e.g. quaking aspen. Seasonal ponds may form adjacent to large lava flows (e.g. landscape area 5) and provide valuable aquatic/riparian habitats for a variety of species.

Current Conditions

• Representatives include long-eared myotis (species of concern, survey & manage) and pika (special interest). At least one species population is declining.

• Direct affects by management activities have included road construction and rock quarries. Indirect affects have been primarily due to timber harvest within (e.g. forested lavas) or adjacent to these features.

• Landscape sub-area 1 has some rock/talus (53 acres) habitats in the higher elevations. Small, local areas are within the forested matrix where forested lavás are present and it has outcropped, e.g. landscape sub-area 2 (21 acres). Cinder pits have exposed areas that were likely previously forested, however the pits are generally low value to wildlife species. Landscape sub-area 5 is a large lava flow (1,079 acres) north of Davis Lake. It provides a unique ecotone habitat with the adjacent forest and with the shoreline along Davis Lake. An inclusion of forest is also present that has potential for bald eagle nesting. Wood ducks and other riparian species are using seasonal ponds that have formed along the western edge of the flow.

• Browns Mountain LSR—rock outcrops occur in the southern portion of the LSR along Browns Creek. These are high value habitats due to the number of springs associated with the outcrops. Several large cinder pits are present in the northeast portion of the LSR near Wuksi and Shukash Buttes. Smaller pits occur in other areas of the LSR. Round Mountain LSR—some small rock outcrops plus an adjacent, old cinder pit.

Note: the other sub-guilds in this category (see Appendix) were not assessed due to their lack of presence or very minor representation in the watershed/LSRs.

Generalist Guild

Reference Conditions

• Representative species assigned—23. MIS designated—none. Total species on the Deschutes National Forest undetermined.

• Historic populations unknown.

• This species group utilizes a wider range of habitat types and conditions than the previous guilds. The composite reference conditions of the other guilds describe the wide breadth of habitats of this guild.

Current Conditions

• Representatives do not include any notable species as far as status with the exception of the golden eagle which has special protective legislation. Declining populations undetermined.

• Both natural and human induced vegetative changes that increase habitat diversity will benefit most generalist species. Permanent losses of habitat from road and facility construction, as an example, are obviously damaging even to generalists. Nearly all generalists have a specific life cycle requirement that must be met. The large number of species in this category and the individual biological traits of each presents a complexity that is outside the scope of this scale of assessment.

• Browns Mountain LSR—habitats are diverse. Round Mountain LSR—small area, low diversity.

Wildlife Resource Recommendations

Introduction

This section provides specific recommendations relative to the wildlife resource. It is supplemented by the referenced summary tables later in the Wildlife Appendix. Refer to Chapter VI in the report text for integrated, all resource recommendations for the watershed and to Chapter VII for recommendations on the Browns and Round Mtn. Late-Successional Reserves. Detailed information is available on suitable habitat (i.e. desired conditions) requirements of late successional wildlife species in the LSR assessment for Cultus and Sheridan Mountains (Table IV-1; DNF 1996).

General Recommendations

Watershed-scale wildlife management strategies are summarized in Table 6-5. Nine strategies are rated for each Landscape sub-area. This is a very broad, coarse filter summary to present an overall, watershed-scale perspective of restoration opportunities within the watershed and LSRs. The strategies should be self-explanatory and useful for other resources to consider during the integration of objectives.

Bald Eagle Management Areas

The Deschutes National Forest Land and Resource Management Plan (DNF, LRMP 1990) has designated 15 individual Bald Eagle Management Areas (BEMAs) within the boundaries of the Browns-Wickiup Watershed Analysis Area including Late Successional Reserve areas outside the boundary. Specific direction for the BEMAs is in the LRMP. Management plans have not been developed for most of them with the exceptions being the three BEMAs near Davis Mt. on the Crescent Ranger District. Management actions should not be implemented until BEMA plans are completed, so the following recommendations must be placed in this context. Refer to Table A-15 for additional details and to Figure 3-9 for locations. Unless otherwise noted, the BEMAs are on the Bend-Ft. Rock Ranger District.

Desired Conditions (DC): Four types of eagle habitat are required including nesting, foraging, perching and roosting. The BEMAs are relatively small compared to the home ranges of bald eagles and may not be capable of providing all the essential habitat components within them. The following general descriptions of desired conditions will be useful in determining the priority of restoration/protection actions. However, more detailed site-level analysis is needed in order to develop the required management area plans.

Nesting Habitat DC: Provide large diameter (32"+) Douglas-fir and/or ponderosa pine trees at a density of 6-10+ trees per acre across 50% of the BEMA at all times. Ensure that adequate small and medium sized trees are developing in the understory to eventually replace the nest trees as they decline with age. In areas with potential disturbance from people, provide screening with dense patches of trees as needed. Consider risk factors of landscape level disturbance from wildfire, insect/disease, windthrow and other elements in development of silvicultural and prescribed fire prescriptions for stands. Dead topped trees and snags are also important in nesting stands for adults to use as perches during the nesting season. Large crowns with good access are critical to attract the birds for nest building. Tree culturing in the

understory and mid-story will be the most common silvicultural treatment in the BEMAs within the Browns/Wickiup watershed. In stands where fuels have been reduced by thinning, piling and burning to levels that reduce current risks, prescribed fire may be another important restoration tool. Potential disturbance of active nesting areas must be controlled by effective road closures.

Foraging Habitat DC: Provide good populations of forage fish species in lakes, reservoirs and rivers within the home range of nesting bald eagles. Ensure that populations are not over fished or impacted by land management activities.

Perching Habitat DC: Provide large trees adjacent to foraging areas with an emphasis on Douglas-fir and ponderosa pine. Snags and dead topped trees are excellent perches. Ensure that adequate tree recruitment is available to provide a steady recruitment of large trees and snags. Focus on areas with less human disturbance. Tree culturing, planting, thinning and top blasting are potential restoration treatments. Fuel wood cutting including camper use may require control near important eagle foraging areas.

Roosting Habitat DC: Provide mature and old-growth forest stands within two miles of high quality winter foraging habitats. Large, full-crowned Douglas-fir and ponderosa pine with substantial sized limbs at mid-canopy height are required. Mid-slope or ridge top stands are preferred. Potential disturbance of documented roosts must be controlled.

BEMA #E1 (Crane Prairie SE & SW, Browns Mountain):

- Located outside of the watershed boundary and only partially within the Browns Mountain LSR (sub-areas 6a and 6c).
- Stands are patchy due to previous logging entries. White fir has become well established in the understory and is competing with ponderosa pine and Douglas-fir.
- Human disturbance is minimal and is partially controlled by established road closures (gates) above road #4285. The gate system has been defeated by vehicles and needs to be fortified in the area on the eastside of Browns Mountain. The area between road #4285 and Crane Prairie has heavy dispersed recreational use and is the likely source of individuals who enter the area.
- Potential restoration actions include 1) Thinning from below to remove competing white fir for culturing of established ponderosa pine and Douglas-fir; 2) Planting of Douglas-fir and ponderosa pine in existing canopy gaps where needed; 3) Obliteration and re-vegetation of old logging roads; 4) Signing of existing gates to explain purpose of closures; and 5) Improve the gate closures that are ineffective; 6) Re-introduce fire into the stands after fuel levels are managed to reduce risk to losses of larger trees, i.e. thinning, piling, burning first.
- Parts of this BEMA have been recommended for the Northern Spotted Owl Management, Riparian and General Protection Management Strategies (MSAs) under the LSR Assessment.
- The BEMA is in good condition, i.e. providing large trees for nesting. This is a very valuable BEMA that supported two active nests in 1997. The principal concern is the competition of fir with ponderosa pine and Douglas-fir.

BEMAs # E2 and #E3 (Westside and Eastside North Twin Lake):

- Located within the watershed boundary in sub-area 4b.
- Stands are generally overstocked in the understory due to white fir regeneration and patchy lodgepole pine within a ponderosa pine matrix. Past timber harvest has removed many of the larger size class

ponderosa. Fuels are beginning to accumulate which may further aggravate fire risks. Mistletoe infections of the overstory on the eastside will complicate understory objectives.

- Disturbance from people is high and likely not a situation that can be mitigated due to a well established trail on the westside and a campground on the north end.
- Potential restoration actions include: 1) Thin the understory to culture large ponderosa pine; 2) Re-enforce the road closure on the south end of the lake and place signs to explain purpose of closure. Evaluate current access to the eastside; 3) Place an emphasis on foraging/perching habitat including retention of large snags that do not pose a safety hazard to recreationists; 4) Actively work with fisheries managers to ensure adequate forage for bald eagles; 5) Re-introduce fire into the stand after risks are reduced; and 6) Consider dropping the BEMA designation on the westside and expanding the area on the eastside which has much better solitude.
- This BEMA has no nesting history that has been documented. The principal concern is that the BEMA's potential has been compromised by the heavy recreational use beginning with the start of fishing season. Its overall condition is fair.

BEMA #E4 (Browns Creek):

- Located within the watershed boundary in sub-areas 2a and 4a.
- Stands are primarily lodgepole pine with inclusions of ponderosa on the higher ground. Past logging activities have removed many of the larger diameter ponderosa and salvaged bug killed lodgepole. Regeneration has been good overall but some local spots are poor. There are no late-structural stage stands classified within the BEMA.
- Disturbance is moderate to high due to recreationists traveling through the area and their use of the shoreline of Wickiup Reservoir.
- Potential restoration actions include: 1) Thinning to culture ponderosa pine; 2) Planting of ponderosa pine where needed; 3) Re-evaluate the road closure which is currently totally ineffective and if continued provide informational signing; 4) Repair the large sink hole on road #4280-100 which causes the public to traverse the BEMA in order to get around it when its impassable (i.e. full of water); and 5) Promote denser stands at strategic points along roads to aid in screening vehicles from eagles.
- This BEMA is in only fair condition but was occupied in 1997. Scattered large ponderosa pine are currently meeting the need but are at risk to windthrow, wildfire, insect attacks, etc.. The principal concern is unauthorized access and its potential to displace nesting birds.

BEMA #E5 (Wickiup North):

- Location is within the watershed boundary in sub-areas 2b and 4a.
- Stands are composed of ponderosa pine primarily. Establishment of white fir does not appear to be a significant issue. The area is at high risk to windthrow. Shrubs have increased and are contributing to risk of wildfire. Lodgepole pine occurs primarily along the shoreline of Wickiup Reservoir. Conifer regeneration is patchy which may be due to past soil compaction from timber harvest. The late-structural stage is limited (19%).
- Disturbance is moderate due to the proximity of Wickiup Reservoir, campgrounds and a paved highway.
- Potential restoration actions include: 1) Plant ponderosa pine where needed; 2) Treat compacted soils and obliterate unneeded roads; 3) Re-introduce fire to control understory vegetation; 4) Improve the road closures which are ineffective east of road #4260 and at risk west of the road, plus add informative signing; 5) Thin where needed to culture large ponderosa pine; and 6) Prohibit dispersed camping via boat access within the BEMA along the Wickiup Reservoir shoreline when needed.

•This BEMA is only in fair condition. The principal concern is that the existing large pine are at risk to further blowdown events. It was occupied by a pair of eagles in 1997.

BEMAs #E6, #E7 and #E8 (Davis Creek):

•Location is within the watershed boundary in sub-areas 2a, 2d and 4a.

•This combination of BEMAs was only partially evaluated. BEMAs #s 6 and 8 are small in size. BEMA #7 is large and was the only portion evaluated. Stands have been heavily logged in the past, however scattered "large" ponderosa pine remain which are providing nesting structures. Understories have been heavily thinned in many stands in the recent past and pose no unusual fire risks. The area is a mix of ponderosa and lodgepole pine with the latter dominant in local areas. There is no classified late-structural stage in any of the three BEMAs.

•Disturbance is moderate to high due to illegal entry past the established road closures and the legal entry via boat to the shoreline.

•Potential restoration actions include: 1) Improve the existing road closures and provide informative signing; 2) Plant ponderosa pine where needed; 3) Restrict shoreline camping if needed, i.e. near active nests; 4) Thin where needed to culture large ponderosa pine; 5) Re-introduce fire as appropriate to site conditions; 6) Obliterate and re-vegetate unneeded roads; and 7) Prohibit campers from cutting snags > 16" DBH along the shoreline for firewood.

•This BEMA is in only fair condition but was occupied (although unsuccessfully) in 1997. The principal concern is the significant problem with illegal vehicle access and that the eagles often select a nest tree adjacent to a road at a time when human use is almost non-existent, i.e. prior to fishing season. Nest abandonment is a possibility later when people enter the area.

BEMA #E9 (Wickiup Butte):

•Location is partially within the watershed boundary in sub-areas 2f and 4a.

•Stands are dominated by ponderosa pine with a variable understory of shrubs. Parts of the area have been harvested and burned in the past, however the untreated areas have dense stocking and a layer of decadent shrubs. Other considerations include mistletoe infections and some lodgepole pine mortality. There is only 1% classified as late-structural stage in this BEMA.

•Disturbance is low to high (near the shoreline of Wickiup). There are no existing road closures, although windthrown trees and rutted roads deter some access in the upland areas. OHV use may be a complicating factor that should be monitored.

•Potential restoration actions include: 1) Thin those stands needing it to culture large ponderosa pine and treat the activity fuels; 2) Re-introduce fire as appropriate, i.e. after thinning, piling and burning (note that the decadent shrubs on the site will complicate prescribed burning); 3) Obliterate and re-vegetate unneeded roads; 4) Evaluate the need for a future seasonal road closure when the stand begins to provide potential nesting habitat; 5) Reduce fuel loading, stand density and other wildfire risk factors in the high use recreation area along the shoreline of Wickiup Reservoir; and 6) Re-vegetate the old quarry within the area.

•This BEMA is in poor condition and will require investments and time to promote suitable nesting habitat. However, it is strategically situated near an excellent foraging area.

BEMA #E10 (Crescent RD, Upper Davis Arm of Wickiup):

•Location is within the watershed boundary in sub-areas 2a and 4a.

•Stands are somewhat patchy due to past timber harvest. Dominated by ponderosa pine with a significant amount of late-structural stage (76%). The stand density is high in local areas.

• Disturbance is moderate to high due to a high open road density.
• Potential restoration actions include: 1) Thin as needed to culture large ponderosa pine; 2) Re-introduce fire as appropriate; 3) Implement a seasonal road closure; 4) Obliterate and re-vegetate unneeded roads; and 5) Promote higher stem densities in strategic locations near roads to provide security screening, e.g. along Century Drive and road #4660.
• This BEMA is in good condition and is very strategically located between Wickiup Reservoir and Davis Lake. Disturbance from vehicles is the most significant concern.

BEMA #E11 (Majority of Crescent R.D., Wickiup South and West, Round Swamp):
• Location is within the watershed boundary in sub-areas 3 and 4a.
• Stands are dominated by late-structural mixed conifer (83%) but fragmentation has occurred due to past timber harvest units. Dense understories and plantations are common. Well established shrub communities also contribute to potential wildfire risk along with slope.
• Disturbance is moderate to high along the shoreline of Wickiup Reservoir and low in the uplands. Road density is high but is somewhat mitigated by road closures, however they are low tech designs that have evidence of failures.
• Potential restoration actions include: 1) Thinning (precommercial and commercial) to culture ponderosa pine and Douglas-fir (including plantations); 2) Re-introduction of fire in small units as the fuels are reduced by prior treatments of thinning, piling and burning; 3) Improve and expand the road closures including informational signing; 4) Obliterate and re-vegetate unneeded roads; 5) Promote higher stem densities in strategically located patches along roads to promote security, e.g. roads # 44 and #6230; and 6) Reduce risk factors for wildfire origin and spread from the high use recreation areas. Refer to the BEMA Management Plan (DNF, Crescent Ranger District 1996) for additional information. Note: This area has several restoration projects in the planning stages currently (DNF, Crescent Ranger District, Seven Buttes Environmental Assessment 1996).
• This BEMA is in good condition and very strategically placed near a high quality foraging habitat. The risk to a stand replacement wildfire is the principal concern.

BEMA #E12 (Eaton Butte):
• Location is partially within the watershed boundary in sub-area 2c.
• Stands are dominated by mixed conifer stands with some purer ponderosa pine on the south and west slopes. Late-structural stage forest comprises 52% of the area. White fir has greatly increased in the understories of the mixed conifer stands and decadent shrubs are common under the ponderosa pine. Stand structure is the most complex on the north aspect in the northern portion of the BEMA. Large ponderosa pine are competing against a dense understory in many places. Mistletoe infections may complicate future stand objectives.
• Disturbance is low due to a gated road closure system, however informative signing is needed.
• Potential restoration actions include: 1) Thin the competing white fir (some commercial sized) to culture the desirable ponderosa pine and Douglas-fir. Some commercial sized ponderosa pine could be removed; 2) Re-introduce fire as appropriate after reducing risks; 3) Younger stands on the southern section of the BEMA need to be assessed for thinning or planting needs; and 4) Assess the potential for access from the adjacent private lands.
• This BEMA is in good condition in the northern portion but poor in the southern portion. This is an important site due to its position near high quality foraging areas. It was active in 1997.

BEMA #E13 (Crescent R.D., Davis Lake NW):

- Location is within the watershed boundary in sub-area 2a.
- Stands are dominated by ponderosa pine which has a dense understory of multiple species. Patchy in areas with older timber harvest/salvage units that have well established regeneration. Late-structural stage forest comprises 61% of the area.
- Disturbance is variable with the area adjacent to Davis Lake receiving moderate use by recreationists. Open road density is high.
- Potential restoration actions include: 1) Thinning to culture ponderosa pine and Douglas-fir; 2) Re-introduction of fir after risks are reduced; 3) Establish a seasonal road closure system with informative signing; 4) Fuelwood cutting areas are adjacent to the BEMA and may result in cutting within the BEMA which may or may not be desirable; 5) Close dispersed camping sites, as needed, if eagles occupy nests near them; 6) Promote dense conifer patches along the high use roads to promote security, e.g. road # 4660; 7) Manage for low fuel loadings in those dispersed recreation sites that may pose a risk to the BEMA from wildfire starts; and 8) Coordinate with fishery management personnel to ensure that forage fish in Davis Lake are managed to accommodate eagle needs as well as for recreation. Refer to the BEMA Management Plan (DNF, Crescent Ranger District, 1996) for additional information.
- This BEMA is in good condition. The principal concern is the competition of white fir and other understory species with the desirable ponderosa pine and Douglas-fir, including plantations. Potential human disturbance is also a significant concern in this area due to the attraction of Davis Lake and the open road system. Windthrow may also be an issue in this area due to the proximity of Davis Lake.

BEMA #E14 (Crescent R.D., Davis Lake lava flow "island"):

- Location is within the watershed boundary in sub-area 5.
- Stands were not field evaluated. However, classification data suggest that they are predominately late structural (97%) mixed conifer.
- Disturbance is low due to the lack of roads and rough terrain.
- Potential for restoration actions: not evaluated.
- This is a small BEMA that has good potential for future nesting due to its strategic location between Wickiup Reservoir and Davis Lake.

BEMA #E15 (Crescent R.D., East Davis Lake/lava flow):

- Location is partially within the watershed boundary in landscape area 3.
- Stands were not field evaluated due to the very small portion (67 acres) of the total BEMA falling within the analysis boundary.
- Disturbance potential is high because nesting in recent years has occurred within a campground. However, seasonal closures have mitigated potential effects.
- Potential for restoration actions: not evaluated. Refer to the BEMA Management Plan (DNF, Crescent Ranger District 1996) for additional information. Also, refer to the Davis Lake LSR Assessment (DNF, Crescent Ranger District 1995).
- This BEMA is in a very strategic location near a high quality foraging area.

The following Table A-15 summarizes the above information for bald eagle management areas:

Table A-15

Bald Eagle Management Areas Summary

ID #*	Location /Site Name	Acre-age	Nest Sites	1997 Nesting Activity	Dominate PAGs	Dominate Structure	Road Density	% LSR	Restor. Priority	General Prescriptions	Comments
E1	Browns Mt./Crane Pr. SE & SW (2) and Browns Mt. (1)	1260	3	All active	MCD 81%	Late 75%	7.7 mi./sq. mi.	98%	M	PCT, CT, PF; PP and DF emphasis	High quality habitat; incorporate LSOG spp. objectives. Rec impacts near shorelines.
E2	Westside North Twin Lake	69	0	na	PPD 48% PPW 28%	Late 77%	9.0***	0	L	PCT, CT, PF; PP emphasis	High use rec area, trail, fishing. Small site.
E3	Eastside North Twin Lake	82	0	na	PPD 41% MCD 29% PPW 22%	Late 95%	6.5***	0	M	PCT, CT, PF; PP emphasis	High use rec area but more solitude than westside. Forage/perch emphasis.
E4	Deschutes Arm Wickiup Res./ Browns Cr.	399	1	Active	LPD 75% PPD 22%	Mid 77% No Late	4.7***	0	H	PP plantings, PCT; PP emphasis	Limited nest trees. High rec use area. Breached road closures
E5	Gull Pt. Wickiup Res./Wickiup N.	317	1	Active	PPD 61% LPD 34%	Mid 68% Late 19%	7.1***	0	M	PP plantings, PCT; PP emphasis	High windthrow risk area. Breached road closures Potential rec disturbances.
E6	NE Wickiup Res./Davis Cr.	61	0	na	LPD 49% PPD 46%	Mid 100% No Late	9.1***	0	M	Not evaluated	Small site. Lacks late-structural forest.
E7	Lower Davis Arm Wickiup Res./Davis Creek	629	1	Active	LPD 56% PPD 41%	Mid 98% No Late	5.4	0	H	PCT, PF; PP emphasis	Breached road closures High rec use area. Lacks late-structural forest.
E8	NE Wickiup Res. at Davis Arm mouth/Davis Cr.	17	0	na	LPD 82%	Mid 76% No Late	0.0	0	L	Not evaluated	Very small site. Lacks late-structural forest.
E9	Wickiup Butte	191 [495]	0	na	PPW 77%	Mid 84% Late 1%	2.8***	0	M	PCT, PF; PP emphasis	Road impacts. Lacks late-structural forest. Majority outside watershed.
E10	Upper Davis Arm Wickiup Res.	616	?	?	PPD 48% PPW 46%	Late 76% Mid 16%	5.2***	0	M	PCT, CT, PF	Road impacts. No records per Isaacs Oregon reports.
E11	South Wickiup Res./Round Swamp, Wickiup S and W.	3220	2-3?	Active	MCD 64% PPW 17% PPD 14%	Late 83%	6.3	0	H	PCT, CT, PF; PP emphasis. Reduce LP.	High quality habitat. Road closures in place but some breaches. Planned sales in BEMA.
E12	Eaton Butte	674 [866]	1	Active	MCD 46% PPW 37%	Late 52% Mid 43%	7.7	0	H	PCT, CT, PF; PP and DF emphasis.	High quality habitat. Road closure in place. Partly outside.
E13	Davis Lake (near Moore Cr.)/Davis Lk. NW	227 (part)	1	?	PPW 97%	Late 61% Mid 27%	6.7***	0	H	PCT, PF; PP emphasis	Only a small portion of the BEMA is within the watershed boundary. Road impacts.

ID #*	Location /Site Name	Acre-age	Nest Sites	1997 Nesting Activity	Dominate PAGs	Dominate Structure	Road Density	% LSR	Restor. Priority	General Prescriptions	Comments
E14	Davis Lake lava flow "island"	117	0	na	MCD 92%	Late 97%	0.0	0	?	Not evaluated	Island of forest within a large lava flow. Good potential for occupancy.
E15	East Davis Lake/Lava Flow (campground)	67 (part)	1	Active	MCD 100%	Late 100%	7.2***	?	?	Not evaluated	Only a small portion of the BEMA is within the watershed boundary.
E*	Wuksi Butte	na	1	Active	na	na	na	Within LSR	H	PCT, PF; PP emphasis.	Nest is not within a designated BEMA. Road closure in place.

Note: * Active eagle site that is not within a designated BEMA. Data is limited. ** Nest sites total excludes alternate nests. *** Road densities should be used with caution on small areas, i.e. less than one square mile.
PCT = Precommercial thinning, CT = commercial thinning, PF = Prescribed thinning, PP = Ponderosa pine, DF = Douglas-fir, LP = Lodgepole

Summary:

- Total 7,946 acres in BEMAs within analysis area. Several areas have acreages outside of the watershed boundary.
- 7% of BEMAs are within potential NWFP Riparian Reserves.
- MCD 45%, PPW 20%, PPD 19%, LPD 13%
- Late-structure 62%, mid-structural 28%, early-structural 8%
- Road density all classes is 6.3 mi./sq. mi. gross ignoring gated closures.
- 15% is within LSR

Old Growth Management Areas

The Deschutes National Forest LRMP has designated five individual Old Growth Management Areas within the boundary of the watershed analysis area and Late Successional Reserves areas outside the boundary. Specific direction for the Old Growth areas is in the LRMP. Also, refer to the Decision Notice for the Continuation of Interim Management Direction Establishing Riparian Ecosystem and Wildlife Standards for Timber Sales (USDA, Forest Service, 1995). Refer to Table A-16 for additional details and to Figure 3-9 for locations.

Desired Conditions (DC): Provide mature/old-growth forest conditions within the capabilities of the respective plant associations. Refer to the R-6 Interim Old Growth Definitions (USDA, Forest Service 1993) and other guidelines including specifics by species and Plant Association Group (PAG) in the Cultus/Sheridan Mtn. LSR Assessment (DNF, 1996). In general, restoration prescriptions in the Browns/Wickiup watershed will include thinning (primarily understory), tree culturing, planting (plantations, old units, canopy gaps), and prescribed fire (dry PAGs). With the exception of lodgepole pine, most stands must be at least 150 years of age to begin providing the desired habitat conditions. Connectivity should be provided between old growth units in order to meet dispersal habitat needs of specific indicator species, e.g. pine marten, goshawk (LRMP, 4-149).

OG #1 (Wuksi-Shukash Buttes):

- Location is mostly outside the watershed analysis boundary but within the Browns Mountain LSR, which are sub-areas 6a and 6b.
- Stands are dominated by mixed conifer. The area is patchy due to past timber harvest units and to the influences of soils classified as forested lavas. Past thinning has created local areas of relatively open ponderosa pine, however many areas have dense understories of competing white fir and lodgepole pine. Late-structural classification indicates 67% of the unit in this stage. Roads and cinder pit development have removed some habitat.
- Connectivity with other Late and Old Structure (LOS) habitat is only fair due to the proximity of Crane Prairie Reservoir, the Four Corners Fire area and past timber harvest units. In particular, some adjacent units have relatively low conifer stocking because of heavy competition from shrubs (ceanothus).
- Potential restoration actions are not addressed in this section because the entire Old Growth Area is within the Browns Mountain LSR. Refer to the Management Strategy Areas in Chapter VII for recommendations.
- This Old Growth Management Area is in fair condition. The principal concerns are lack of connectivity and increasing wildfire risk due to a dense understory in local areas. Stand structure simplification has occurred in some stands due to past logging and thinning activities. Snags and coarse woody materials (CWM) are generally below acceptable levels.

OG #2 (Deschutes River):

- Location is mostly within the watershed boundary and entirely within the Browns Mountain LSR (sub-area 6a).
- Stands are relatively uniform with 95% of the area classified in the late-structural stage forest. Understories are dense. Both the mixed conifer and ponderosa pine Plant Association Groups (PAGs) are present in the unit. Road densities are very high and have removed habitat.
- Connectivity is good to the to the west with LOS stands on Browns Mountain. However, it only fair to the north to OG #1 and poor to the east to LOS on Round Mountain.

• Potential restoration actions are not addressed in this section because the entire area is within the Browns Mountain LSR. Refer to the Management Strategy Area recommendations in Chapter VII.
• This Old Growth Management Area is in good condition presently but at risk to future insect/disease damage and wildfire.

OG #3 (West of Sokol Land Exchange):
• Location is within both the watershed boundary and Browns Mountain LSR (sub-area 6a and 6d). The map displays only a small portion of the original LRMP allocation, because a large portion has been absorbed by a Proposed Wild and Scenic River designation.
• Stands are dominated by ponderosa pine and mixed conifer PAGs. There are some lodgepole pine stands. Past selective timber harvest and some small regeneration units have occurred in the area. Overall there is a well established overstory with a dense understory of competing trees.
• Connectivity is good to the north to LOS stands on Browns Mt and poor in all other directions due to past timber harvest activities. Several major roads also contribute to the isolation.
• Potential restoration actions are not addressed in this section, because the entire area is within the Browns Mountain LSR. Refer to the Management Strategy Area recommendations in Chapter VII.
• This Old Growth Management Area is in good condition presently but at risk to future insect/disease damage and wildfire.

OG #4 (South of Sokol Land Exchange)
• Location is within both the watershed boundary and Browns Mountain LSR (sub-area 6d).
• Stands were not field evaluated. However, classification data suggest that they are 74% late-structural stage and dominated by the lodgepole pine wet PAG.
• Connectivity is only fair to the north to OG #3 and poor in all other directions.
• Potential restoration actions are not addressed in this section, because the entire unit is within the Browns Mountain LSR Refer to the Management Strategy Area recommendations in Chapter VII.
• The condition of this Old Growth Management Area was not evaluated, however it occupies a wet soil type and has higher productivity than nearby sites.

OG #5 (Crescent Ranger District, Road #4650)
• Location is within the watershed analysis boundary in sub-area 2a.
• Classification data indicate that none of this area has late-structural habitat. Preliminary field evaluation supports the data, however there are areas with scattered mature ponderosa pine. Forested lava soils dominate this site and limit its potential to provide old-growth forest structure.
• Connectivity is only fair due to dominance of lodgepole pine types and past/planned timber harvest activities adjacent to the area.
• Potential restoration actions have not been determined because additional field evaluation is needed.
• The condition of this Old Growth Management Area is poor. Alternative sites should be considered. The best potential area in the vicinity is south and west of Pine Butte. The old-growth habitat there is high quality but some fragmentation has occurred. Its potential far exceeds the present site.

The following Table A-16 summarizes the information listed above for old growth management areas:

Table A-16 Old-Growth Management Areas Summary

ID #	Location	Acre-age	Dominate PAGs	Dominate Structure	Road Density	Restor. Priority	General Prescriptions	Comments
OG1	Wuksi-Shukash Buttes	354 100% LSR	MCD 86%	Late 66% Mid 26%	1.6* mi./sq. mi.	H	PCT, PF; PP plantings	Past harvest units have impacted the area.
OG2	Deschutes River below Crane Prairie Res.	236 100% LSR	MCD 65% PPD 35%	Late 95%	8.3*	H	PCT, PF	Heavy road and rec. use impacts.
OG3	Westside of Sokol land exchange	40 (part) 100% LSR	PPD 55% LPW 40% (over estimates LP)	Late 50% (under estimated)	--	VH	PCT, CT, PF	Original OG area was about 300 ac. but Wild & Scenic River designation encompassed area.
OG4	Southside of Sokol land exchange	212 100% LSR	PW 72% LPD 24%	Late 75% Mid 24%	0	M	Plant PP, culture for large LP and PP	Lodgepole dominated with significant past timber harvest impacts. 94% within potential Riparian Reserves.
OG5	Road #4650	456 0% LSR	LPW 65% MCD 19%	Mid 82% Early 15%	2.2*	L	Plant PP, PCT, PF	Late-structural stage is deficient. Forested lavas present. Poor site with low potential.

Note: * Road densities should be used with caution for small areas, i.e. less than one square mile. Road mileage is gross and ignores seasonal closures. Refer to Figure 3-9 for locations

Summary:

- Total of 1,298 acres excluding those absorbed by a Wild & Scenic River designation (add ~260 acres).
- Approximately 19% in potential NWFP Riparian Reserves.
- MCD 42%, LPW 36%, PPD 14%, LPD 7%
- Late-structural 59%, mid-structural 33%, early-structural 6%
- Road density all classes 2.7 mi./sq. mi. gross ignoring gate closures.
- 64% is within LSR

Connectivity Corridors

Connectivity function for LSRs and Matrix lands is directed by the Northwest Forest Plan (NWFP) for areas west of the "owl line" and by the Interim Direction for Eastside Forests (USDA, Forest Service, 1995, Regional Forester Amendment No. 2; B1, B6, B13, B23, C44) for designated eastside Forests. In addition, the draft EIS for the Eastside Forests (Forest Service et al. 1997) will apply to all lands east of the crest of the Cascades Mountains. Therefore, connectivity between designated Late Successional Reserves, Old Growth Management Areas and Late Old Structure (LOS) habitats were addressed by the watershed analysis and the LSR Assessment (refer to Chapter VII). This function was addressed both within and external to the watershed. The Northwest Forest Plan (NWFP) notes the importance of Riparian Reserves in meeting this need, however the dry eastside conditions common to the Browns/Wickiup Watershed area provides limited stream corridors. Upland corridors are more important here than in the areas west of the Cascades and have been designed to complement the limited Riparian Reserves. Connectivity function is needed to provide conditions for movements/landscape flows of plants, animals and other components in a functional ecosystem. It is critical for the dispersal and ultimate genetic exchange of populations of many species. Refer to Figure 7-3, Connectivity Corridors, for the recommended corridors.

Desired Conditions (DC): Provide a minimum of 30% canopy cover within stands in the connectivity corridor that are linked with an interface of no less than 1000 feet at all times through the entire length of the corridor. The width is based upon both the biological needs of wildlife and the effect of edge distances as related to potential predators. A mix of tree species is desirable. Small crowned trees like lodgepole pine should not occupy extensive areas within the connectivity corridor if possible. Additionally, provide levels of snags and coarse woody materials as prescribed by the applicable direction (i.e. NWFP, LRMP and/or Interim Screens) within those stands that are meeting the 1000 foot connect. Ensure that understories are adequate to provide the recruitment of green trees for canopy, snag recruitment and eventually CWM through time. Mitigate fragmentation from regeneration units, roads and other restorable conditions that impair the function of the connectivity corridor. Restoration prescriptions that are likely to be applied within the corridors include thinning, planting, road closures, and culverts under paved highways to promote herbtile movement.

CC #1 (Browns Mt. LSR-Cultus LSR):

- Located outside the watershed boundary.
- Links two LSRs, one Old Growth Management Area and three BEMAs with LOS.
- Moderately fragmented by timber harvest units and roads.
- Good potential to provide canopy cover and attributes for a movement of mammals and birds but poor for amphibians and reptiles due to the Cascades Lakes Highway dissection.
- There are no adequate riparian reserves present to meet the need of this connection.

CC #2 (Browns Mt. LSR-Round Mt. LSR-Sheridan Mt. LSR):

- Majority of corridor is outside the watershed boundary.
- Links two LSRs to LOS habitat on Lookout Mountain and then to a third LSR. Additionally, two Old Growth Management Areas are in this portion of the Browns Mountain LSR. Future linkage should be established from Round Mountain east to the Old Growth Management Area near roads #4250 and #4380 intersection.
- Moderate level of fragmentation from harvest units but high from road density.

- Good potential to provide canopy cover and attributes for movement of all species.
- There are no adequate riparian reserves present to meet the need of this connection.

CC#3 (Eaton Butte-Wickiup Butte):
- Located outside the watershed boundary.
- Links two BEMAs and LOS habitats within them. Future linkage should be established from the Wickiup BEMA north to the Deschutes River below the Wickiup Reservoir dam.
- Small size with moderate fragmentation that is primarily from a dense road network.
- Fair potential to provide canopy cover and attributes for movement of all species. Principal limitation is the dominance of the lodgepole pine dry PAG.
- There are no adequate riparian reserves present to meet the need of this connection.

CC #4 (Eaton Butte-Davis Mt. NE)
- Located within the watershed boundary.
- Links two BEMAs and the LOS within them.
- Small size with moderate fragmentation that is due to both harvest units and high road density.
- Fair potential to provide canopy cover and attributes for most species. Principal limitations are the dominance of the lodgepole pine dry PAG and an inclusion of private land.
- There is a significant block of riparian reserves within this area that is associated with Wickiup Reservoir.

CC #5 (Davis Mountain LSR-Browns Mountain LSR)
- Majority is located within the watershed boundary.
- Links two LSRs and four BEMAs. Additional linkage potential to a nearby Old Growth Management Area, but this needs additional evaluation.
- Moderate fragmentation due to harvest units and road density. Somewhat limited in one area by lava fields.
- Fair to good potential to provide canopy and attributes for all species with the possible exception of amphibian movement through the lava flow area.
- Some minor contributions from riparian reserves along the lava flow.

CC#6 (Browns Mt.-Hi Elevation Roadless):
- Located within the watershed boundary.
- Links the Browns Mountain LSR to the west to significant LOS in a roadless area. Additionally, two proximate Old Growth Management Areas within the LSR will be linked.
- Moderate fragmentation due to both harvest units and road density, primarily in the lower elevations.
- Fair to good potential to provide canopy cover and attributes for mammals and birds but poor for amphibians and reptiles due to the Cascades Lakes Highway dissection.
- Partially covered by a riparian reserves for an intermittent stream. Upper Browns Creek (intermittent flow section) was evaluated for potential to meet the connectivity objective. It was determined that it would not properly function due to current poor conditions along the drainage from past timber harvest units, soil compaction and cinder pit areas. Future potential is also poor due to the dominance of dry lodgepole pine types.

Note: A Connectivity Corridor was not designated for linkages to Old Growth Management Area #5, because it has been recommended that the allocation be moved to a more suitable location.

The following Table A-17 summaries the information listed above for connectivity corridors:

Table A-17 Connectivity Corridors Summary

ID #	Location	Acre-age	Dominate PAGs	Dominate Structure	Road Density	Restor. Priority	Comments
CC1	Browns Mt. LSR -Cultus LSR	2907	MCD 65% LPW 30%	Late 38% Mid 39% Early 21%	4.8	M	Nearly 100% outside of watershed boundary. Links 2 LSRs and 1 Old Growth Area.
CC2	Browns Mt. LSR-Round Mt. LSR-Sheridan Mt. LSR	4160	MCD 88% LPW 8%	Late 27% Mid 31% Early 6%	6.0	M	87% outside of watershed boundary. Links 3 LSRs and significant LOS on Lookout Mt.. Veg data unknown for 37% of corridor.
CC3	Eaton Bu.-Wickiup Bu.	135	LPD 81% PPD 18%	Unknown	6.7*	M	Nearly 100% outside of watershed boundary. Links 2 BEMAs and LOS within them. Veg data unknown for 100% of corridor.
CC4	Eaton Bu.-Davis Mt NE	296 + 25 pvt.	LPD 72% PPD 14%	Late 29% Mid 40% Early 15%	5.6*	M	100% inside watershed boundary. Small pvt. parcel. Links 2 BEMAs and LOS within them.
CC5	Davis Mt. LSR-Browns Mt. LSR	3646	PPD 37% PPW 24% LPD 18%	Late 37% Mid 29% Early 6%	4.6	L	81% inside watershed boundary. Links 2 LSRs and 4 BEMAs with LOS within them. Veg data unknown for 28% of corridor.
CC6	Browns Mt. LSR-Hi Elev Roadless	2694	MCD 59% LPD 19% LPW 18%	Late 49% Mid 37% Early 12%	4.5	M-H	99% inside watershed boundary. Links 1 LSR to high elevation LOS habitats. There are 2 Old Growth Areas proximate and within LSR boundary.

Note: Refer to Figure 7-3 for locations. *Road densities should be used with caution on small areas, i.e. less than one square mile. Road mileage used is gross and ignores seasonal closures.

Summary:

- Total of 13,863 gross acres in 6 connectivity corridors
- Only 2% is estimated to be covered by Riparian Reserves.
- Early-structured forest presently occupies about 10% of the total area.
- Unknowns include: canopy cover, stem densities, coarse woody material levels, snag levels, and cover continuity (horizontal) which have important functions in connectivity corridors.
- Spotted owl NRF habitat: CC1 = 588 acres or 20%; CC2 = 678 acres or 16%; CC3 = no data, outside "owl line;" CC4 = no data, outside "owl line;" CC5 = 17 acres or <1%; CC6 = 152 acres or 6%.
- Spotted owl dispersal habitat data was determined to be inaccurate.
- OG #5 will need corridor linkages if retained.

Riparian Reserves

There are about 3,495 acres of total area recommended as Riparian Reserves as directed by the Northwest Forest Plan for the portion of the watershed that is west of the "owl line." Refer to Figure 6-3 for their locations and to Table A-18 for summary data. The reserves have been divided into 10 segments in order to facilitate a quantitative analysis of wildlife habitat attributes.

Desired Condition (DC): Provide mature/old-growth conditions within the forested portions of the riparian reserves. At the upland-stream interface provide shrubs and other riparian species of plants where the potential exists. In general, restoration may include tree culturing, planting, stream bank and channel reconstruction and overall protection of these areas.

R1 (Wickiup Reservoir)

- Located around the perimeter of Wickiup Reservoir.
- About 44% of the total acreage of reserves are in this area.
- Conditions are variable due to the fluctuation of the water level on the reservoir. Habitat conditions vary widely but are best in the western and southern portions. Some areas of mature willows that are stable and providing high quality habitat conditions.
- Future potential for improvement is limited due to the instability of the system. Shrub and tree plantings may be appropriate in some local areas. Protection of existing communities is the highest priority. Vehicles, Off-Highway Vehicles, camping, etc. are primary problems that are affecting the area.

R2 (Browns Creek)

- Located along the lower portion of Browns Creek including the perennial stream section and the adjoining wet meadows.
- About 16% of the total acreage of reserves are in this area.
- Conditions are very good due to the stable nature of the stream. Large springs maintain a constant flow and low water temperatures. The riparian vegetation and aquatic plants are in excellent condition and providing very unique habitats for fish and wildlife.
- The emphasis for the area is protection. The wet meadows have been invaded by lodgepole pine in some areas, and it is recommended that the trees be controlled (but not eliminated). There is a high level of elk use and the lodgepole is providing cover for them. This area has potential for occupancy by great gray owl and spotted frogs but their presence has not been verified. Browns Creek is a critical brown trout and kokanee spawning area. It is extremely valuable to bald eagles in the fall for foraging.

R3 (Deschutes River)

- Located on the portion of the Deschutes River that flows between Crane Prairie and Wickiup Reservoirs.
- About 2% of the total acreage of reserves are in this area.
- Conditions are good. However, water levels do fluctuate due to releases from the reservoir. Also, water quality is affected by temperature increases and algae blooms in Crane Prairie Reservoir. Road construction has caused some impacts.
- The emphasis for the area is protection. Maintenance of large trees along the banks is important as habitat for bald eagles and other raptors and as shade and future inputs of woody material into the stream for fish cover.

R4 (North Twin Lake)
- Located around the perimeter of North Twin Lake.
- About 2% of the total acreage of reserves are in this area.
- Conditions are fair. Some impacts have occurred from construction of a campground and associated boat ramp. Heavy recreation use around the lake has impacted the vegetation.
- Emphasis is on protection and mitigation of recreational impacts.

R5 (South Twin Lake)
- Located around the perimeter of South Twin Lake.
- About 2% of the total acreage of reserves are in this area.
- Conditions are fair to good. Some impacts have occurred from construction of a campground, boat ramp and resort. The latter facility has been the most damaging. The shoreline appears less impacted by recreationists than around North Twin Lake.
- Emphasis is on protection and mitigation of impacts by the resort.

R6 (Johnny & Found Lakes)
- Located around the perimeters of two small lakes that are in a high elevation roadless (non-wilderness) area.
- About 1.5% of the total acreage of reserves are in this area.
- Conditions were not evaluated but secondhand reports indicate that they are good.
- Emphasis is on protection and mitigation of impacts from recreation.

R7 (Davis Lake)
- Reserves for the shoreline of Davis Lake have not been designated because it is technically outside of the watershed boundary. Therefore, no acreage was calculated.
- This is a very unique area due to the interface of the lake with a large lava flow.

R8 (Misc. Intermittent Streams)
- Located in several locations along intermittent drainages.
- About 29% of the total acreage of reserves are in this area.
- Conditions were not evaluated.

R9 (Seasonal Ponds)
- Located around small seasonal ponds that adjacent to the Davis Lava Flow sub-area (#5), north of North Twin Lake and between the Twin Lakes.
- About 2% of the total acreage of reserves are in this area.
- Conditions are generally good. High quality willow communities are present in the areas near the lava flow. Some adjacent logging units have caused some minor impacts. The pond north of North Twin Lake is in very good condition and provides seasonal waterfowl habitat.
- Emphasis is on protection.

R10 (Crane Prairie Reservoir)
- Located along the southern portion of Crane Prairie Reservoir within the Browns LSR including the Deschutes River arm (both sides) above Crane Prairie dam.
- About 2% of the total acreage of reserves are in this area.

• Conditions are fair. This reservoir has less fluctuation than Wickiup and thus, provides more stable habitats. Some impacts have occurred due to day use area and boat ramp together with heavy dispersed camping.
• Emphasis is on protection and mitigation of impacts from recreation.

The following Table A-18 summarizes the information found above for the 10 riparian segments:

Table A-18 Riparian Reserves Summary

ID #	Location	Acre-age	Dominate PAGs	Dominate Structure	Road Impacts	Restor. Priority	General Prescriptions	Comments
R1	Wickiup Reservoir	1525	LPD 67% LPW 7%	Late 6% Mid 55% Early 10%	4.4 mi./sq. mi.	Mod	Plantings, tree culturing	Reduce impacts from recreation.
R2	Browns Creek	569	LPW 44% LPD 30%	Late 42% Mid 39% Early 5%	1.6*	Mod/High	Protection, remove invading trees in meadows.	Risks from adjacent areas with high fuel loadings.
R3	Deschutes River	69	MCD 72%	Late 88% Mid 6% Early 6%	6.4*	Low	Protection, tree culturing	Provide perch trees for raptors.
R4	North Twin Lake	61	PPD 69%	Late 90%	8.8*	Low	Protection, tree culturing	Reduce impacts from recreation. Mistletoe is affecting the p. pine.
R5	South Twin Lake	59	PPW 85%	Late 78% Mid 17%	7.6*	Mod	Protection, tree culturing, planting	Reduce impacts from the resort. Mistletoe is affecting the p. pine.
R6	Johnny & Found Lakes	52	MHD 87%	Late 88%	0	Low	Protection	Reduce impacts from recreation.
R7	Davis Lake	na	--	--	--	--	--	Outside of watershed boundary.
R8	Misc. Intermittent Streams	1021	MHD 27% MCD 23% LPW 18%	Late 44% Mid 27% Early 17%	31.8*	Variable	Channel restoration, planting, tree culturing	Cinder pit and logging impacts.
R9	Seasonal ponds	58	PPW 33% MDW 28%	Late 71% Mid 10%	42.2*.	Low	Protection	Some logging impacts.
R10	Crane Prairie Reservoir	81	MCD 69%	Late 48% Mid 41%	12.4*	Mod	P otection, tree culturing	Reduce impacts from recreation. Provide trees for raptor perching.

Refer to Figure 6-3 for locations

Note: * Road densities for small areas should be used with caution. Seasonal closures were ignored.

Summary:

- Total of 3,449 acres of recommended Riparian Reserves.
- Generally in good condition.
- The emphasis for most areas is protection, particularly from recreation impacts.
- Several areas may be at risk to wildfire due to high fuel loadings on adjacent lands.

Snags and Coarse Woody Materials (CWM)

A very coarse filter analysis was done on the current levels of snags and coarse woody materials in a portion of the watershed. The purpose was to utilize the data available to document whether areas met minimum needs for dependent wildlife or not. However, many stands do not have exams, so only the LSRs were assessed. The minimum level was based upon the work done in the Cultus/Sheridan Mtn. LSR assessment, however recent research data suggest that this level is not adequate to maintain viable populations of dependent species. Project level analysis is critical to adequately develop restoration actions for this habitat component. The summary data in Table 7-5 provides the analytical data for the LSRs.

Matrix

The NWFP has designated a significant area of the watershed as Matrix (26,062 acres gross with riparian reserves or 55% of the watershed). Standards and Guidelines are detailed in the NWFP. The Matrix lands have an important role in meeting the goals of the NWFP in preserving viable populations of old-growth dependent species. As an example, Late and Old Structure (LOS) habitat should be maintained at no less than 15% of a watershed area. Late-structural habitat presently occupies 48% of the Matrix lands in the Browns/Wickiup watershed. The Matrix also has an important function in providing connectivity between established LSRs. Specific direction is also provided on snags, green tree replacements, coarse woody materials and prescribed fire. Due to time constraints, specific recommendations were not developed. However, review of the narratives on ecological function and trends, connectivity corridors, and other sections of the watershed analysis should provide some clues for habitat restoration opportunities on the Matrix lands. A priority need would be to identify all stands that meet the definition of late successional old-growth, i.e. to address the direction on retention of old-growth fragments. Current data that has classified stands as late-structure may not meet the more stringent definition of functional old-growth habitat.

Habitat Guilds/Management Indicator Species Evaluation

Following is a list of species for the habitat guilds. See discussion beginning on page A-31 for more detail.

Specialists are noted where applicable: snags, coarse woody material (CWM), late successional old growth obligate (LSOG), riverine ®, lake (lk), hardwoods (hdw), etc. Threatened/Endangered/Sensitive (T/E/S) and Species of Concern (SOC) are designated species within a group may be labeled separately if MIS, TES, SOC, SM (Survey & Manage) or OR (Oregon Sensitive; ODFW 1992).

Riparian/Aquatic Guild (R/A)

great blue heron (MIS)
wood duck (snags)
*osprey (MIS)
bald eagle (TES)
American dipper (MIS ®)
Barrow's goldeneye (OR, lk, snags)
bufflehead (OR, lk, snags)

river otter ®

spotted frog (TES, OR)

Riparian/Terrestrial Guild (R/T)

*yellow warbler (MIS)
downy woodpecker (snags, MIS)
*willow flycatcher
*bank swallow
*tree swallow (snags)
*violet-green swallow (snags)
greater sandhill crane (TES, SOC, OR)
*bank swallow (OR)

beaver
Yuma myotis (SOC)
racoon
mink (MIS, ®)
Richardson's vole
Preble's shrew (SOC, TES)
pallid bat (OR, S&M)

Pacific chorus frog
northwestern salamander(high elev.)
long-toed salamander
Cascades frog (OR, SOC,®)

Marsh/Wet Meadow Guild (M/WM)

red-winged blackbird (MIS)
*white-crowned sparrow (MIS)
*MacGillivray's warbler (MIS)
*Swainson's thrush
great-horned owl
*Wilson's warbler
western screech owl
barred owl (snags)
marsh wren
long-billed curlew (TES)

muskrat
Preble's shrew (SOC)

spotted frog (TES, OR)
western toad

Dry Meadow Guild (DM)
(Includes seasonally wet meadows)

great gray owl (MIS, SOC, OR)
*mountain bluebird
*American robin
*willow flycatcher

long-tailed meadow mouse
northern pocket gopher (MIS)

Shrub Guild (S)
(Includes shrub communities in forest understories and xeric open shrub lands)

*green-tailed towhee (MIS)

golden-mantled ground squirrel

western toad

western sage grouse (TES, SOC)	great basin pocket mouse	n. sagebrush lizard (SOC)
sage thrasher	Or kangaroo rat	
*ruby-crowned kinglet	bushy-tailed woodrat	
*house wren	pinyon mouse	
rufous-sided towhee	northern grasshopper mouse	
horned lark	sagebrush vole	
pinyon jay	gray fox	
*Brewer's sparrow (MIS)	pygmy rabbit (TES, SOC, OR)	
ferruginous hawk (OR)	least chipmunk (MIS)	
*loggerhead shrike	white-tailed hare	

Alpine/Subalpine Guild (A/SA)

Clark's nutcracker (MIS)	yellow-bellied marmot	Cascades frog (®)
*mountain bluebird (snags)	wolverine (TES, SOC)	
*American pipit	northern pocket gopher	
	heather vole (MIS)	
	red fox	
	least chipmunk	

Coniferous Forest—Early Structural Guild (CF-E)

dark-eyed junco (MIS)	yellow pine chipmunk (MIS, cwm)
*mountain bluebird (snags)	northern pocket gopher (MIS)
common flicker (snags)	deer mouse
Calliope hummingbird	mountain lion
Anna's hummingbird	black bear (cwm)
*olive-sided flycatcher (edge)	coyote
western bluebird (OR, snags)	Rocky Mt. elk (edge)

Coniferous Forest—Mid Structural Guild (CF-M)

ruffed grouse	Douglas squirrel (MIS)
mountain chickadee (MIS)	mule deer
western tanager	porcupine
*Cooper's hawk	
*sharp-shinned hawk	
*long-eared owl	
Pacific slope flycatcher	
red-breasted nuthatch (snags)	

Coniferous Forest—Late Structural Guild (CF-L)

Sub-guilds—

LSOG/Ponderosa Pine Dry/Wet Plant Association Groups (PAG) (CF-L/PP)

northern goshawk (OR, MIS)
western bluebird (OR, snags)
white-headed woodpecker (OR, MIS)
pygmy nuthatch (OR, snags)
*olive-sided flycatcher
*Williamson's sapsucker (OR, snags)
bald eagle (TES)
*flammulated owl (SOC, OR, MIS, snags)
great gray owl (S&M, OR)
mule deer
northern pocket gopher
yellow pine chipmunk
fringed myotis (OR, S&M)
long-eared myotis (SOC, S&M)
silver-haired bat (snags, S&M)
big brown bat (snags
western toad

LSOG/Mixed Conifer Dry/Wet PAGs (CF-L/MC)

northern spotted owl (TES)
northern goshawk (MIS, OR)
white-breasted nuthatch (MIS, snags)
*hermit thrush
varied thrush
golden-crowned kinglet
red-breasted nuthatch (snags)
mountain chickadee (snags)
pileated woodpecker (OR, MIS, snags, cwm)
bald eagle (TES)
northern pygmy owl (OR, snags)
great gray owl (OR, S&M)
white-headed woodpecker (OR, snags)
northern flying squirrel
hoary bat (S&M)
silver-haired bat (snags, S&M)

LSOG/Lodgepole Pine Dry/Wet PAGs (CF-L/LP)

black-backed woodpecker (MIS, OR, snags)
red crossbill
*Hammond's flycatcher
*osprey (snags)
*western wood peewee
great gray owl (OR, S&M)
n. three-toed woodpecker (OR, snags)
American marten (OR, MIS, cwm)
snowshoe hare
ermine
western red-backed vole

LSOG/Mt. Hemlock PAG (CF-L/MH)

northern spotted owl (TES)
n. three-toed woodpecker (OR, SOC, snags)
American marten (OR, MIS, cwm)
snowshoe hare

gray jay
Townsend's solitare
black-headed grosbeak
northern saw-whet owl (snags)
northern goshawk (OR, MIS)
boreal owl
fisher (SOC, OR)
heather vole
western red-backed vole
Rocky Mt. elk

Unique-Special Habitats Guild (U-S)

Sub-guilds—

Caves (U-S/C)

bushy-tailed woodrat
California myotis
long-eared myotis (SOC, S&M)
little brown myotis
Townsend's big-eared bat (TES, OR, SOC)
fringed myotis (OR, S&M)
Yuma myotis (SOC)
long-legged myotis (SOC, S&M)

Cliffs/Rimrock (U-S/C/R)

*cliff swallow
*Say's phoebe
*peregrine falcon (TES)
prairie falcon
little brown myotis
bushy-tailed woodrat (MIS)
bobcat
pallid bat (OR)
bald eagle (TES)

Talus/Rock/Lava Flows (U-S/T/R/LF)

canyon wren
*Say's phoebe
rock wren (MIS)
pika
yellow-bellied marmot
bushy-tailed woodrat (MIS)
long-eared myotis (SOC, S&M, MIS)
vagrant shrew
least chipmunk
long-toed salamander
western rattlesnake

Edge (Ecotones) (U-S/E)

*olive-sided flycatcher (MIS)
*brown-headed cowbird
great gray owl (S&M, MIS)
great horned owl
pygmy owl (OR)
*sharp-shinned hawk
*American kestrel
blue grouse (MIS)
Lewis' woodpecker (snags)
fringed myotis (OR, S&M)
hoary bat (S&M)
northern flying squirrel (snags)
Rocky Mt. elk
Townsend's big-eared bat (TES, OR, SOC)
western fence lizard

Snag/Log (S/L)

northern flicker
Lewis' woodpecker
great gray owl (S&M, MIS)
pileated woodpecker (OR, MIS)
black-backed woodpecker (OR, MIS)
northern pygmy owl
pygmy nuthatch (OR)
western bluebird (OR)
*mountain bluebird (MIS)

long-tailed vole (MIS, logs)
yellow pine chipmunk (MIS, logs)
silver-haired bat (S&M)
northern flying squirrel
American marten (OR, MIS, logs)
big brown bat
Douglas squirrel

long-tailedsalamander(logs)
south. alligator lizard (logs)

Generalist Guild (G)

blue grouse
gray jay
Steller's jay
*American robin
common raven
*turkey buzzard (snags)
golden eagle
common flicker
*red-tailed hawk
common flicker (snags)

coyote
badger
mule deer
ermine
deer mouse

rubber boa (Rocky Mt.)
short-horned lizard
common garter snake
striped whipsnake
bullsnake
gopher snake
night snake
n. Pacific rattlesnake
n. alligator lizard
western skink

Special Grouping: Neotropical Migrant Birds

turkey vulture
osprey
northern harrier
sharp-shinned hawk
Cooper's hawk
Swainson's hawk
red-tailed hawk
American kestrel
merlin
peregrine falcon
band-tailed pigeon
mourning dove
western kingbird
house wren
ruby-crowned kinglet
mountain bluebird
Swainson's thrush
hermit thrush
American robin
orange-crowned warbler

flammulated owl
burrowing owl
long-eared owl
short-eared owl
common nighthawk
common poorwill
Vaux's swift
black-chinned hummingbird
calliope hummingbird
rufous hummingbird
belted kingfisher
purple marten
tree swallow
violet-green swallow
n. rough-winged swallow
bank swallow
cliff swallow
barn swallow
sage thrasher
American redstart

red-naped sapsucker
Williamson's sapsucker
olive-sided flycatcher
western wood-pewee
willow flycatcher
Hammond's flycatcher
dusky flycatcher
gray flycatcher
Pacific-slope flycatcher
cordilleran flycatcher
Say's phoebe
ash-throated flycatcher
American pipit
cedar waxwing
loggerhead shrike
European starling
solitary vireo
warbling vireo
red-eyed vireo
northern waterthrush

Nashville warbler	yellow-breasted chat	western tanager
yellow warbler	black-headed grosbeak	Lazuli bunting
yellow-rumped warbler	green-tailed towhee	chipping sparrow
black-throated gray warbler	yellow-headed blackbird	Brewer's sparrow
Townsend's warbler	Brewer's blackbird	vesper sparrow
hermit warbler	brown-headed cowbird	lark sparrow
MacGillivray's warbler	northern oriole	savannah sparrow
common yellowthroat	Cassin's finch	Lincoln's sparrow
Wilson's warbler	American goldfinch	white-crowned sparrow

Total = 87 spp.

Ref. Neotropical Migrants on National Forests in the Pacific Northwest: A compilation of existing information (Sharp 1992).

* Denotes neotropical migrants

Fish Appendix

Taxonomic list and abundances of aquatic invertebrates collected 09/26/95 at station BROWNS-1, Browns Creek, Oregon. Life stage: L = Larve, P = pupae, A = adult. NC = not calculated, abundance data is number/m^2 for quantitative samples and number per sample for qualitative samples. Rep = replicate #, see sampling methods for additional information.

Order	Family	Subfamily	Genus/species	Life Stage	sample rep 1	sample rep 2	sample rep 3	Mean
Phylum: Annelida								
Class: Oligochaeta								
Tubificida	Tubificidae			A	240	360	350	317
Phylum: Arthropoda								
Class: Crustacea								
Ostracoda				A	0	0	3	1
Class: Insecta								
Coleoptera	Elmidae		Heterlimnius	A	7	173	67	82
Coleoptera	Elmidae		Heterlimnius	L	740	160	27	309
Diptera	Chironomidae			P	13	47	13	24
Diptera	Chironomidae	Orthocladiinae		L	63	120	50	78
Diptera	Empididae		Chelifera	L	3	0	0	1
Diptera	Simuliidae			P	0	0	3	1
Diptera	Simuliidae		Simulium	L	0	7	0	2
Diptera	Tipulidae		Dicranota	L	17	13	13	14
Ephemeroptera	Baetidae		Baetis	L	80	167	37	94
Ephemeroptera	Ephemerellidae			L	13	0	0	4
Ephemeroptera	Ephemerellidae		Drunella	L	177	420	163	253
Ephemeroptera	Heptageniidae		Cinygmula	L	113	293	210	206
Ephemeroptera	Heptageniidae		Ironodes	L	0	13	3	6
Ephemeroptera	Heptageniidae		Rhithrogena	L	30	0	0	10
Plecoptera	Capniidae			L	7	7	27	13
Plecoptera	Chloroperlidae		Sweltsa	L	10	7	17	11
Plecoptera	Nemouridae		Zapada	L	33	47	43	41
Plecoptera	Peltoperlidae		Yoraperla	L	3	20	3	9
Plecoptera	Perlodidae			L	7	27	7	13
Plecoptera	Perlodidae		Kogotus	L	0	7	3	3
Trichoptera				P	0	7	0	2
Trichoptera	Rhyacophilidae		Rhyacophila	L	63	147	67	92
Phylum: Mollusca								
Class: Gastropoda								
Basommatophora	Planorbidae			A	0	0	3	1
Phylum: Platyhelminthes								
Class: Turbellaria								
Tricladida	Planariidae		Polycelis	A	0	0	30	10
Total: 25 taxa					1620	2040	1140	1600

Sample statistics for samples collected 09/26/95 at station BROWNS-1.

Number of samples:	3	Standard deviation:	450.35
Number of taxa:	25	% Coefficient of variation:	28.15
Mean sample abundance:	1600	Standard error of mean:	260.01

Taxonomic list and abundances of aquatic invertebrates collected 10/24/94 at station DESCHUT-C1, Deschutes River, Oregon. NC = not calculated, abundance data is number/m^2 for quantitative samples and number per sample for qualitative samples. Rep = replicate #, see sampling methods for additional information.

Order	Family	Subfamily	Genus	Species	riffle rep 1
Phylum: Annelida					
Class: Oligochaeta					
Tubificida	Naididae				320
Phylum: Arthropoda					
Class: Arachnoidea					
Hydracarina					40
Class: Crustacea					
Copepoda					67
Ostracoda					267
Class: Insecta					
Coleoptera	Elmidae		Optioservus		13
Diptera	Ceratopogonidae				373
Diptera	Chironomidae				13
Diptera	Chironomidae	Chironominae			67
Diptera	Chironomidae	Orthocladiinae			1533
Diptera	Chironomidae	Tanypodinae			40
Diptera	Psychodidae		Pericoma		53
Diptera	Tipulidae		Hexatoma		10
Ephemeroptera	Baetidae				40
Ephemeroptera	Baetidae		Baetis		40
Ephemeroptera	Ephemerellidae				67
Ephemeroptera	Heptageniidae		Cinygmula		107
Ephemeroptera	Leptophlebiidae		Paraleptophlebia		27
Ephemeroptera	Siphlonuridae		Ameletus		13
Plecoptera	Chloroperlidae				67
Plecoptera	Chloroperlidae		Sweltsa		213
Plecoptera	Nemouridae				53
Plecoptera	Perlodidae				13
Plecoptera	Perlodidae		Kogotus		13
Trichoptera	Hydroptilidae				360
Trichoptera	Hydroptilidae		Agraylea		27
Phylum: Nematoda					40
Phylum: Platyhelminthes					
Class: Tubellaria					
Tricladida	Planariidae		Polycelis		27
Total: 27 taxa					3903

Table A-21

Mid-Deschutes River, Browns Crossing, Sept. 25, 1992.

OR:Deschutes N.F., Riffle habitat.
Benthic invertebrate biomonitoring sample. Surber, 500 micron.
Abundances adjusted to a 1 square meter basis. File:2DSEMDR

Taxon	R1	R2	R3	MEAN	STDEV	%
Hydra	37	294	57	1293	1429.6	31.19
Nematoda	0	1	0	3	5.8	0.08
Oligochaeta	2	5	8	50	30.0	1.21
Sphaeriidae	0	0	1	3	5.8	0.08
Physella	0	2	4	20	20.0	0.48
Planorbidae	0	0	3	10	17.3	0.24
Vorticifex	0	0	2	7	11.5	0.16
Copepoda	0	0	2	7	11.5	0.16
Hyalella azteca	0	2	3	17	15.3	0.40
Acari	3	0	2	17	15.3	0.40
TOTAL: MISC. TAXA	42	304	82	1427	1411.4	34.41
Enallagma/Ischnura	0	3	3	20	17.3	0.48
TOTAL: ODONATA	0	3	3	20	17.3	0.48
Baetis tricaudatus	6	6	0	40	34.6	0.96
TOTAL: EPHEMEROPTERA	6	6	0	40	34.6	0.96
Hydroptila	0	1	1	7	5.8	0.16
TOTAL: TRICHOPTERA	0	1	1	7	5.8	0.16
Optioservus	2	0	0	7	11.5	0.16
TOTAL: COLEOPTERA	2	0	0	7	11.5	0.16
Hemerodromia	0	10	6	53	50.3	1.29
Simulium	34	11	9	180	138.9	4.34
TOTAL: DIPTERA	34	21	15	233	97.1	5.63
Chironomidae-pupae	10	10	10	100	0.0	2.41
Chironomini	0	0	8	27	46.2	0.64
Cricotopus Nostococladius	0	5	1	20	26.5	0.48
Micropsectra	0	0	3	10	17.3	0.24
Nanocladius	1	12	5	60	55.7	1.45
Orthocladius Complex	10	24	15	163	70.9	3.94
Parachironomus	0	4	5	30	26.5	0.72
Psectrocladius	1	0	0	3	5.8	0.08
Rheotanytarsus	20	369	190	1930	1745.2	46.54
Synorthocladius	0	8	13	70	65.6	1.69
TOTAL: CHIRONOMIDAE	42	432	250	2413	1951.4	58.20
GRAND TOTAL	126	767	351	4147	3252.1	100.00

Table A-22

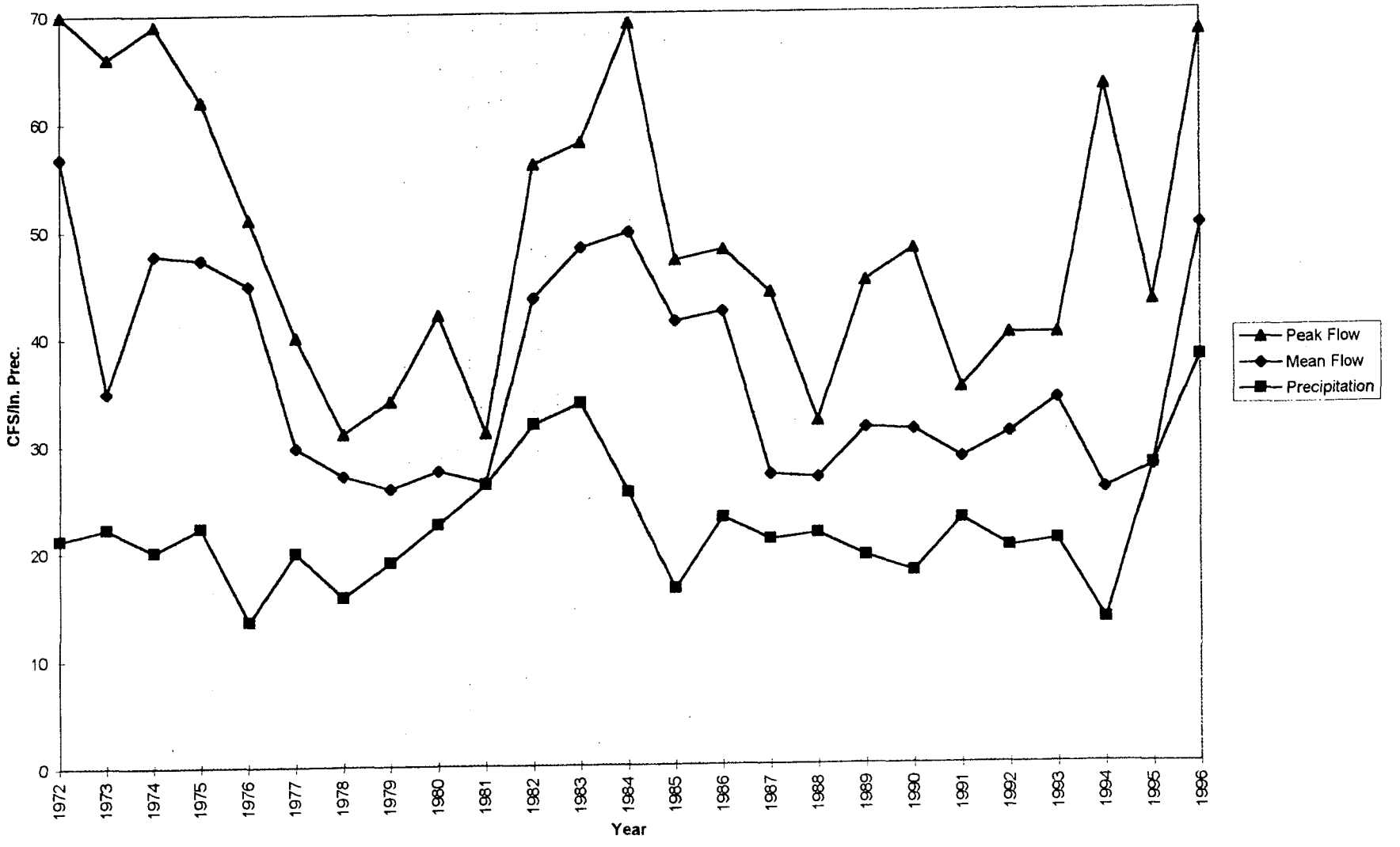
Browns Creek, Sept. 26, 1991.

Deschutes National Forest. Bend Ranger District.
Benthic invertebrate biomonitoring sample(s). Hess (500-micron).
Mean abundances have adjusted to a square meter basis.
File: 91BRO

	Replicates					
Taxon	R1	R2	R3	MEAN	STDEV	%
Turbellaria	3	1	4	27	13.1	3.04
Oligochaeta	9	48	15	240	180.7	27.38
Acari	0	1	0	3	5.0	0.38
TOTAL: MISC. TAXA	12	50	19	270	174.1	30.80
Baetis bicaudatus	10	1	1	40	44.7	4.56
Drunella coloradensis/flaviline	11	7	7	83	19.9	9.51
Drunella grandis/spinifera	1	0	0	3	5.0	0.38
Ephemerella inermis/infreque	0	0	2	7	9.9	0.76
Cinygmula	28	14	15	190	67.2	21.67
Paraleptophlebia	0	0	1	3	5.0	0.38
TOTAL: EPHEMEROPTERA	50	22	26	327	130.3	37.26
Sweltsa	2	1	1	13	5.0	1.52
Zapada cinctipes	1	2	1	13	5.0	1.52
Isoperla	1	0	0	3	5.0	0.38
Taeniopterygidae	1	1	1	10	0.0	1.14
TOTAL: PLECOPTERA	5	4	3	40	8.6	4.56
Rhyacophila	1	0	0	3	5.0	0.38
Rhyacophila Brunnea Gr.	0	1	1	7	5.0	0.76
Rhyacophila narvae	0	1	1	7	5.0	0.76
Rhyacophila valluma	0	1	0	3	5.0	0.38
TOTAL: TRICHOPTERA	1	3	2	20	8.6	2.28
Heterlimnius	14	26	17	190	53.7	21.67
TOTAL: COLEOPTERA	14	26	17	190	53.7	21.67
Simuliidae	0	0	1	3	5.0	0.38
Antocha	1	0	0	3	5.0	0.38
Dicranota	0	1	0	3	5.0	0.38
TOTAL: DIPTERA	1	1	1	10	0.0	1.14
Cricotopus	0	1	1	7	5.0	0.76
Cricotopus Nostococladius	1	1	0	7	5.0	0.76
Eukiefferiella	1	0	0	3	5.0	0.38
Pagastia	1	0	0	3	5.0	0.38
TOTAL: CHIRONOMIDAE	3	2	1	20	8.6	2.28
GRAND TOTAL	86	108	69	877	168.3	100.00

Table A-3

Browns Creek Streamflow 1972-1996



Fire/Fuels Appendix

Fire/Fuels Appendix

Large Fire Risk - a Statistical Probability Overview

A statistical probability of large fire risk was run for the Browns/Wickiup Assessment Area (which includes Browns/Round Mtn. LSRs) using National Fire Management Analysis (NFMAS) information derived for the Bend-Ft. Rock Ranger District. This run was done using a program called PROBACRE, a computer model for predicting wildfire risk based on past annual fire frequency and associated levels of fire intensities. See Table 7-13 for a display of probability of wildfires exceeding certain size thresholds within a 20, 50, & 100 year period for the analysis area.

Determining Crown Fire Susceptibility Based on PMR Data

The increasing occurrence of high energy, crown fire events on the Deschutes National Forest, and the assessment of watershed and Late-Successional Reserves, has underscored the need to evaluate and quantify the potential for crown fire across forest landscapes.

The ability to identify and rank the relative susceptibility of a timber stand to crown fire disturbance would greatly aid fire specialists in analyzing the expected ecological effect and extent of future fires. As an agent of ecological disturbance in timber stands, crown fire far exceeds surface fire or understory fire in magnitude (Agee, 1993). Fire Specialists supporting landscape scale analysis for late successional and riparian reserve areas and watershed restoration projects need tools to evaluate crown fire potential and to display the changes in crown fire susceptibility resulting from natural processes such as insect and pathogen attack or from human manipulation of stand structure, vegetation, and down woody material.

The Final Report on Federal Wildland Fire Management Policy and Program Review, published in December, 1996, directs resource managers to assess "values at risk" when determining suppression strategies. These values may be life, property or natural resources, such as late successional habitats. The fire behavior characteristics of crown fires threaten all of these, often simultaneously. Knowing where those highly susceptible stands conditions exist is of paramount importance to resource managers who the public expects to preserve these values.

A determination of the relative susceptibility of an area to crown fire should be based on well documented criteria such as those addressed in the publication INT-438, Predicting Behavior and Size of Crown Fires in the Northern Rocky Mountains (Rothermel, 1991). In this publication, eight criteria are described as being favorable conditions for a crown fire: dry fuel, low relative humidity, high temperature, heavy surface fuel accumulations, ladder fuels, slope, winds, atmospheric instability, and a continuous forest canopy.

Of these elements, the ones that are relatively static over a period of time and can be represented on a map are: surface fuels, canopy closure, and stand structure. Surface fuels were represented by the 13 NFFL fire behavior models as fuels inventories have not been completed for the entire forest and would have to be redone for updated information. The fuel model map based on Pacific Meridian Resources (PMR) satellite imagery was used to represent surface fuels. PMR data was also used to characterize canopy closure, species and stand structure.

Using the criteria of fire behavior fuel model and canopy fuel loading, a matrix can be developed by fire

behavior experts that ranks timber stand susceptibility to crown fire in relation to other stands with different characteristics. Stands that can expect to support independent crown fire episodes under average worst case weather conditions are labeled as "extreme". Stands that will support active crown fire under the same weather conditions are labeled as "high". Stands that will only support passive crown fire are labeled as "moderate" and stands where only incidental torching is possible are labeled as "low".

Canopy fuel loading can be determined from a number of silviculture data sources, specifically, information on size structure, canopy closure and species group. Much of this information can be acquired from professionally interpreted satellite imagery. Data tables are also available to assist in developing assumptions for "if/then" statements to convert existing stand data to generate a crown fuel loading layer. These tables commonly use species, tree size and tree spacing as inputs to estimate canopy fuel load in tons per acre.

The combination of surface fuel loads with sufficient potential energy to ignite crown fuels, as well as the species, age and structure of the stand can result in an adjective rating of susceptibility to sustain crown fire. The crown fuel load is based on density and species and is assumed to be the fine fuels or needles and > 1/4" material in the crowns (Rothermel 1991).

The rating and the assumptions for each are defined and listed below:

Null - Little if any overstory present or canopy closure is < 20% or surface fuel model is 1. Previously harvested area, old burns, meadows, shrub fields, and unforested areas.

Low - Fire is generally an intense ground fire with some incidental torching where fuels are concentrated. < 50% of the crowns are effected. Assumptions: Canopy closure is < 56% or there is a fuels model 2 in the understory or it is a single story ponderosa pine stand > 21" dbh.

Moderate - Passive crowning can be expected in patches of trees. Short duration, crowning runs occur. <70% of the crowns are effected. Assumptions: Canopy closure is >56% < 71% and it is a single storied stand or it is or it is a mixed conifer/lodgepole pine stand or fuels models 6/10/11 represent the surface fuels.

High - Active crown fire being sustained by a intense ground fire. >90% of the crowns are effected. Assumptions: Canopy closure is >56% < 71% and it is a multi-storied stand and fuels models 6/10/9+30tons/11 represent the surface fuels.

Extreme - Fire is burning through the crowns independent of ground fire which may be lagging far behind or is burning through light surface fuels at times. Assumptions: Canopy closure is >71% and it is a multi-storied or single-storied stand and surface fuels are 6, 9, 10, 11 and 12.

The matrix does not consider the probability that sufficient surface fire intensity and low crown foliar moisture content would be present at the time of ignition. It is assumed that the necessary environmental conditions are present to precipitate crown fire.

The matrix does not consider element of fire spread such as slope, dead fuel moisture, and weather.

Crown Fire Potential Within the Watershed

Using the criteria listed above, the crown fire potential was mapped for the Browns/Wickiup Watershed Analysis area (Figure A-5, Browns/Wickiup Watershed Crownfire Susceptibility Map). One goal of late-successional forests is to maintain late-successional and old-growth species habitat on federal lands. Standards and guidelines for Late-Successional Reserves are designed to protect them from loss due to large-scale fire. Within the Browns/Round Mtn. LSRs, management of species habitat may include no treatment in areas where the level of crown fire risk is rated as high. In these areas, the effect of crown fires on LSOG stands could be severe, usually changing those attributes which are desirable for late-successional and old-growth habitat. Wherever these conditions are present, strategies could be used which reduce risk in adjacent stands.

Fuel Components

Fuel represents the whole array of combustible material in the forest including: 1) Aerial (ladder fuels) - limbs, branches, foliage, lichens, and snags; 2) Surface - brush, all down woody, and litter, leaves, stumps, seedlings and saplings, and grasses; 3) Ground -duff, roots, and decomposing logs, see National Fire Equipment System--NFES #1193, S-190. Fires that climb vertically through continuous fuels (ladder fuels) from surface up into aerial fuels are called crown fires. The potential for a crown fire to occur, based on stand structure, crown closure, and surface fuel models, have been established by the Deschutes Fuels Group using satellite imagery from Pacific Meridian Resource data. Null - no chance of crown fire; Low - ground/surface fire occasional torching; Moderate - passive, torching occurs; High - active, fire readily consumes the crown sustained by the heavier surface fuel loading; and Extreme - independent, fire moves through the crowns of the tree canopy apart from surface fire. See Crown Fire Potential map. Fire behavior for surface fires are based on the Fire Behavior Fuel Models 1-13, see NFES #1574, Anderson, 1982. The amount of fire intensity (flame length) in the flaming front is largely dependent on the amount of moisture in the zero to three inch diameter fuels at the time of the fire.

Urban interface presents human made fuels in the forest environment, such as vehicles, structures, chemicals, and gases. In addition, urban interface areas are places where more human-caused fires begin due to carelessness and intentional use of fire.

Reduction of fire suppression resources due to downsizing, 80 years of fire exclusion, and a high activity wildfire season is likely to result in a higher percentage of fires which reach a larger scale. A higher severity fire will result in increased mortality to the large tree component of stand, alter wildlife habitat, and volatilize a greater amount of nutrients from the soil.

The following table lists the current condition based on fuel models within the Browns/Wickiup Watershed Analysis area and the LSRs.

Table A-23

Fuels Hazard Synopsis

Fuel Model Number*	Total Acres (Browns/Wickiup)	Total Acres Browns LSR	Total Acres Round Mtn. LSR
1	0	0	0
2	1,353	169	28
3	0	0	0
6	8,834	1139	43
8	16,236	2199	43
9	2,704	571	5
10	13,253	2797	106
11	950	161	0
998	1,507	36	0
999	48	4	0

*Further discussion on fuel modeling is provided below

1 - Fine, cured grasses
2 - Grass/herbaceous fuel
3 - Tall, dense grasses
6 - Flammable shrubs
8 - Light timber litter
9 - Ponderosa pine litter
10 - Heavy timber litter/slash
11 - Very heavy timber litter/logging slash
998 - Sparsely vegetated
999 - Water

Fuel Model Descriptions

Fuel Modeling

There are 13 Fire Behavior fuel models (Anderson, 1982) which are grouped into four major categories: grass, shrub, timber and slash. The criteria is based on the fuels which will carry a fire. Each model yields flame length and rate-of-spread information for the purpose of fire behavior prediction and fuels planning. The models described in this section exist in the project area and are displayed by acreage and percentage of occurrence for each subwatershed. Fuel models 1-3 (grass) are not described.

Fuel models are intended to help estimate fire behavior only when the ground fuel is involved and are not used in the event of an understory or overstory crown fire. Crown fire potential models are still being developed. Flame length and rate-of-spread data for the pertinent fuel models in the analysis are based on BEHAVE outputs.

The fuel model and representative stand descriptions are intended to help clarify current ground fuel situations with the visual aid of the landscape fuel model maps of the analysis area. The fuel model maps display the dominant model identified in the stands, but it is very important to note that every stand has

secondary models with variable occurrence percentages. For example, stands identified as primarily Fuel model 8 or 9 will have a certain percentage of model 10, but "pockets" of model 10 are not being mapped over the entire landscape in this analysis. Also, area that are identified as model 10 will not yield continual model 10.

Definitions for each of the fuel models come from "Aids to Determining Fuel Models for Estimating Fire Behavior" by Hal E. Anderson (1982).

The weather-related factors are constant for every model. The fire behavior table for each model displays flame length and rate-of-spread (in chains/hour) for a range of mid-flame wind speeds, an average one-hour fuel moisture (material that is less than a quarter inch diameter), and a slope of 30%. Fire behavior expectations are important as factors influencing the fire can change and rarely do flame lengths and rates-of-spread remain constant over the course of a fire event. These weather factors are typical for the analysis area during a summer afternoon.

Brush Model

Model 6 Profile and Associated Fire Behavior

Fire carries through the shrub layer where the foliage is more flammable than a fuel model 5, but it requires moderate winds to sustain it by itself. Fire will drop to the ground at low wind speeds or openings in the stand. The shrubs are older and usually act as a ladder for fire to carry into the tops of trees in a stand under ideal burning conditions.

Fuel Model 6 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	1.9	3.9	5.9*	7.9*	9.9*	11.9
Rate of Spread Chains/Hour	10	24	41*	60*	80*	103

*Represents fire behavior expectations for the analysis area.

Timber Models

Model 8 Profile and Associated Fire Behavior

Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, lodgepole pine, spruce, fir and larch.

Fuel Model 8 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	0.2	1.0	1.3*	1.5*	1.6*	1.6
Rate of Spread Chains/Hour	1	2	3*	4*	5*	5

*Represents fire behavior expectations for the analysis area

Analysis Area Model Profiles: Model 8 fuel profiles are associated with the following stand and ground fuel characteristics in the analysis area:

Mixed Conifer:
Harvested and treated stands (former and recent) where these activities have reduced the available timber litter and needlecast. Heavier concentrations of fuel may exist in "pockets" from harvest operations or natural events but generally ground fuel loads are very light throughout the stands. Fine fuel (branchwood) loadings for model 8 are generally less than 5.0 tons/acre in the 0-3 inch size classes and the needlecast must be light (< 1 inch in depth) to exhibit model 8 fire behavior.

High-elevation mixed conifer (hemlock/lodgepole) stands where the needlecast (short needles) and timber litter fuel load is light and displays a "matted" characteristic that inhibits flame lengths under most conditions because oxygen cannot readily interact with the fuels. With a matted needle layer, branchwood fuel loadings could exceed model 8 criteria but may not burn well due to the limited rate-of-spread through the needlecast.

Mixed conifer stands (all elevations) which, due to certain site characteristics and/or stand history (such as a fire event) yield a light ground fuel load at the present time. One example of a site characteristic would be a riparian area with a live, green grass and shrub component which would greatly limit flame lengths and rate-of-spread. Though model 8 is not uncommon in the mixed-conifer stands, generally there is a sufficient amount of timer litter (needles and branchwood) to exceed model 8 criteria. This is due to the heavy biomass associated with mixed-conifer sites which results in greater ground fuel accumulations (primarily models 9 and 10).

Lodgepole Pine:
Primarily harvested and treated stands (including young reproduction stands) that exhibit light ground fuel loadings because the stands are too young to initiate much fuel accumulation beyond a light needlecast. Also stands 15 to 20 years after thinning has occurred. Model 8 is generally not associated with natural lodgepole stands because normally these stands are subject to decadence and collapse and ground fuel accumulations tend to be in sufficient amounts to exceed model 8 criteria. High elevation lodgepole/hemlock stands will display a "matted" needlecast layer which will limit flame lengths and rate-of-spread, but other stands at the lower elevations of the analysis area have a volatile combination of needlecast, branchwood, bitter brush, and large woody debris which yield fire behavior described by models 9, 10, 11, and 12.

Model 9 Profile and Associated Fire Behavior
Describes fires that run through surface litter faster than model 8 and have longer flame heights. Both long-needle conifer stands and hardwood stands are typical. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-woody material will contribute to possible torching out of trees, spotting, and crowning.

Fuel Model 9 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	2.0	2.7	3.5*	4.3*	5.0*	5.8
Rate of Spread Chains/Hour	4	7	13*	20*	28*	38

*Represents fire behavior expectations for the analysis area

Analysis Area Model Profiles: Model 9 fuel profiles are associated with the following stand and ground fuel characteristics in the analysis area:

Ponderosa Pine and Associated Species
Harvested and treated stands (former and recent) where a sufficient number of trees remain and associated the site to add needlecast and other litter in accumulations exceeding model 8 criteria. Generally, a needlecast layer of 1 inch or more (with added branchwood) would exhibit model 9 fire behavior. For harvested areas, model 9 fuel loadings may not be continuous, but rather intermixed with model 8 fuel loads.

Ponderosa Pine
Stands dominated by ponderosa pine in the overstory, including previously harvested stands that retain some of the large pine component, but now support a dense, mixed-conifer understory. Needles from ponderosa pines have properties that inhibit decay and will accumulate over time and create a thick (>1 inch depth) needlecast layer that will initiate model 9 fire behavior. The needlecast is commonly intermixed with a light (<5.0 tons/acre) branchwood component that would meet the criteria for model 8 if not for the characteristics of ponderosa pine needles. Long-needled pines leave a needle layer that does not "mat" as well as short needles and allows oxygen to more readily interact with the fuel bed resulting in the fire behavior exceeding model 8. If the branchwood tonnages exceed 5.0 tons/acre in this type of needlecast the fire behavior will start to be better represented by a light fuel model 10 or other models. Though branchwood fuel loads are similar (and light) for both models 8 and 9, the amount of needle accumulation is the primary factor for distinguishing these models in ponderosa stands or mixed-conifer stands with an overstory pine component.

Lodgepole Pine:
Lodgepole pine stands (all elevations) that are generally devoid of shrubs but yield sufficient amounts of timber litter (needles and branchwood) to exhibit model 9 behavior. Though model 9 is more associated with long-needled ponderosa pine fuel beds, the fire behavior would be similar in lodgepole

stands when the needlecast is supporting a branchwood fuel load of 5.0 tons/acre to 7.0 tons/acre in the 0-3 inch size classes. Under 5.0 tons/acre of branchwood fuel, the fire would not spread well through the "matted" needlecast. Over 7.0 tons/acre of branchwood the fire behavior will start to be better represented by a light fuel model 10 or other models. The branchwood loading is the primary factor in determining fire behavior in lodgepole pine stands when a shrub component is absent.

Model 10 Profile and Associated Fire Behavior
Describes fires that burn in the surface and ground fuels with greater fire intensity that the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect or disease ridden stands, windthrown stands, overmature situations with dead fall, and aged light thinning or partial-cut slash.

Fuel Model 10 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	3.7	4.9	6.0*	7.1*	8.1*	9.0
Rate of Spread Chains/Hour	4	8	12*	16*	22*	28

*Represents fire behavior expectations for the analysis area

Analysis Area Model Profiles: Model 10 fuel profiles are associated with the following stand and ground fuel characteristics in the analysis area:

Mixed-Conifer:
Mixed conifer stands (all elevations) that yield a heavy deadfall component resulting from factors such as disease, insect infestations, and windstorms. The heavier amount of 0-3 inch size class fuels (as compared with models 8 and 9) readily interacts with the larger fuels and this results in greater fire intensity and possible control problems. Model 10 in mixed conifer stands tend to exist in "areas" of a few acres or scattered pockets throughout a stand depending on the conditions causing the heavy deadfall. Model 10 pockets are difficult to map on a large landscape level but can be expressed in terms of a percentage of area based on stand exam data and field notes. Model 10 in mixed conifer stands tend to be more prevalent when lodgepole pine is a major component of the stand due to greater instances of deadfall involving lodgepole. Model 10 "areas" and pockets also exist in mixed conifer stands that are accumulating debris due to the absence of fire over many years.

Lodgepole Pine:
Lodgepole pine stands (all elevations) that yield a heavy deadfall component resulting from factors such as disease, insect infestations, and windstorms. Unlike mixed conifer and ponderosa pine stands, lodgepole pine is much more susceptible to decadence and collapse and model 10 fuel loads are more common. In lower elevation lodgepole stands, model 10 situations can be enhanced by the presence of

bitterbrush resulting in fuel beds that are very volatile. To meet model 10 criteria, as in the mixed conifer and ponderosa stands, the fine fuel loadings must generally exceed 5.0 tons/acre (in the 0-3 inch size class) up to 12.0 tons/ acre. The branchwood component must be sufficient to interact with the larger fuel to yield model 10 fire behavior. Fine fuel loadings exceeding 12.0 tons/acre would begin to exhibit slash model 12 characteristics.

Slash Models

Model 11 Profile and Associated Fire Behavior

Describes fires that are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of rather light fuel loads, shading from overstory, or the aging of the fine fuel can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here. The 0-3 inch fuel load is less than 12.0 tons/acre Material greater than 3 inch is represented by not more than 10 pieces (4 inches in diameter) along a 50-foot transect.

Fuel Model 11 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	2.7	3.4	4.0*	4.6*	5.1*	5.5
Rate of Spread Chains/Hour	3	6	8*	11*	14*	17

*Represents fire behavior expectations for the analysis area

Analysis Area Model Profiles: Model 11 fuel profiles are associated with the following stand and ground fuel characteristics in the analysis area:

Mixed-Conifer:

Harvested and treated stands where the activity-created slash is generally over three years old and the needles, though still a component of the ground fuel load, have fallen from the residual slash and are no longer capable of initiating long flame lengths which are more associated with model 12. Though fire potential is described as limited, this is only in comparison to other slash situations. In mixed-conifer and other timber stands, model 11 fire behavior slightly exceeds model 9 behavior due to the additional aging slash component intermixed with fuel beds readily capable of spreading a fire. In mixed conifer stands, residual slash from partial cuts is most likely to result in model 11 fuel loads once the needles have dropped.

Ponderosa Pine:

Harvested and treated stands where activity-created slash is generally over three years old. A heavy needlecast (>2 inches in depth) intermixed with additional light and aged residual slash load could exhibit model 11 fire behavior without a heavy branchwood component. Residual slash from partial cuts is most likely to result in model 11 fuel loads once the needles have dropped.

Lodgepole Pine:
Lodgepole stands that have had harvest activity and currently exhibit a light residual slash loading intermixed with a fine fuel component readily capable of carrying a fire. Natural lodgepole pine stands (also without bitter brush) would exhibit model 11 behavior if the deadfall is light and aged.

Model 12 Profile and Associated Fire Behavior
Describes rapidly spreading fires with high intensities capable of generating firebrands. When a fire starts, it is generally sustained until a fuel break or change in the fuels is encountered. The visual impression is dominated by slash and much of it is less than 3 inches in diameter. Heavily thinned conifer stands, clearcuts, and medium or heavy partial cuts are represented. The material greater than 3 inches is represented by encountering 11 pieces (6 inches in diameter) along a 50-foot transect.

Fuel Model 12 - Fire Behavior Model For 1 Hour Fuel Moisture @ 6%

	Mid-Flame Windspeed (MPH)					
	2	4	6	8	10	12
Flame Length (Feet)	6.3	7.9	9.3*	11*	12*	13
Rate of Spread Chains/Hour	8	13	18*	24*	29*	35

*Represents fire behavior expectations for the analysis area

Analysis Area Model Profiles: Model 12 fuel profiles are associated with the following stand and ground fuel characteristics in the analysis area:

Mixed-Conifer:
Harvested and/or thinned stands that received little or no fuels treatment and the residual slash is heavy, continuous, and having most of the needles still attached and "suspended" just above the ground fuel stratum. This fuel situation is hazardous as the attached needles will greatly enhance the fire behavior, increasing flame lengths and rates-of-spread.

Ponderosa Pine:
Harvested and/or thinned stands that received little or no fuels treatment and the residual slash is heavy, continuous, and having most of the needles still attached and "suspended" just above the ground fuel stratum. Model 12 is primarily associated with activity created slash in ponderosa pine because windstorm events generally do not result in heavy, continuous blowdown in these stands.

Lodgepole Pine:
Harvested and/or thinned stands that received little or no fuels treatment and the residual slash is heavy, continuous, and having most of the needles still attached and "suspended" just above the ground fuel stratum. Model 12 fuel loads are sometimes associated with windstorm events in lodgepole pine due to the general susceptibility of the stands to collapse. In many cases, the fresh blowdown is intermixed with an already volatile fuel bed of previously fallen timber. If left untreated and no fire occurs, model 12 fuel loads will eventually model to a 10.

Fire Occurrence Rate (1970 - 1996)

To date, the Bend side of the Bend-Ft. Rock Ranger District (which includes the Browns/Wickiup Watershed Analysis area) has had a total of 1,333 recorded fires (1970-1996). Within this timeframe, 142 of these fires have occurred in the Browns/Wickiup Analysis area (approximately 11% of the total).

The fire occurrence rate (FOR) is the probability of a fire occurring in a given area per year. For comparison reasons it is often referred to in terms of fires per thousand acres per year. The fire occurrence rate is higher in the Browns Mountain subwatershed than the Wickiup subwatershed (Table A-24). The FOR rate for both subwatersheds 12.13%.

Table A-24

Fire Occurrence Rate (FOR) for 1970-1996

SUBWATERSHED	TOTAL ACRES	# FIRES	FOR
Browns	24,012	86	13.78%
Wickiup	20,988	56	4.94%

Large Fire History

Since 1908, 21 large fires have occurred in the Browns/Wickiup Watershed Analysis area (Figure A-4, Large Historical Fire Map). The most recent large fire events were the Four Corners Fire (1994) and the Charlton Fire (1996).

Table A-25

Large Fires Adjacent and Within the Analysis Area

Year	Fire Name	Total Acres
1908	**Round Swamp**	**4,869**
1909	**Wickiup Butte**	**137**
1909	**NW Davis Mtn.**	**278**
1913	**Moore Creek**	**249**
1914	**The Twins**	**411**
1914	Lookout Mtn Eastside	233
1914	Three Trappers	863
1915	**Wickiup RS**	**100**

Year	Fire Name	Total Acres
1918	**Shoestring**	**200**
1926	Cultus Mtn	880
1983	Pringle Falls	123
1985	Lookout Mtn.	620
1990	Crane Prairie	35
1991	**Pine Butte**	**80**
1994	Four Corners	1,524
1995	Cultus Corral	47
1996	Charlton	1,020

* Bold type denotes fires that have occurred within the Browns/Wickiup Watershed Analysis area.

Two recent fires have burned adjacent to the Browns/Wickiup Watershed Analysis area: the Four Corners and Charlton Fires. The Four Corners fire was ignited by lightning on July 24, 1994. It was reported by Round Mountain Lookout and several fire fighting resources were dispatched to the incident. The fire was burning in a mature stand of dense lodgepole pine. Mountain pine beetle mortality was 50 - 60 percent. Most of the dead trees were standing with needles attached. Ground fuels were relatively light, but there were large patches of heavy down fuels and ladder fuels where mortality had occurred several years previous to 1994. The fire made the transition from ground to crown fire within 30 minutes. The fire was moving south at approximately 16 - 24 feet per minute. The fire began to display extreme fire behavior characteristics: horizontal roll vortices, 150 - 300 foot flame lengths, and long-range spotting. Energy release was between 7,000 - 8,500 BTU's/ft/squared. Crane Prairie Campground and Resort were evacuated. Spot fires were ignited within the campground as the fire moved into a thinned stand of ponderosa pine and returned to the ground as a very intense ground fire. It was contained the next day at approximately 1,500 acres.

The Charlton fire (adjacent to the Browns/Wickiup Watershed Analysis area) started on August 23, 1996 by multiple lightning strikes. The Charlton fire consumed 10,000 acres in one day, almost entirely on the Willamette National Forest. Extreme fire behavior was observed. Although most fires are driven by the wind, Charlton was driven by its convection column which was sustained by fire-generated wind and weather patterns. Fire whirls blew down old-growth trees and scattered them in a circular pattern. Firefighters reported a "muddy rain" which was a result of rapid fuel combustion. Lakes within the interior of the fire boiled or evaporated out. It is estimated that the fire spread rates ranged from .5 to 1.5 miles per hour, in all directions. Flame lengths were 175 - 300 feet.

Fig. A-4

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Large Historical Fires

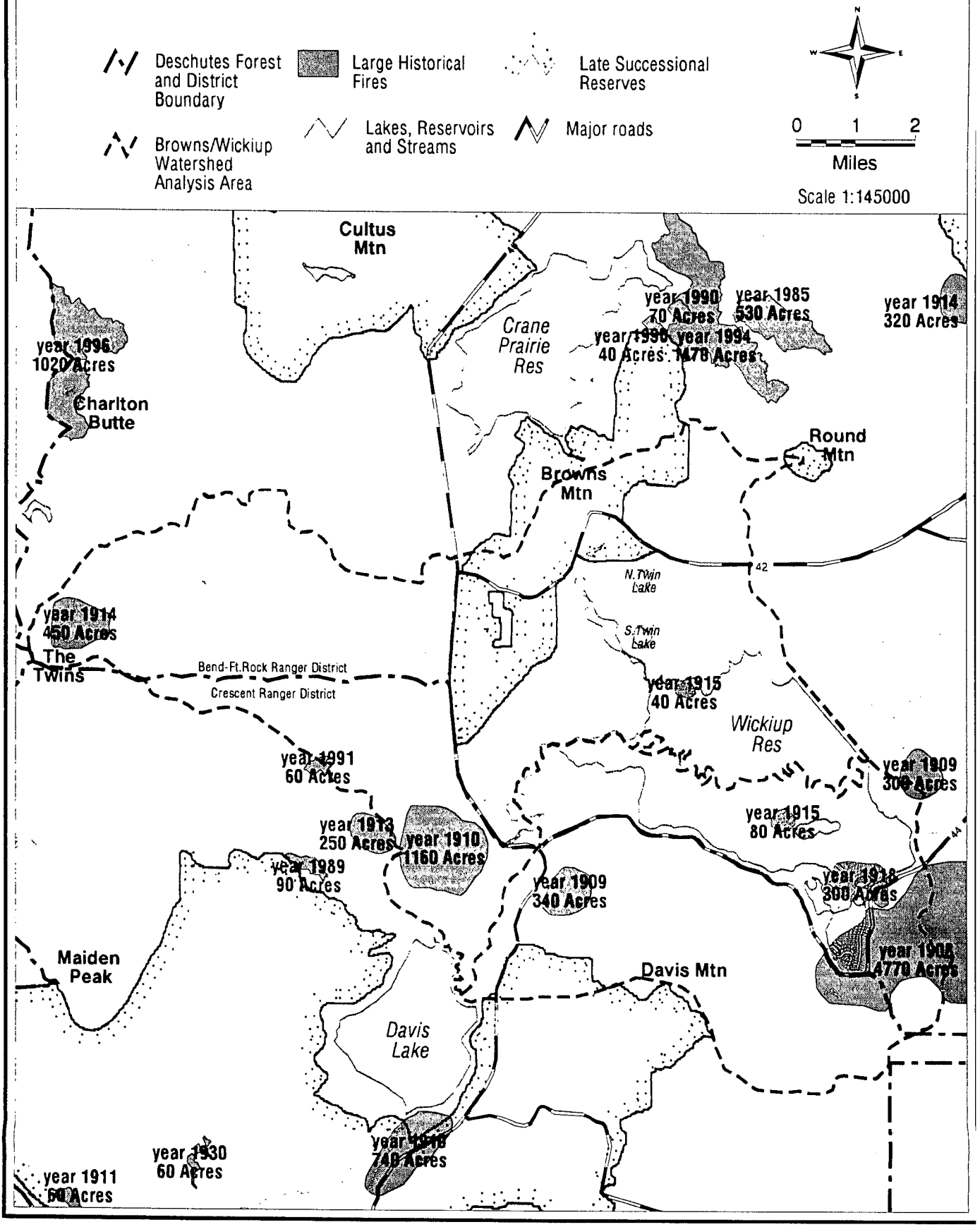


Fig. A-5

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Crownfire Susceptibility

Deschutes Forest and District Boundary

Browns/Wickiup Watershed Analysis Area

Late Successional Reserves

Extreme

High

Moderate

Low

Rock, lava, and other sparsely vegetated areas

Reservoirs, Lakes, and Streams

0 1 2

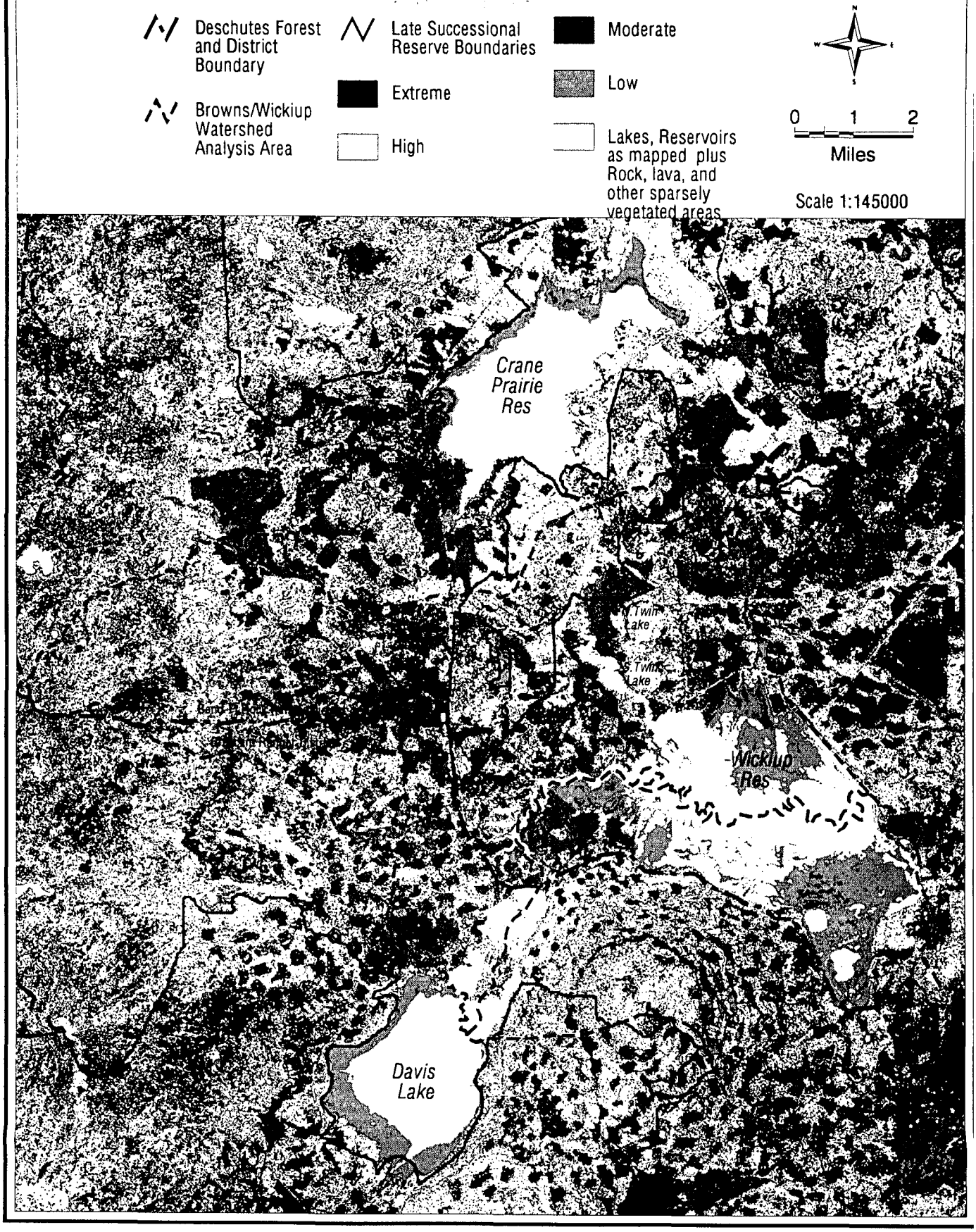
Miles

Scale 1:145000

Fig. A-6

BROWNS/WICKIUP WATERSHED ANALYSIS AREA

Fire Behavior Fuel Model



Recreation Appendix

Recreation Appendix

Dispersed Camp Site Inventory

Browns/Wickiup Dispersed Camp Site Inventory (Size & Area)

This inventory was developed in 1993, and covers primarily areas and roads associated with a water body. It's known that new water based sites have been established since 1993. It's unknown how many upland sites there are since these areas have yet to be inventoried.

Total Number of Inventoried Sites:	140
Total in Davis Mountain Quad 54:	96
Total in Wickiup Dam Quad 55:	33
Total in The Twins Quad 53:	11

Total Size for the analysis area: 247,820 sqft. (approx. 6 acres)
Average Size for the analysis area: 1,657 sqft. (approx. .04 acres)

Size & Area by Quad

Davis Mountain Quad: Total acres: 148,895 sqft. Avg. Size: 1,752 sqft.
Fat Man's Point: Sites 174-184 (11); Total: 9,590 sqft,; Avg: 872 sqft.
Mini Fat Man: Sites 185-190 (6); Total: 9,450 sqft,; Avg: 1,575 sqft.
Ctr Sec.18 Peninsula: Sites 197-201 (5); Total: 7,155 sqft.; Avg: 1,431 sqft.
N. Davis Creek Arm: Sites 202-208 (7); Total: 13,725 sqft.; Avg: 1,961 sqft.
N. Davis Arm to River: Sites 209-224, 383 (17); Total: 38,750 sqft.; Avg: 2,279 sqft.
W. Bank Deschutes Arm: Sites 225-247, 374-382 (31); Total: 64,725 sqft.; Avg: 2,088 sqft.
Exchange Block: Sites 470-473 (4); Total: 3,000 sqft.; Avg: 750 sqft.
N. Davis Lake: 2 sites ea.on roads 4660090 & 095; Total: 2,500 sqft.; Avg: 625 sqft.

Wickiup Dam Quad: Total acres: 57,800; Avg. size: 1,752 sqft.
Gaging Station to Spillway: Sites 261-271 (11); Total: 11,425 sqft.; Avg: 1,039 sqft.
Spillway to Round Swamp: Sites 152-162 (11); Total: 24,275 sqft.; Avg: 2,207 sqft.
Round Swamp to Quad End: Sites 163-173 (11); Total: 22,100 sqft.

The Twins Quad: Total acres: 7,000 sf.; Avg. size: 636 sqft.
Johnny Lake Area: Sites 437-443 (7); Total: 3,075 sqft.
Found Lake Area: Sites 449-452 (4); Total: 3,925 sqft.

Cultural Resources Appendix

Cultural Resources Appendix

Prehistory and History

Archaeological evidence indicates prehistoric occupation of this watershed dating from 8,000 to 7,000 years before present. Generally speaking, most prehistoric sites within this area do not have pre-Mazama components; however, in 1937 archaeologists excavated a site and recovered two knives from below a layer of Mazama ash, indicating a date of over 7,000 years. Most of the sites (fifty-four out of sixty known sites) within this analysis area are prehistoric, occurring along the river, lakes, lava flows, and springs. It is not surprising that prehistoric peoples preferred riverine environments since they offered an abundance and variety of subsistence resources, scarce in semi-desert environs such as Central Oregon. Here the Deschutes River offered a reliable source of water, and varied faunal and floral resources for the native peoples.

While there is evidence that bands of Klamath, Molalla, and Tenino all used this watershed, it is not known who actually may have occupied this area. Archaeological findings suggest that the area was used seasonally for hunting and fishing. Historical accounts describe wickiup poles left standing in a grassy basin ready for the next season. This basin was later called Wickiups.

Although hunting and fishing were the major activities documented, there is also evidence of plant collecting and processing. Prehistoric travel included use of watercourses and overland travel routes were established over the years along the river, lava flows and game trails. Later these overland routes would provide access to this area for the first Euro-Americans, and establish the pattern for future access in historic and modern times.

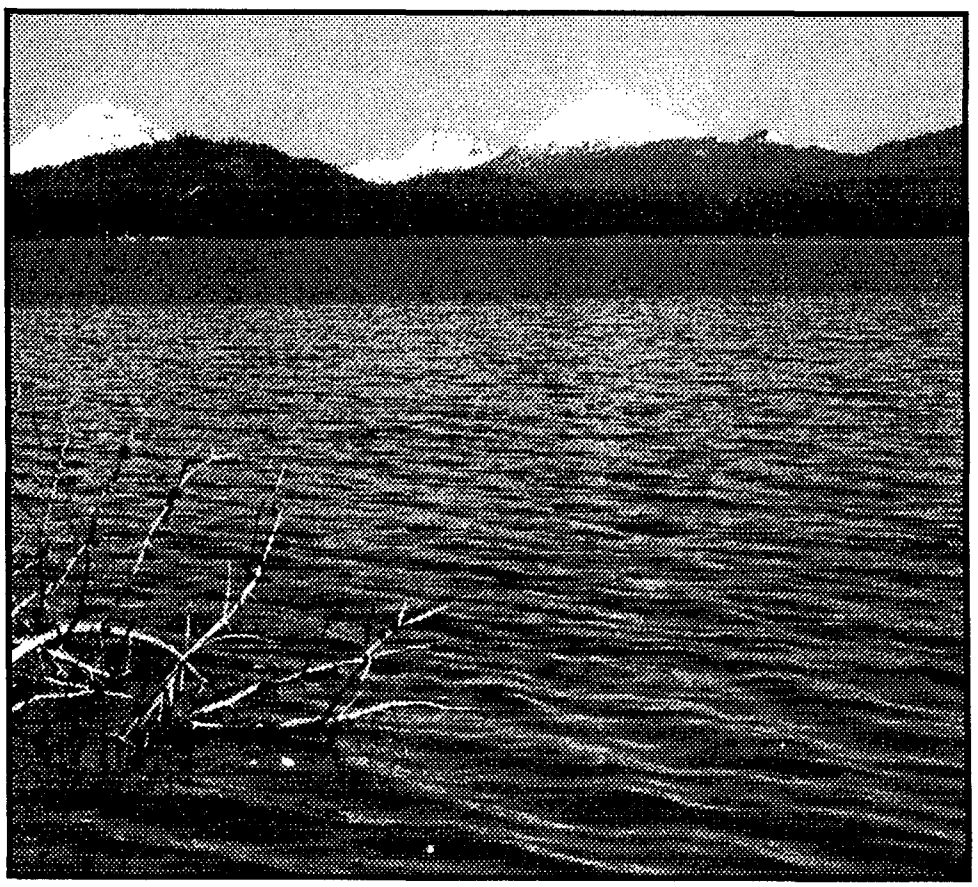
Trappers and explorers were the first Euro-Americans to pass through this country looking for furs and new travel routes. The first use of this watershed was range for cattle and sheep grazing in the 1880s and 1890s. It was also during this time that the creation of the Deschutes National Forest had its beginnings with President Cleveland signing a proclamation establishing the Cascade Forest Reserve. Recreation within the area was probably minimal until the coming of cars and the opening and signing of roads.

Despite the homestead acts in the mid-1800s, settlement in the Deschutes National Forest area was slow prior to the turn of the century; however, with the 1906 Forest Homestead Act the number of claims increased including several applications around Davis Lake, Crane Prairie, and one that lies in a portion of what is now Wickiup Reservoir. In 1915 the Shevlin-Hixon and Brooks-Scanlon Timber Companies opened sawmills in Bend and timber became an important industry with the forest opening to logging. The early development of Central Oregon is largely due to irrigation. There are two reservoirs occurring near or within the analysis area, Crane Prairie built in 1922 is north of the study area, and the Wickiup Reservoir completed in 1949 is located within the area, both played an important part in this development. The Civilian Conservation Corps (CCC) helped in the construction of this reservoir. All that remains of this period of history are the foundations of the buildings lying in the north end of Wickiup Reservoir, visible when the water level is down. In addition to providing water for irrigation, the reservoirs have become popular recreational areas for fishermen and campers.

These past prehistoric and historic activities are seen across the landscape. Evidence of early Native Americans is reflected by the presence of lithic scatters (the most common site type recorded in the area) associated with hunting and gathering activities; cambium peeled trees, the cambium layer of the tree was harvested to supplement their diets; and the discovery of dugout canoes in a nearby lake suggesting these people used the waterways possibly for hunting, and harvesting vegetal resources for consumption and basketry material. Historic accounts describe the presence of wickiups in the Wickiup Reservoir, however further research is needed to verify them. Although areas of spiritual significance have not been identified continued investigations into probable areas is still needed. In addition ethnobotanical studies of plants that occur within the analysis area will provide important information regarding plant resources that may have been harvested.

Historic use loosely followed prehistoric patterns in that travel routes and campsites established by early Native Americans were probably also used by the first Euro-American trappers and explorers. In turn these people left traces as they moved across the landscape leaving blazed trails and remnants of old cabins. Later came ranchers and homesteaders leaving remains of cabins, fence lines, corrals and roads as they settled and used the area for grazing. The advent of Forest Service custodial stewardship in the early 1900s through the post-World War II period left many a mark in the region, including improved roads and trails, Forest Service lookouts, campsites and picnic areas, and reservoirs originally constructed for irrigation and which have become popular areas for fishing and camping. These recreational activities that started in the early 1920's are well established patterns that still exist today.

References



LIST OF REFERENCES

Agee, J.K., 1993. Fire Ecology of Pacific Northwest Forests. Washington, D.C. Island Press, 493 p.

Anderson, H.E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. GTR INT-122

Block, W.M., 1987. Evaluation of Guild-indicator Species for Use in Resource Management. Vol. 11, No. 2., pp. 265-269.

Bork, J. 1984. Fire History in the Three Vegetation Types on the Eastern Side of the Cascades. A thesis submitted to Oregon State University. 94 pp.

Bull, E.L. et al. 1992. Northern Goshawks in Northeastern Oregon. Pacific Northwest Research Station. 34 pp.

Chenoweth, R., 1991. What Is Beauty Worth in a Forest Landscape? Forum For Applied Research and Public Policy. pp. 13-17.

Cochran, P.H., 1996, Personal communication

Cochran, P.H.; Geist, J.M.; Clemens, D.L.; Claustnitzer, R.R.; and Powell, D.C. 1994. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington. Research Note PNW-RN-513, Portland, Oregon; USDA, Forest Service, Pacific Northwest Research Station. 21 p.

Cooper, K., 1995. Cascade Lakes Watershed Analysis: Appendix A-3. Deschutes National Forest

Corkran and Thoms. 1997. Amphibians of Oregon, Washington, and British Columbia

Daniel, T. C., and Boster, R. S. 1976. Measuring Landscape Aesthetics: The Scenic Beauty Estimation Method. USDA Forest Service Research paper RM-107, Ft. Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Dixon, R.D., 1995. Density, Nest-site and Roost-site Characteristics, Home Range, Habitat Use and Behavior of White-headed woodpeckers. Deschutes and Winema National Forests, Oregon Department of Wildlife and USDA Forest Service. 71 pp.

Duncan, J.R., 1994. Review of Technical Knowledge: Great Gray Owls. In: Flammulated, Boreal, and Great Gray Owls in the United States: A technical Conservation Assessment. Hayward and Verner eds. USDA Forest Service. GTR RM-253. pp. 159-175.

Eglitis, A,. 1996. An Overview of Insect Activity in the Cultus and Sheridan Area between 1988 and 1995 as Determined from Aerial Detection Surveys.

Eglitis, A,. 1997. Personal communication.

Erwin, L., 1986. Ecology of Spotted Owl in Oregon and Washington. NCASI Tech. Bulletin #509. 58 pp.

Forest Service Manual 2500. Watershed and Air Management. 1996. R6 Supplement. 5 pp.

"Fun for the Masses". 1997. The Economist. August 2, p. 62.

Gerdes, M.; Archuleta, R.; Newton, R.; and Lowrie, J., 1997 Biological Assessment for 1997 on the Deschutes National Forest. 94 pp.

Gerdes, M.; Maffei, H.; and Booser, J. 1996. Desired Late Successional Reserve Condition. Deschutes National Forest occasional paper. 13 p. plus appendices.

Gerrard, J.M. and Bartolotti, G.R., 1988. The Bald Eagle. 178 pp.

Grenier, Katie Deschutes National Forest Weed List, Deschutes National Forest. 1997.

Guenther K. and Kucera, T.E., 1978. Wildlife of the Pacific Northwest: Occurrence and Distribution by Habitat, BLM District, and National Forest. USDA Forest Service, PNW Region. 128 pp.

Hann, W. J.; Jones, J.L.; Karl, M.G.; (and others). 1996. Chapter 3: An
Gobster, P. H. "Forest Aesthetics, Biodiverstiy, and the Perceived Appropriateness of Ecosystem Management Practices." 1992. North Central Forest Experiment Station.

Hann, W. J., 1997. Personal communication.

Hayes, M.P., 1997. Status of the Oregon Spotted Frog (*Rang pretiosa* sensu stricto) in the Deschutes Basin and selected other systems in Oregon and Northeastern California With a Rangewide Synopsis of the Species Status. The Nature Conservancy. 57 pp.

Haynes, R.W.; Graham, R.T.; Quigley, T.M., tech. eds. 1996. A Framework for Ecosystem Management in the Interior Columbia Basin including Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-374. Portland, OR; USDA, Forest Service, Pacific Northwest Research Station. 67 p.

Hejl, S.J. et al. 1995. Effects of Silviculture Treatments in the Rocky Mountains. In: Ecology and Management of Neotropical Migratory Birds. Martin and Finch eds. pp. 220-244.

Hessburg, P.F.; Smith, B.G.; Kreiter, S.D.; Miller, C.A., Salter R.B.; and McNicholl, C.H. In press. Historical and Current Forest and Range Landscapes in the Interior Columbia River Basin and Portions of the Klamath and Great Basins. Part I: Linking Vegetation Patterns and Landscape Vulnerability to Potential Insect and Pathogen Disturbances, in The Midscale Ecological Assessment of the Interior Columbia Basin (Paul F. Hessburg, tech. ed.). USDA, Dept. of Agric., Forest Service, Gen. Tech. Rpt. PNW-GTR-000.

Hessberg, P.F.; Mitchell, R.G., and Filip, G.M. 1994. Historical and Current Roles of Insects and Pathogens in Eastern Oregon and Washington Forested Landscapes. Gen. Tech. Rep. PNW-GTR-327. Portland, Oregon. USDA, Forest Service, Pacific Northwest Research Station.

Hickman, J.C., ed.. 1993. The Jepson Manual: Higher Plants of California, University of California Press.

Hitchcock, L.C. and Cronquist, A., 1973. Flora of the Pacific Northwest: An Illustrated Manual, University of Washington Press.

Holthausen, R.S., Team Leader. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl: Appendix J2, Results of Additional Species Analysis.

Hunt, J., 1997, Personal communication

Irwin, L., 1986. Ecology of the Spotted Owl in Oregon and Washington, NCASI Technical Bulletin No. 509, New York, N.Y., 58 pp.

Jensen, M.E.; Goodman, I.; Brewer, K.C.; Frost, T.P.; Ford, G.; and Nesser, J., 1996. Chapter 2: Biophysical Environments of the Basin. In: Quigley, T.M.; Arbelbide, S.J., tech. eds. In press. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station.

Keane, R.E.; Long, D.G.; Menakis, J.P.; Hann, W.J.; Bevins, C.D., 1996. Simulating coarse-scale vegetation dynamics using the Columbia River Basin Succession Model - CRBSUM. Gen. Tech. Rep. INT-GTR-340. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 50 p.

Kuzloski, J. "Using Social Science Knowledge As Well As Social Science Data" August 26, 1997. USDA Forest Service, Northern Region, Bridger-Teton National Forest.

Leonard, W.; Brown, H.; Jones, L.; McAllister, K.; and Storm, R. 1993. Amphibians of Washington and Oregon. 168 pp.

Lynch, A. M., Orland, B., Daniel, T. C., and Maffei, H. "Visualization and Perceived Beauty

Effects of Western Spruce pine beetle and Management Alternatives on the Deschutes National Forest." 1992. Pacific Northwest Region, Deschutes National Forest, Bend, Oregon.

McCauley, P., 1993. Deschutes National Forest Fire History. 30 pp.

Maffei, H., 1997. Personal communication.

Marshal, D.B., 1992. Status of the Black-backed Woodpecker in Oregon and Washington. Audubon Society of Portland. 13 pp.

Morgan, P.; Bunting, S.; Long, D.; Byler, J.; Harvey, A.; O'Hara, K.; Latham, P.; Hessburg, P.; and Smith, B. 1996. A Structural Classification for Inland Northwest Forest Vegetation. Western J. of Applied Forestry 11(3), 97-102.

Oregon Department of Fish and Wildlife Deschutes River Basin Plan. 1996. pp. 111-130

Odgers, S., 1997. Personal conversation.

O'Hara, K.L.; Latham, P.A.; Hessburg, P.; and Smith, B.G., 1996. A Structural Classification for Inland Northwest Forest Vegetation. Western J. of Applied Forestry 11(3), 97-102.

O'Neil, C., 1990-1991. Locations, habitats, and descriptions of sensitive plants on the Deschutes National Forest.

Oregon Natural Heritage Program. 1993. Rare, Threatened and Endangered Plants and Animals of Oregon, Oregon Natural Heritage Program.

Oregon Department of Agriculture. 1995. Noxious Weed Program, Noxious Weed Policy and Classification System.

Oregon Department of Fish and Wildlife. 1992. Sensitive Vertebrates of Oregon.

Ottmar, R.D.; Ernesto, A.; Hessburg, P.F.; Smith, B.G.; Kreiter, S.D.; Miller, C.A.; and Salter, R.B. Historical and Current Forest and Range Landscapes in the Interior Columbia River Basin and Portions of the Klamath and Great Basins. Part II: Linking Vegetation Patterns To Potential Smoke Production and Fire Behavior. In: Quigley, T.M.; Arbelbide, S.J., tech. eds. In press. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station.

Quigley, T.M.; Arbelbide, S.J., tech. eds. 1996. Assessment of Landscape Dynamics of the Basin. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station.

Regional Interagency Executive Committee and the Intergovernmental Advisor Committee, Revised August 1995, Ecosystem Analysis at the Watershed Scale (Federal Guide for Watershed Analysis, 26 p.

Reynolds, R.T. et al. 1991. Management Recommendations for the northern Goshawk in the Southwestern United States. USDA Forest Service, Southwestern Region. 184 pp.

Ribe, R.G., Department of Landscape Architecture School of Architecture and Allied Arts, University of Oregon. "The Aesthetics of Forestry: What Has Empirical Preference Research Taught Us?" Environmental Management Vol. 13, No. 1, pp. 55-74

Roper Starch Worldwide. 1996. "Key Findings of the 1996 Recreation Roundtable Survey: Outdoor Recreation in America".

Roper survey results on the increased importance of leisure. 1997.

Rothermel, R.C. 1991. Predicting behavior and size of crown fires in the northern Rocky Mountains. Research Paper INT - 438. USDA-FS Intermountain Research Station

Ruggiero, L.F. ed. et al. 1994. American Marten, Fisher, Lynx and Wolverine in the Western United States. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. GTR RM-254. pp. 7-37.

Salwasser, H. "Tackling the Human Dimension of Natural Resources Conservation: Will Professionals Lead, Follow or Get Out of the Way?" USDA Forest Service, Northern Region, Missoula, Montana.

Sharp, B.E., 1992. Neotropical Migrants on National Forests: A Compilation of Existing Information. USDA Forest Service, Region 6.

USDA Forest Service. ROS Users Guide.

USDA Forest Service 1974. National Forest Landscape Management Volume 1. Agriculture Handbook Number 434, U.S. Government Printing Office.

USDA Forest Service. 1974. National Forest Landscape Management Volume 2. Agriculture Handbook Number 462, U.S. Government Printing Office.

USDA Forest Service, Deschutes National Forest. 1976. Soil Resource Inventory.

USDA Forest Service, Deschutes National Forest, Pacific Northwest Region. 1990. Land and Resource Management Plan. Irregular pagination, plus appendices.

USDA Forest Service. 1991. Bald Eagle Species Management Guide. Region 6. 66 pp.

USDA Forest Service. 1993. Region 6 Interim Old Growth Definitions.

USDA Forest Service, Deschutes National Forest and USDI Bureau of Land Management. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Volumes I, II, and Appendix J-2.

USDA Forest Service and USDI Bureau of Land Management. 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. 73 p. plus attachments.

USDA Forest Service, Deschutes National Forest. 1994. Watershed Evaluation and Analysis for Viable Ecosystems. 24 pp.

USDA Forest Service, Deschutes National Forest, Bend-Ft. Rock RD. 1995. Cascade Lakes Watershed Analysis. Irregular pagination, plus appendices.

USDA Forest Service. Pacific Northwest Region, Deschutes National Forest, Crescent R.D. 1995. Davis Late-Successional Reserve Assessment.

USDA Forest Service. 1995. Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales. Regional Foresters Plan Amendment #2. 23 pp. including Decision Notice and Appendix B.

USDA Forest Service, Intermountain, Northern, and Pacific Northwest Regions. 1995. Inland Native Fish Strategy Environmental Assessment.

USDA Forest Service, Deschutes National Forest, Bend-Ft. Rock R.D. 1996. Cultus and Sheridan Late-Successional Reserve Assessment.

USDA Forest Service, Deschutes National Forest, Crescent R.D. 1996. Bald Eagle Site-Specific Management Plan for the Davis Lake East and West Nest Sites and Wickiup South Nest Sites. 26 pp.

USDA Forest Service, Deschutes National Forest, Crescent R.D. 1996. Seven Buttes Environmental Assessment.

USDA Forest Service, Deschutes National Forest. 1996. Definitions and Procedures for Classifying Stands as Imminently Susceptible to Insect Attack and Wildfires. 4 pp.

USDA Forest Service, Deschutes National Forest. 1996. Upper Deschutes Wild and Scenic River Record of Decision and Final Environmental Impact Statement.

USDA Forest Service 1997. Landscape Aesthetics: A Handbook for Scenery Management.

Agriculture Handbook Number 701, U.S. Government Printing Office.

USDA Forest Service, Deschutes National Forest, Crescent R.D. 1997. Big Marsh Late-Successional Reserve Assessment.

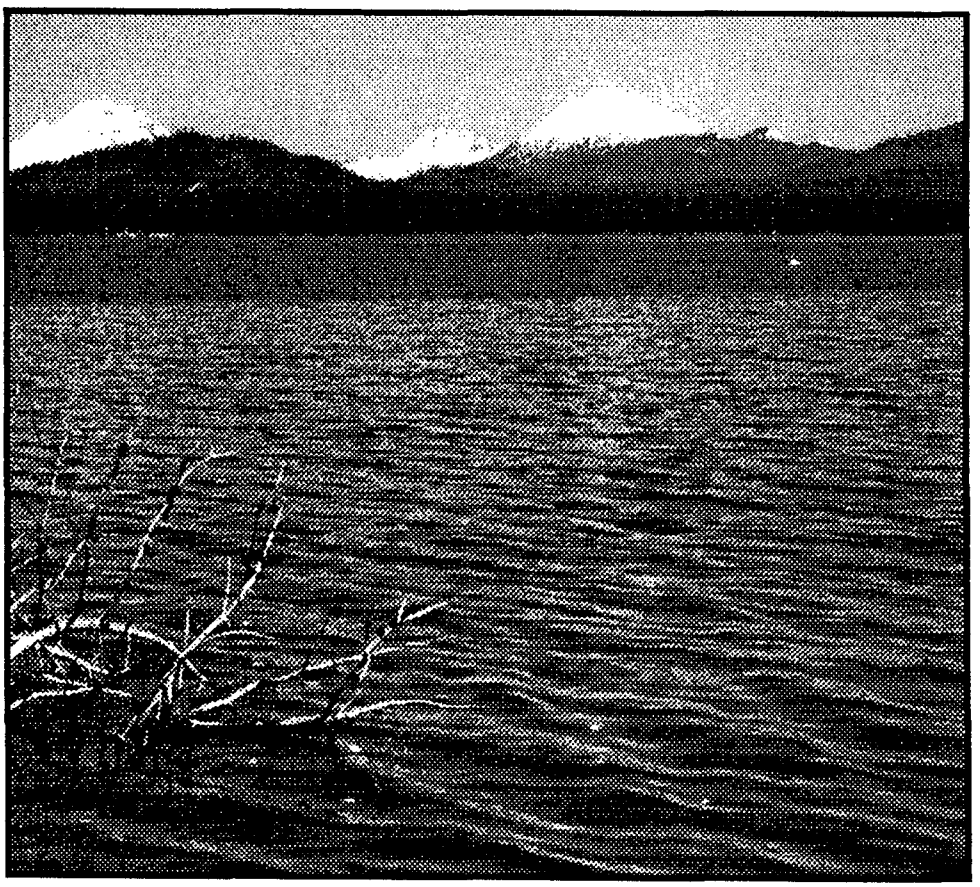
USDA Forest Service and USDI Bureau of Land Management. 1997. Eastside Draft Environmental Impact Statement, Interior Columbia Basin Ecosystem Management Project (irregular pagination, plus appendices).

USDI Fish and Wildlife Service. 1986. Pacific Bald Eagle Recovery Plan. 163 pp.

Volland, L.A., 1985. Plant Associations of the Central Oregon Pumice Zone. USDA, Forest Service, Pacific Northwest Region, R6-ECOL-104-1985 (Reprint with minor revisions of R6 Area Guide 4-2 published January 1976 and R6-ECOL-104-1982 of September 1982).

Wilson, R., 1996, personal communication.

Glossary



Glossary

Aboriginal areas - A modern term used to describe historic and prehistoric lands where a Tribe(s) carried out food gathering or seasonal activities or traded with other Indian peoples.

Administratively withdrawn areas - Areas removed from the suitable timber base through agency direction and land management plans.

Adfluvial - A population that all life stages occur in a river.

Advisory Council on Historic Preservation - A group responsible for commenting to Federal agencies on undertakings that affect historic properties.

Aerial fuels - All live and dead vegetation located in the forest canopy or above the surface fuels, including tree branches and crowns, snags, moss, and high brush.

All Terrain Vehicle (ATV) - Class I (three wheelers, four wheelers) and Class II (off-road motorcycles) all terrain vehicles as defined by the State of Oregon.

Andesite - A fine grained igneous rock with an intermediate silica content of 57 to 62%.

Aquatic habitat - Habitat that occurs in free water.

Aquatic zone - An area covered by water.

Archaeological and Historic Preservation Act (AHPA) - This Act imposes additional requirements on an agency if a Federal project will affect historic properties that have archaeological value.

Archaeology - The study of physical remains from people who have lived before us.

Ashflow - A turbulent mixture of gas and pyroclastic materials of high temperature, ejected explosively from a vent, that travels swiftly down the slopes of a volcano or along the ground surface.

Aspect - The direction a slope faces.

Associated species - A species found to be numerically more abundant in a particular forest successional stage or type compared to other areas.

Basalt - A dark fine grained igneous rock with a low silica content of less than 52%, and rich in iron and magnesium.

Basaltic-andesite - A fine grained igneous rock with a low silica content of 52 to 57%.

Baseline - The starting point for analysis of environmental consequences. This may be the conditions at a point in time (e.g., when inventory data are collected) or may be the average of a set of data collected over a specified period of years.

Bedrock - Rock that lies below all loose or unconsolidated soil and organic materials.

Biodiversity - The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

Biological corridor - A habitat band linking areas of similar management and/or habitat type.

Buffer - Zone between a sensitive area and disruptive management activities. Usually includes minimally disturbed, vegetation communities.

Burning period - That part of each 24-hour period when fires will spread most rapidly.

Caldera - A large circular depression resulting from collapse of the land over a large emptying chamber of magna.

Candidate species - Those plants and animals included in Federal Register "Notices of Review" that are being considered by the Fish and Wildlife Service for listing as threatened or endangered. Two categories that are of primary concern: **Category 1 (C1)** - Taxa for which there is substantial information to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher priority listing work. **Category 2 (C2)** - Taxa information indicates that listing may be appropriate. Additional information is being collected.

Canopy - The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth. Layers of canopy may be called stories.

Canopy cover - The degree to which the canopy blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy as openings in the branches and crowns must be accounted for.

Carbon dioxide - A colorless, odorless gas that, when inhaled, reduces the oxygen-carrying capacity of the blood and can result in adverse health effects.

Category 2 Species - Species under review by the US Fish and Wildlife Service for protection under the Endangered Species Act. Listing of the species as threatened or endangered may be appropriate, but further information is needed to determine their status.

Cavity nesters - Wildlife species, most frequently birds, that require cavities (holes) in trees for nesting and reproduction.

Ceded - Refers to lands conveyed to the U.S. by a Tribe. There are no Treaty rights with

regards to cultural, religious or spiritual resources or activities and practices.

cfs - Cubic feet per second, a measure of the volume of water that flows past a given location.

Cinder cone - Cone shaped pile of mafic tephra erupted from a central vent.

Cinders or **Scoria** - Dark colored pieces (usually black to red) of volcanic rock full of vesicles.

Climax - The terminal, theoretically stable, self-perpetuating condition in a series of plant communities that culminates plant succession on any given site in the absence of any major disturbance.

Climax species (or series) - The tree species predonimating on a site at climax, especially in the absence of major disturbances. Sites are often described in terms of the major forest series they belong to. For example, ponderosa pine climax series includes plant associations where ponderosa pine is the dominant overstory species at climax.

Code of Federal Regulation (CFR) - A codification of general and permanent rules published in the Federal Register by the Executive Department and agencies of the Federal Government.

Community - An aggregation of living organisms having mutual relationships among themselves and to their environment.

Composite volcano - Usually a steep sided cone made of numerous layers of lava, ash, pumice, and cinders strengthened by numerous dikes and sills.

Congressionally Withdrawn Area - Areas that require congressional enactment for their establishment such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness.

Connectivity of habitats - The linkage of similar but spatially separated vegetative stands (such as mature forests) by patches, corridors, or "stepping stones" of the same vegetation across the landscape; also, the degree to which similar habitats are son linked.

Contiguous habitat - Habitat suitable to support life needs of species that is distributed continuously or nearly continuously across the landscape.

Core area - That area of habitat essential in the breeding, nesting and rearing of young, up to the point of dispersal of the young.

Corridor - A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life-sustaining needs.

Council on Environmental Quality (CEQ) - Reviews federal programs for their effect on

the environment, conducts environmental studies and advises the President on environmental matters.

Cover - Vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce. May also refer to the protection of the soil and the shading provided to herbs and forbs by vegetation.

Crater - A bowl or funnel shaped depression usually at the top of a volcanic cone formed during explosive eruptions.

Critical habitat - Under the Endangered Species Act, critical habitat is defined as (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.

Crown fire - A fire that advances form top to top of trees or shrubs more or less independently of the surface fire.

Cultural Resources - The remains of sites, structures, or objects used by people in the past; this can be historic or prehistoric.

Cultural or Heritage Resources - The remains of sites, structures or objects used by humans in the past, historical or archaeological.

Cumulative effects - Those effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Dacite - A glassy to fine grained igneous rock with an intermediate silica content of 62 to 67%.

Data recovery - Mitigating adverse effects to historic properties by recovering a representative sample of data.

dbh - diameter at breast height; the diameter of a tree measured 4.5 feet above the ground on the uphill side.

Dead and down material - Dead, woody plant material, usually trunks and branches of dead trees, lying on or near the soil surface.

Desired future condition (DFC) - Collection of resource goals translated into descriptions of

biological and physical conditions that are created, maintained or restored.

Developed recreation - Recreation that requires facilities (buildings, parking, picnic tables, etc.) which, in turn, results in concentrated use of the area.

Developed site - An area with facilities specifically constructed for public recreation purposes.

Developed recreation Recreation use that occurs within a site or facility specifically established and constructed for public recreation purposes.

Dike - A sheet like body of formerly molten rock that intruded steeply into bedded rock.

Dispersal - The movement, usually one way and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.

Dispersed campsite - Designated area for overnight dispersed recreation, not facility based.

Dispersed recreation - Recreation use outside of a developed recreation site.

Dispersed site - A user-created recreation site with no facilities.

Disturbance - A short term event, whether natural or human induced, that causes a significant change from the predicted pattern in an ecological system.

Diversity - The variety, distribution, and abundance of different plant and animal communities and species within an area.

Down woody material - Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 9 inches in diameter.

Draft Environmental Impact Statement (DEIS) - The draft statement of environmental effects which is required for major federal actions under Section 102 of the National Environmental Policy Act and released to the public and other agencies for comment and review.

Duff - A mat of partially decomposed organic matter immediately above the mineral soil, consisting primarily of fallen foliage, herbaceous vegetation and decaying wood.

Ecological old growth - Climax forest conditions where fire has been suppressed.

Ecosystem - A unit comprising interacting organisms considered together with their environment (e.g., marsh, watershed, and lake ecosystems).

Ecosystem diversity - The variety of species and ecological processes that occur in different physical settings.

Ecosystem - A community of living plants and animals interacting with each other and their physical environment.

Endangered species - A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endangered species - Species of animal or plant that is in danger of extinction throughout all or a significant portion of its range.

Endemic - A species that is unique to a specific locality.

Environmental consequence - Projected effect of a federal action or actions on the social and biological environment.

Ephemeral stream - Stream that contains running water only sporadically, such as during and following storm events.

Escaped fire situation analysis - A documented decision analysis process with alternative strategies for management of an escaped fire.

Escaped fire- A fire that has exceeded initial attack capabilities.

Extreme Fire Behavior - Erratic and sometimes dangerous wildfire behavior that ordinarily precludes methods of direct control action.

Final Environmental Impact Statement (FEIS) - Final version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses.

Fine fuels - Fuels such as grass, leaves, draped pine needles, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

Fire climax - A climax condition that is maintained by frequent, low intensity fire regimes.

Fire cycle - The average time between fires in a given area.

Fire environment - The surrounding conditions, influences, and modifying forces that determine the behavior of fires.

Fire intensity - The rate of heat release for an entire fire at a specific point in time.

Fire management - An extension of the concept of wildfire decision making which takes into account resource values, role of fire in the environment, the level of protection required,

opportunities for prescribed use of fire, consideration of fire effects, and the efficiency of fire control operation.

Fire occurrence - The number of wildland fires started in a given area over a given period of time.

Fire prevention - Activities directed at reducing fire occurrence.

Fire regime - A combination of environment, plant species characteristics, and fire ignition patterns.

Fire Return Interval - The average time between wildfires in a given ecosystem.

Fire Risk - The probability that a wildfire will start as determined by the presence and activities of causative agents.

Fire Suppression Strategies - **Confine**: Allowing a fire to burn so long as it remains or is predicted to remain within predetermined natural boundaries. **Contain**: Restricting a fire to a certain area by using natural or constructed barriers that stop fire spread under the prevailing and forecasted weather conditions. **Control:** Using aggressive suppression tactics to establish firelines around a fire to halt its spread, and to extinguish all hotspots.

Fire Suppression Tactics - The science and art of deploying and maneuvering forces against wildfires.

Fireline Intensity - The rate of heat energy released during combustion per unit length of fire front, expressed in BTUs/second/foot.

Flame length - The distance measured from the tip of the flame to the middle of the flaming zone at base of the fire.

Fluvial - A population that reproduces in streams or river, but the majority of the adult life stage is spent in a lake or reservoir.

Forage - To feed; or the material on which animals feed.

Forb - Herbaceous plant species other than those in the *Gramineae* (grass), *Cyperaceae* (sedge), and *Juncaceae* (rush) families.

Fragmentation - The process of reducing size and connectivity of stands that compose a forest.

Fuel loading The weight of fuels in a given area, usually expressed in tons per acre.

Fuel type - An identifiable association of fuel elements of distinctive species, form, size,

arrangement, of other characteristics.

Fuels - Plants and woody vegetation, both living and dead, that are capable of burning.

GIS (Geographical Information System) - An organized collection of computer hardware, software, geographical data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced (spatial) information.

Green tree retention - A stand management practice in which live trees as well as snags and large down wood are left as biological legacies within harvest units to provide habitat components over the next management cycle.

Ground fuels - All combustible materials lying beneath the ground surface including deep duff, roots, rotten buried logs, peat and other woody fuels.

Ground water - Water beneath the earth's surface that accumulates as a result of seepage from the surface and serves as the source of springs and wells.

Guided/outfitted recreation - Recreation opportunities, typically requiring special skills, knowledge, or equipment, provided to the public for a fee and operated under a special use permit from the Forest Service. Examples: guided whitewater rafting, canoe rentals, etc.

Guzzler A structure which provides water to wildlife, consisting of a large apron (400-600 sq. ft.) which collects rainwater and snowmelt, stores the water in a tank (600 to 2000 gallons), and provides the water in a basin.

Habitat - The place where a plant or animal naturally or normally lives and grows.

Habitat fragmentation - The splitting or isolating of patches of similar habitat, typically forest cover; habitat can be fragmented from natural conditions, such as thin or variable soils, or from forest management activities.

Hazard - A fuel complex that forms a special threat of ignition or of suppression difficulty.

Hazard tree - A tree which poses a threat to life or property due to its condition or attitude.

Heavy fuels - Fuels of large diameter such as snags, logs, and large limbs which ignite and are consumed much more slowly than fine fuels.

Herbaceous plant - A seed-producing plant that does not develop persistent woody tissue, but dies down to ground level at the end of the growing season.

Hiding cover - Cover used by animals to hide from predators.

Historic old growth - Climax forest conditions in the absence of fire suppression.

Historic Range of Variability (HRV) - The typical fluctuation of processes or functions, and the typical proportions of ecosystem elements in a watershed over a period of time when the ecosystem was not significantly affected by European settlement and management. HRV is the amplitude or minimum-maximum range of "natural conditions."

Hydrophobic- A state of impaired water permeation

Imminent susceptibility - Forest condition with a high probability of significant change in structure or character of forest stands on a large scale as a result of insect attack and/or fire within the next 10 years.

Indirect effects - Effects on the environment that were triggered by changes in the environment directly caused by some action. Indirect effects, compared to direct effects, are later in time or farther removed in distance but are still reasonably foreseeable.

Intermittent Stream - A stream or portion of a stream that flows only at certain times of the year and having a definable channel and evidence of annual scour or deposition..

Irretrievable - Term that applies to losses of production, harvest or use of renewable natural resources.

Irreversible - Term that applies primarily to use of nonrenewable resources, such as minerals or cultural resources, or to factors such as soil productivity that are renewable only over long time periods. Also includes loss of future options.

Jackpot burning - Hand ignition of woody fuel concentrations that lie in a random fashion like "pick-up sticks."

Kipuka - An area surrounded by a lava flow.

Ladder fuels - Fuels which allow fire to carry by convection from surface fuels into the crowns with relative ease.

Large Woody Material - Whole or portions of trees, usually with branches and the root wad attached to the bole, which are at least partially submerged and which provide fish habitat.

Late-Successional Reserve - A forest in its mature and/or old-growth stages that has been reserved under the ROD.

Lava - A general term for molten volcanic material on the earth's surface; also used for the rock which solidifies from it.

Lava tube - A roofed over channel that develops within a fluid lava flow through which lava travels to feed the advancing front of the flow. When lava ceases to pour out of the vent, the lava in the channel may flow out the end leaving a hollow winding cave.

Lithic scatter - A prehistoric site with a contiguous cluster of 10 or more artifacts and no more than one feature.

Litter - The uppermost layer of loose debris composed of freshly fallen or slightly decomposed organic materials such as dead sticks, branches, twigs, and leaves or needles.

Long-term - 50-100 years in the future and sometimes beyond.

Mafic - Pertaining to igneous rocks rich in magnesium and iron and comparatively low in silica, includes rocks classified as basalt, basaltic-andesite, and andesite.

Magma - A term for molten volcanic material below the earth's surface.

Matrix - Federal lands outside of reserves, withdrawn areas, and Managed Late-Successional areas.

Maximum population potential - The greatest number of wildlife that can live within a given area. For cavity-dependent wildlife, the number is often expressed as a percentage of potential, where snags are assumed to be the factor which limits populations. 100% of the population potential cannot be exceeded due to territorial requirements of the animals.

Mesotrophic - a water body of moderate biological productivity. Determination based on evaluations of transparency, total phosphorus concentration, and chlorophyll a.

Migration route - A travel route used routinely by wildlife in their seasonal movement from one habitat to another.

Migration corridor - Normal path followed by animals during regular, seasonal travel.

Mitigating measures - Modifications of actions that: 1) avoid impacts by not taking a certain action or parts of an action; 2) minimize impacts by limiting the degree or magnitude of the action and its implementation; 3) rectify impacts by repairing, rehabilitating, or restoring the affected environment; 4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or 5) compensate for impacts by replacing or providing substitute resources or environments.

Mitigation - An action to minimize, ameliorate or compensate for the adverse effects of certain management activities.

Model - An idealized representation of reality developed to describe, analyze, or understand the behavior of some aspect of it; a mathematical representation of the relationships under study. The term model is applicable to a broad class of representations, ranging from a relatively simple qualitative description of a system or organization to a highly abstract set of mathematical equations.

Monitoring - The collection of information to determine the effects of resource management and to identify changing resource conditions or needs.
Mosaic - A landscape pattern composed of variably sized and shaped patches of different plant species, ages or stand structures. Mosaics are created and changed by natural disturbances (fire, wind, insects, etc.) or vegetation management.

Multi-storied stands - Forest stands that contain trees of various heights and diameter classes and therefore support foliage at various heights in the vertical profile of the stand.

National Environmental Policy Act (NEPA) OF 1969 - Promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity.

National Forest Management Act (NFMA) - Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Regional Guides and Forest Plans and regulations to guide them.

National Register of Historic Places - A register of cultural resources of national, state or local significance, maintained by the Department of the Interior.

Neotropical migratory birds - Birds which migrate from wintering grounds in Mexico, Central and South America, and the Caribbean to breeding grounds in Canada and the USA; includes most songbirds.

Non-commercial recreation - Recreational activities on Forest Service land which do not involve guides or outfitters.

Nongame wildlife - Wild animals which are not hunted, fished or trapped during any part of their life cycle.

Noxious weed - A plant specified by law as being especially undesirable, troublesome, and difficult to control.

Northwest Forest Plan - Alternative 9 and the preferred alternative of the 1994 Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl..This plan amends the 1990 Deschutes National Forest Land and Resource Management Plan.

Obsidian - Black to clear volcanic glass form a lava flow or dome with a high silica content.

Obsidian hydration analysis - A technique of determining the age of volcanic glass surfaces by measuring the depth of water penetration.

Old growth - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying

wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

Oligotrophic - a water body of low biological productivity. Determination is based on transparency, total phosphorus concentration, and chlorophyll a. Transparency is typically high.

Opening - A break in the forest canopy; the existence of an area of essentially bare soil, grasses, forbs, or shrubs in an area dominated by trees.

People at one time (PAOT) - A measurement of designed or physical capacity that indicates the maximum number of people who can use a facility or area at one time. (Not to be confused with Recreational Carrying Capacity).

Perennial stream - Stream which normally flows throughout the year.

Plant Association - The distinctive combination of trees, shrubs, grasses, and herbs occurring in a theoretical terminal or climax community or a series of communities.

Plant communities - Association of plants in a given area or region in which various species are more or less interdependent upon each other.

Pleistocene - The geologic epoch dating from approximately 2 million years ago to 10,000 years ago.

PM_{10} - Fine particulate air pollution consisting of solid particles or liquid droplets that are less than 10 microns in diameter and may cause adverse health effects.

Population viability - Probability that a population will persist for a specified period across its rang despite normal fluctuations in population and environmental conditions.

Pre-Mazama - Prior to the eruption of Mt. Mazama approximately 7600 years ago.

Pre-suppression - Activities in advance of fire occurrence to ensure effective suppression action.

Prehistoric - The time before the coming of Europeans. In central Oregon, prior to 1800 A.D.

Prescribed fire - The burning of forest or range fuels on a specific area under predetermined conditions so that the fire is confined to that area and fulfills management objectives.

Pumice cone - Cone shaped pile of silicic tephra erupted from a central vent.

Pumice - Light colored pieces of volcanic rock so full of vesicles that they will often float on water.

Radio carbon dating - (or Carbon-14 Dating) A means of establishing absolute dates for organic materials by measuring the ratio of radioactive C-14 present.

Range of variability (historic range of variability or natural range of variation) - The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself.

Reconstruction - Reproducing by new construction the exact form and detail of a vanished building, structure or object.

Recovery plan - A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act, to improve the status of the species to justify delisting in accordance with the Endangered Species Act.

Recreation Opportunity Spectrum (ROS) - The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords, based on access, remoteness, naturalness, facilities, social encounters, visitor impacts, and visitor management.

Recreation Visitor Days (RVDs) - Twelve hours of recreational use of a site or area by one or more visitors.

Recreational carrying capacity - The type and level of visitor use that can be accommodated without substantially diminishing the quality of the recreation experience or the physical environment.

Reforestation - The natural or artificial restocking of an area with forest trees.

Refugia - Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range (i.e., endemic populations).

Regeneration harvest - A cut in a particular stand of timber designed to remove existing volume and start a new crop.

Rehabilitation - Returning a property to a state of utility through repair or alteration which makes possible a contemporary use while preserving the significant features of the property.

Resilience - The ability of an ecosystem to return to a predicted, desired, or earlier state after disturbance.

Restoration - Actions taken to return an ecosystem in whole or in part to a desired condition.

Rhyodacite - A glassy to fine grained igneous rock with a high silica content of 67 to 72%.

Rhyolite - A glassy to fine grained igneous rock with a high silica content of more than 72%.

Riparian area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplain, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water.

Riparian reserves - The area adjacent to streams, lakes and wetlands which is designed to protect aquatic and riparian functions and values.

Salvage - Removal of insect infested, dead, damaged, or down timber not otherwise left for resource or environmental purposes.

Scenic Integrity - Represents the current status of the landscape , determined on the basis of visual changes that detract from the scenic quality of the area.

Scoping - Process by which the Forest Service determines how inclusive and detailed an analysis is necessary to make an informed decision on a proposed action.

Scorch height - The maximum vertical height at which lethal scorching of foliage occurs.

Secondary range - That part of the suitable range that, under the existing management and improvement level, is grazed significantly only after the primary range has been overused. Secondary range is not used to base initial carrying capacity estimates.

Sensitive habitats - Include meadows, wetlands, big game winter range areas, big game calving and fawning areas, important ruffed grouse areas, important songbird and waterfowl nesting and foraging areas, and TES wildlife and plant habitats.

Sensitive species - Plant and animal species identified by the Regional Forester for which population viability is a concern.

Seral stage - One of a series of ecological communities that succeed one another in the biotic development of an area.

Shield volcano - A gently sloping volcano in the shape of a flattened dome, built of flows of very fluid basaltic lava.

Short-term - For this report, usually 10 years.

Shrub - Bush or low-growing, perennial plant, usually with several main stems arising near the ground.

Silicic - Includes rocks classified as dacite, rhyodacite, and rhyolite.

Silvicultural system - A planned sequence of treatments or prescriptions over the entire life of a forest stand.

Silviculture - The art and science of controlling the establishment, composition and growth

of forests.

Single-storied stand - A stand of trees in which the canopy is contained in one layer.

Slash - Debris left after logging or resulting from wind or fire.

Snag - Any standing dead, partially dead, or defective (cull) tree at least 10 inches in diameter at breast height and at least 15 feet tall.

Snag dependent species - Birds and animals dependent on snags for nesting, roosting, or foraging habitat.

Spatter cone - A mound of welded clots of lava and cinders that were thrown a few feet into the air but were still molten when they landed.

Spatter rampart - A rim of welded clots of lava and cinders along a fissure.

Spawning gravel - Pea-size to baseball-size rocks usually located in riffle or tail-outs of pools. Water must flow over and through the gravel to allow for the exchange of oxygen for in incubation of the young fish to be successful.

Species - (1)A group of individuals that have their major characteristics in common and are potentially interfertile. (2)The Endangered Species Act defines species as including any species or subspecies of plant or animal. Distinct populations of vertebrates also are considered to be species under the act.

Species diversity - The number, different kinds, and relative abundance of species.

Spotting - Behavior of a fire producing sparks or embers which start new fires beyond the main fire.

Stand - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

Standard and Guideline (S&G) - Practice needed to achieve desired conditions or levels of environmental quality.

Stochastic - Involving chance or probability

Stocking - The degree to which trees occupy the land. High stocking implies high density of trees.

Succession - A process of plant community development that involves changes in species structure and community processes over time.

Successional stage - One in a series of usually transitory communities or developmental stages

that occur on a particular site or area over a period of time.

Suppression - All actions undertaken to extinguish or limit fire growth beginning with its discovery.

Surface fuels - All combustible materials lying on, or immediately above, the ground.

Sustainability - The ability of an ecosystem to maintain its organization and autonomy over time including but not limited to maintenance of ecological processes, biological diversity and productivity.

Tephra - All rock fragments, molten or solid, thrown out of a volcano by expanding gasses.

Thermal cover - Cover used by animals to lessen effects of weather.

Thermocline - In a thermally stratified lake, the horizontal layer of water in which temperature decreases rapidly with depth.

Thinning - A cut made in an immature stand of trees to improve the vigor of the remaining trees.

Threatened species - A plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future.

Transition range - Areas used by deer and/or elk prior to onset of winter and in the spring before moving to summer range.

Travel corridor - A route followed by animals along a belt or band of suitable cover or habitat.

Tree scarring fire - A fire that leaves an injury on a woody plant.

Tuff - A type of igneous rock resulting from solidification of volcanic ash and/or pumice.

Tuff cone or ring - A broad, low volcanic cone with a wide flat bottomed crater which result when magma encounters abundant ground water and huge amounts of steam are generated which drive a violent eruption of steam, water, and rock fragments.

Ultra-oligotrophic - a water body of extremely low biological productivity. Determination is based on transparency, total phosphorus concentration, and chlorophyll a. Transparency typically is very high.

Underburning - Prescribed burning of the forest floor or understory for botanical or wildlife objectives, hazard reduction, or silvicultural objectives.

Understory - The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth.

Undesirable exotic plants - Non-native plant species which have the potential to out-compete and replace native vegetation or desirable non-native vegetation.

Utilization - Determined by key forage species which are based on preference by cattle, one to two key forage species are selected to represent the area and each species at the site is compared to the Standards and Guidelines. For grasses and grasslike species utilization is based on percent removed by weight. For shrubs utilization is based on incidence of use (if 50 leaders out of 100 are browsed, utilization is 50%)

Vent - The opening at the Earth's surface through which volcanic materials issue.

Viable population - The number of individuals, adequately distributed throughout their range, necessary to perpetuate their existence in natural, genetically stable, self-sustaining population.

Visual Quality Standards - Categories of acceptable landscape alteration measured on degrees of deviation from the natural-appearing landscape.

Volcanic ash Fine tephra less than 2 mm in diameter.

Water table - The level of groundwater beneath the land surface.

Watershed - The drainage basin contributing water, organic matter, dissolved nutrients and sediments to a stream or lake.

Wet meadows - Areas where grasses predominate. Normally waterlogged within a few inches of the ground surface.

Wetlands - Areas that are inundated by surface water or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction (Executive Order 11990). Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar areas.

Wildfire - An unplanned wildland fire requiring suppression action, or other action according to Agency policy.

Wildlife tree - A live tree retained to become future snag habitat.

Wildlife/fish user days - Twelve hours of recreation that is the result of fish or wildlife. See Recreation Visitor Days.

Xeric - Of, characterized, or adapted to an extremely dry environment.

Questions and Answers About the Document

1a. Question: Describe the General Protection (GP) MSAs

Answer: These GP/LT MSAs (General Protection/Large Trees; #11 and #12) are relatively narrow strips of land in the lower elevations and alongside travel routes where a combination of high fuel loadings and concentrated recreation occurs adjacent to Crane Prairie Reservoir. The objective is to promote public safety and to protect the integrity of the LSR by treating the high risk areas within these strips to decrease the likelihood of a wildfire reaching the upper slopes of Round or Browns Mountain. To illustrate this, we have enclosed a PAG (Plant Association Group) map with contours and an overlay of the MSAs as well as a copy of the aerial photos.

1b. Question: What are the general prescription objectives within General Protection (GP) MSAs?

Answer: The general objective for the GP MSAs will be to retain large ponderosa pine and Douglas-fir overstory trees, as well as smaller recruitment trees of the same species. The strategy for the 300 foot GP corridor will include an emphasis on firefighter safety and reduction of stem density for the first 100 feet, particularly discriminating against understory lodgepole pine and white fir. The remaining 200 feet will continue to focus on large structure, with some white fir component. Clumps of trees within the 300' corridor will be thinned to favor ponderosa pine and to reduce stem density. Individual lodgepole pine and white fir trees will be selectively removed, although some large diameter white fir with low crown fire potential (e.g., lower limbs absent) will be retained. On a short-term basis, stand density for the first 100' is expected to range from 40-80' basal area/acre. The next 200', stand density is expected to be greater, with stand density averaging 60-100' basal area/acre. Using variable spacing, the stand will be "feathered" to blend into surrounding MSA stand conditions. Promotion of the regeneration of ponderosa pine and Douglas-fir will be done (if needed) using small canopy gaps that are commensurate with regeneration strategies for target species. The creation of these gaps will not compromise the expected natural mosaic common to dry forests with frequent fire regimes.

Large snags will be a component of the stand, retained at minimum or greater levels. These need to be examined on a case-by-case basis, especially within 100' of the road. Down woody material created by thinning will be treated to meet protection objectives, especially within the first 100 feet of the corridor. Throughout the corridor, existing levels of down woody will be retained and protected where feasible, especially during the application of prescribed fire.

The areas outside of the LSRs and adjacent to the General Protection/Large tree MSAs would be managed to complement the protection objectives for the LSR and to facilitate fire safety considerations within a high use recreational zone. Critical road corridors for public and firefighter evacuation/egress (or "defensible zones") would be treated inside and adjacent to the LSR. Lands within the LSR would have a "lighter treatment" than outside the LSR in order to meet wildlife objectives. The long-term objective is to return fire which mimics a more natural fire regime.

1c. **Question: Is there a target tonnage you are shooting for?**

Answer: Target tonnage is 8-12 tons per acre in the General Protection/Large Tree and General Protection/Large Tree - Riparian/Neotropical Migrant Bird (outside of riparian zone) MSAs. Fuels targets (by size classes) will be: 0-.25" = .5 tons/ac., .26-1.0" = 2.0 tons/ac., 1-3" = 3.5 tons/ac., 3-9" = 4 tons/ac., >9" = 1 tons/ac. The tonnage targets are averages which are actually represented by a range of values.

1d. **Question: Are removal of ladder fuels (including green trees) and an increase in crown spacing a part of the prescription?**

Answer: Yes, reducing ladder fuels and increasing crown spacing are an important part of managing the fuels in these MSAs. Presently, this is the primary objective, as the existing coarse woody materials and snags are not a significant factor.

The GP/LT MSAs would be treated to a maximum of 300 feet in width adjacent to the ignition source (campers) to the above standards. Minimum levels of down logs and snags or greater would be retained for wildlife (where minimum levels exist). These levels would be determined by the minimums as identified in adjacent MSAs as listed in Table 7-4, page 7-33. For example, minimum levels of snags and CWM for the GP/LT-R/NMB (General Protection/Large Tree-Riparian/Neotropical Migrant) MSA would be those levels listed for the BE/N/R (Bald Eagle/Nesting/Roosting) MSA or 3-5 snags and 7-15 logs.

1e. **Question: What is the extent of treatment?**

Answer: Approximately 150 acres (one-half of the total area within the two MSAs) match the criterion for treatment.

2a. **Question: Describe large tree culturing.**

Answer: The objective of treatment is to keep from losing large tree character within stands where large pines (and occasionally large Douglas-firs) are threatened by dense, rapidly-growing white fir and lodgepole pine understories. In essence, this calls for reducing the competitive stress from around large structural (early-seral) individuals without compromising the goal for forest canopy coverage of 50-70% (average) in the long term.

2b. Question: Do you have a target distance from which competing trees will be removed?

Answer: Individual tree culturing treatment would involve removing small to moderate sized trees to a distance of two crown widths of the big tree, or by reducing the density down below the upper management zone (as described in Cochran et al. 1994).

2c. Question: Will every tree be removed within this distance, including other pines?

Answer: Yes, in most cases. Culturing would occur for up to 10 individual existing large trees and/or future large trees per acre. If these trees are evenly spaced, more than 50% of the area would be retained and not cultured. If these trees are grouped, then, the untreated area would be greater. Typically, this treatment would remove white fir and lodgepole pine understory trees from around individual ponderosa pines (occasionally Douglas-fir trees). Under some circumstances, a non-favored species within the radius to be cultured could be retained if it does not substantially increase the risk of favored tree loss.

2d. Question: Is there a size limit to the trees removed, and would it differ by species?

Answer: Generally, no. The objective is to promote the largest favored trees (Table 7-4) for nesting and roosting while retaining the desired canopy cover.

2e. Question: Will culturing occur around every PP/DF in a stand?

Answer: No (answered previously). We realize that succession is an ongoing process, and that in the absence of disturbance, pines will be replaced by firs. However, we want to maintain a modicum of the large, structural legacy in these areas to promote a viable, functioning landscape.

3a. Question: Will thinning take the stand down to a certain density?

Answer: Yes. Each thinning treatment would be designed to meet specific objectives for each MSA at the stand level (i.e., smallest scale of data collection). Table A-9 (found in the Vegetation Appendix) shows the density classification we used to determine risk ratings for individual stands. Although each MSA has specific objectives, our approach will be to move high risk stands to a long-term sustainable condition for those stands where treatments are chosen. Due to site-specific objectives, some stands will end up with a moderate risk rating, while others at a low risk rating immediately after treatment.

3b. Question: How strongly will species be favored?

Answer: Favored species will be based upon MSA objectives listed in Table 7-4. For example, the favored species for the white-headed woodpecker would be ponderosa

pine whereas the bald eagle MSA favors ponderosa pine and Douglas-fir. No species will be eliminated in these thinning treatments, only selected against.

3c. **Question: Would spacing be variable to promote clumpiness and patchiness?**

Answer: Probably, if desired in site-specific goals. The intention is to promote structural diversity where it is lacking, and maintain it where it is presently found.

4a. **Question: In MSA #4, would patches of seedlings, saplings and pole-sized trees be retained as unthinned patches within units, or outside?**

Answer: Patches of seedling, saplings and pole-sized trees would be retained as unthinned patches both inside and outside of the thinning units.

4b. **Question: Would older, denser patches of fire-resistant species be retained to allow stress or suppression mortality to create snags?**

Answer: Yes. Initially, 20% of the stand would be thinned and fire would be reintroduced. Thick-barked, fire-adapted species are desired in this MSA (Table 7-4). Snag recruitment would continue in the unthinned 80% initially. The goal is for fire to play a greater role in this MSA, recruiting snags as a natural process.

4c. **Question: Would some of these smaller patches not be treated for fuels reduction to allow fires to go through and create snags?**

Answer: Yes.

5a. **Question: In MSA #2, is the term "removing understory" actually tree culturing?**

Answer: Yes, on a larger scale. The goal in this MSA is to promote big trees suitable for nesting for the bald eagle, with sufficient understory to provide replacement trees. The objective is to prepare the stands to reintroduce prescribed fire into the system. An exception would apply where the MSA also has the objective to provide spotted owl foraging habitat (i.e. Browns Mountain).

6a. **Question: What is the definition of patch cutting as it relates to MSAs #3, #4, and #10?**

Answer: The intent of patch cutting within the framework of this document differs from the definition used in Terminology of Forest Science Technology Practice and Products (Society of American Foresters, 1983). In MSA #3, patch cuts would range from roughly 1-8 acres, and in #10, 1-5 acres. Patch cuts would be located in dense stands that are not late-successional. If they are located in a late-successional habitat, they would be in stands that need treatment to reduce risk of loss to a large-scale stand replacement event (e.g. high risk lodgepole pine). In MSA #4, approximately 10% of the area will be patch cut. This cutting will be in lodgepole and white fir dominated stands and will be used to control the understory and retain a PP/DF overstory (more analogous to tree culturing and density reduction). The ultimate goal is to control the understory in order to meet the desired conditions for the individual MSA.

7a. **Question: Are there any planned salvage activities as described in the ROD (C 13-15) in disturbed stands >10 acres and <40% canopy cover which need to be exempted from further review?**

Answer: No, not in the short-term.