Sensitive and Rare Plant Species

REFERENCE CONDITION

The historic distribution of sensitive and rare plant populations is assumed to be generally similar to that of today with the exceptions discussed in the following narrative. Areas prone to higher frequency, stand replacing fires may have contributed to a higher abundance of non-forested patches and underburned areas maintained by more frequent fire events, as suggested by Figure 2 of the Characterization chapter.

CURRENT CONDITION

Several types of natural openings and forested lands found in the watershed are habitat for plants currently listed as sensitive by the Region 6 Regional Forester's TES Plant List. See Appendix F for a list of potential habitats for sensitive plants. No plants on the sensitive list are documented as occurring within the watershed.

Succession, in the form of tree encroachment into meadows and tree canopy closure (possibly increased by fire suppression), is occurring where low intensity natural ground fires contributed to more open understory conditions. The result may be the exclusion of the Umpqua swertia (*Frasera umpquaensis*) from its meadow and forest edge habitat and may be a long-term concern (USDA, USDI, 1993). The germination of woodland milkvetch (*Astragalus umbraticus*) and branching Montia (Montia diffusa) is influenced by fire. Both species may have occurred more frequently in reference conditions, following closely after fire events. No occurrence of woodland milkvetch has been discovered in the watershed to date. However, it may be that this plant extended its currently known range into the watershed prior to fire management activities, based on recent documentation of its occurrence in the Warner Creek Fire area in 1993. The central range of this species is in the Umpqua NF, just to the south of the Willamette National Forest. An assumption is made that the North Fork of the Middle Fork of the Willamette River, the Middle Fork of the Willamette River, Salmon Creek, and the Umpqua River watersheds may have contained connected populations. The branching Montia, documented south of the Salmon Creek watershed, could have existed in similar habitat in greater abundance in the watershed.

Additional rare plant species occur in the watershed. Some, like most sensitive plants in this ecosystem, are found within non-forested habitats while others occur in forested habitats. Four species listed on the Willamette National Forest Watch and Concern Lists are located within the watershed. These species are usually located and tracked along with sensitive plant and other botanical inventories conducted in Wilderness Areas, Special Interest Areas, and other non-timber production land allocations. See Appendix F for a listing of rare and unique plants in the watershed.

Survey and Manage Species: Fungi, Bryophytes, Lichens, and Vascular Plants

REFERENCE CONDITION

In the western half of the watershed, prior to extensive logging and fire suppression, large old-growth tracts of forest developed with patchy fire occurrences, as suggested by the representation of the watershed fire history pattern (see Figure 2 of the Characterization Chapter). Since fire suppression was introduced, longer intervals have occurred between large scale fire events. Species diversity and richness in old-growth and riparian dependent communities, where these survey and manage species tend to occur, would have had more time to develop before increases in early seral stages were brought about by extensive timber harvesting.

In the eastern half of the watershed, residual patches of old-growth occurred in a more isolated pattern, due to a higher frequency of stand replacing fires. Old-growth associated species there were relegated to riparian areas and refugia such as basins, valley bottoms, and ridge line breaks where a higher level of down woody material and snag development remained.

CURRENT CONDITION

Late-successional species habitat in the watershed has declined due to extensive harvest of old-growth stands and associated road building. The remaining old-growth in the watershed is concentrated at higher elevations or in relatively small areas associated with previously designated spotted owl reserves. In many areas, the old-growth stands are highly fragmented. Many Survey and Manage Species have limited dispersal capabilities, thus gene flow may be restricted between populations in fragmented habitat areas. Management for single species plantations after harvest in riparian forests along with adjacent upland stands has contributed to a simplification of species richness in plant communities.

Several sites have been documented in the watershed for candy stick (*Allotropa virgata*). Candy stick is a non-green species dependent upon a mutual association with several conifer species and fungal species such as Matsutake.

Survey and Manage Species have not yet been systematically inventoried in this watershed. The Regional Ecosystem Office species location information and survey protocols are expected to be released in 1996. Existing biological and ecological information is minimal for most of these species. However, it is reasonable to assume that if systematic surveys were conducted for old-growth dependent species, a much larger number would be found in the watershed. See Appendix F for a list of potentially occurring Survey and Manage Species.

Noxious Weeds and Other Non-Native Invasive Plant Species

REFERENCE CONDITION

Non-native plant species legally designated as "noxious", are "any weed designated by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife, or any public or private property" (ODA Noxious Weed Policy and Classification System, 1995). Several detrimental effects are included in the criteria for rating and classifying weeds as noxious. One such effect is "a plant species that is or has the potential of endangering native flora and fauna by its encroachment in forest and conservation areas" (ODA, 1995). Most northwest weeds are originally native to Europe or Asia and were introduced intentionally or by accident. Noxious weeds and other invasive non-natives have the potential to alter native plant communities, as they are able to displace and out compete native species. They are opportunists with broad ecological tolerances, can grow under a wide range of climatic and soil conditions, and have excellent reproductive capabilities (Taylor, 1990).

No noxious weeds were present prior to European colonization. Non-native plant species have been introduced into Oregon since settlers began bringing them in accidentally or for various uses. The advent of large-scale logging and road building in the 1930's produced a large increase in the spread of non-native plants. Livestock grazing also contributed to the spread of some noxious weeds.

CURRENT CONDITION

Weed competition with native plant species is occurring in conifer plantations; wildlife use areas (including small wetlands and river flood plains); and road, railroad, and power line right-of-ways. It has also been noted that some weeds are extending into natural dry and moist meadow openings and rock garden communities. In many areas, non-desirable weed species are excluding native plants to the point of forming dense weed patches and thickets.

Non-native plant species play a significant role in influencing changes to native plant communities. Many noxious weed species and other non-native invasive plants are found in the watershed. Many of these species are firmly established, and have been for some time now. Some are currently increasing in extent largely due to logging and road building practices, which act as dispersal mechanisms. See Appendix F for a list of noxious weeds present in the watershed.

Invasion of non-native plants in the watershed is a serious threat to native plant abundance. The Willamette National Forest Integrated Weed and Management Environmental Assessment, April 1993, lists 7 site types where a potential exists to harbor noxious weeds already established on the forest and potential invader weeds. All of these site types are found within the watershed. Site types range from bare, rocky, gravely ground, such as road beds and quarries, to floristically diverse areas such as meadows, sensitive plant habitat, and wetlands (refer to the Environmental Analysis for full descriptions).

Major forest roads and other corridors, such as right-of-way clearances, serve as noxious weed dispersal pathways and establishment sites. Salmon Creek Road (FS Road 24) is a well used travel corridor by which vehicular, mechanical, and wind-born weed seed transport and spread has occurred. Timber sale units, associated roads and landings, trails, and other disturbed openings have seral conditions which typically support weed populations. Other spread mechanisms in the watershed include bird and mammal seed dispersal, livestock and their feeds, and weed seed contamination of forage and erosion control seeding mixes.

Roadside inventories on the Oakridge Ranger District of noxious weeds were conducted by the ODA in 1988 and again in 1993. The results of these inventories have shown that some noxious weed species

have spread at an alarming rate. For instance, scotch broom (*Cytisus scoparius*) is estimated to have infested an additional 35 percent of the area since the 1988 survey and the number of roads infested has increased to 51 percent (Glen Miller, personal communication).

Special Forest Products
REFERENCE CONDITION
Special Forest Products have long been gathered for traditional native American and folk use.

CURRENT CONDITION
A forest-wide programmatic special forest product environmental assessment was completed in 1993 that provides the framework for decisions on the collection of special forest products. Willamette Forest Plan Amendment No. 23 allows commercial collection in all lands open to commercial timber harvest.

Many miscellaneous non-convertible special forest products (SFPs) found in the watershed are frequently requested by local and non-local collectors for personal and commercial use. There is a growing interest in the SFP industry as a source of alternative income. These plants will continue to be an important part of future forest resource use.

No formal SFP inventories have been done on the district for species with economic potential. Therefore, information that provides specific locations, quantities, qualities, and accessibility for these species is limited. Several types of plant communities in the watershed contain products of marketable quality, such as ornamental cuttings, transplants, boughs, and floral greenery products. The following is a preliminary list of those products identified in the watershed that may occur in quantities sufficient for commercial collection rates, while remaining abundant enough to maintain plant populations as prescribed in the Willamette NF SFP Program standards and guidelines: mushrooms, floral greens (salal, sword fern, dwarf Oregon grape, beargrass, scotch broom), landscape transplants (vine maple, rhododendron, manzanita, etc.), huckleberries, nuts, ornamental cuttings/crafts (willow, vine maple, ceanothus, madrone, chinquapin, Pacific yew), boughs, pitchwood, cones, conks, botanicals (such as prince's pine, wild ginger, wildflowers, etc.) Lichens and moss are not currently being offered for commercial collection on the Oakridge District. "Vine maple moss", a collective term used for several species that are collected, has been harvested on the district. Several thousands of pounds of moss were sold in the late 1980's. Records are no longer available to indicate precisely how much of that amount came from the Salmon Creek watershed. The demand for boughs and their collection riparian areas has heightened concern for riparian dependent lichens, mosses, liverworts and hornworts, many of which may be rare and for which biological information is lacking.

FUEL ACCUMULATION
Determining dead fuel accumulation is necessary to define potential fire behavior and suppression difficulty in the event of a fire. Once dead fuel loading is determined, it can be characterized into standard fuel models for predictive purposes.

REFERENCE CONDITION
This watershed is typical of a high-severity fire regime as described by Agee (1981). Fires in this regime are very infrequent on a given piece of land within the watershed (more than 100 years between fires). They are usually high-intensity, stand replacement fires. Fires are associated with drought years, east wind synoptic weather types with lower humidity, and an ignition source such as lightning (Huff and Agee, 1980, Pickford et al, 1980). Accurate fire return intervals have never been calculated in these forests because the interval between fires are long and may not be cyclic (Agee and Flewelling, 1983). Fahnestock and Agee (1983) estimated that dryer sites may burn again after 100 years. Following a fire event, the forest then would develop through the seral stages.

The following conditions were found in this watershed:
Subwatershed 18 1
A very large fire event occurred around 1790 in the western end of the area nearest to Oakridge. It appears that other fires occurred in this subwatershed approximately every 50 years. In the northern part of this subwatershed outside of the area just described above, no large fires have occurred since around 1910, but the fire return interval prior to 1910 was approximately 50 years. Approximately 51 percent of this subwatershed has burned in the last 200 years.

Subwatershed 18 2
A very large fire event occurred around 1790 with a large amount of reburning in 1840 (50 years). Other large fires around 1900 and 1930 occurred within the 1840 fire area (100 years). Nearly all of these fires occurred above 4,000 feet in elevation. Approximately 47 percent of this subwatershed burned in the last 200 years.

Subwatershed 18 3
A very large fire event occurred around 1790 with a large amount of reburning in 1840 (50 years), 1900 (60 years), and 1930 (30 years). There has been very little fire disturbance the last 50 years. Nearly all of these fire acres were above 4,000 feet in elevation, with 75 percent to 85 percent of them above 5,000 feet in elevation. Approximately 62 percent of this subwatershed has burned in the last 200 years.

Wilderness
In subwatershed 18 2, the majority of fire activity occurred between 100 and 150 years ago.
In subwatershed 18 3, the majority of fire activity occurred between 50 and 100 years ago.
For both areas, the majority of fire events appear to be reburns. Approximately 70 percent of all wilderness acres have burned within the last 200 years.

For the total watershed, fire history was broken down into 50 year intervals as shown in Table 30 below.

Table 30: Fire History for the Salmon Creek Watershed

Time Period	Acres Burned	% of Total Watershed
1790 to 1840	21,396	26
1850 to 1890	6,042	7
1900 to 1940	12,608	15
1950 to Present	4,051	5

Approximately 54 percent or 44,169 acres of this watershed has burned in the last 200 years. In most cases the lack of large woody material on the ground and fire boundaries are not typical of a single fire event. This leads one to postulate that many of the fires of the 1790 decade were reburns. This pattern holds true for most of the remaining events with most of the fire activity occurring in the same general topographic areas of previous fires and within 30 to 100 years. Given a fire start, this would be expected due to large accumulations of large dead material on the ground combined with young stands of brush and trees. Stand age determination is difficult, but when a variance of 5 to 10 years is applied, the majority of these events correspond well to drought years and or abnormally dry winters (Hemstrom and Franklin, 1982). Using data from 72 natural stand plots, an attempt was made to identify trends in fuel loading. Fuel loading was then classified into one of the Northern Forest Fire Laboratory (NFFL) fuel models (FM) used to predict fire behavior. Table 31 shows the fuel models used in this analysis.

Table 31: Fuel Models

Fuel Model >>	FM4	FM5	FM8	FM10	FM12
Total fuel load, <3-inch dead and live, tons/acre	13	3.5	5.0	12.0	34.6
Dead fuel load, 1/4-inch tons/acre	5.0	1.0	1.5	3.0	4.0
Live fuel load, foliage, tons/acre	5.0	2.0	0	2.0	0
Fuel bed depth, feet	6.0	2.0	0.2	1.0	2.3

No direct correlation could be found between fuel loading versus aspect and elevation. Fuel loading conditions expected after an event are shown in Table 32.

Table 32: Post Fire Event Fuel Loading

Years after event >	0-30 years	31-80 years	81-200 years	200 plus years
1st event fire	FM5	FM12	FM10	FM10
2nd event fire	FM5	FM4	FM10	FM8

With this sequence of events, a determination of reference conditions would require looking at each 50 year period of time to determine fuel loading conditions for that period only. FM4 was not used when determining reference conditions even though it existed and exists now.

Table 33: Reference Condition of Fuel Loading for Burned Areas of the Salmon Creek Watershed

Period	Subwatershed 18 1 (35271 acres) Acres Burned	Subwatershed 18 2 (21747 acres) Acres Burned	Subwatershed 18 3 (25417 acres) Acres Burned	Fuel Model with one Fire Event	Fuel Model with Reburn Fire Event
1790-1840	6269--18%	7165--33%	7962--31%	10	8
1850-1890	4859--14%	567--3%	617--2%	10	8
1900-1940	4263--12%	1374--6%	7043--28%	12	10
1950-present	2768--8%	1179--5%	105--1%	4	5

Most of these fire events were determined to be reburns. The total fuel loading by fuel model is shown below.

- FM8 represents 38 percent of those acres that burned 100 to 200 years ago.
- FM10 represents 18 percent of those acres that burned 50 to 100 years ago.
- FM5 represents 6 percent of those acres that burned 0 to 50 years ago.

Stands greater than 200 years old total 38,263 acres or 46 percent of watershed. Table 34 shows the breakdown of fuel loading by subwatershed.

Table 34: Fuel Loading by Subwatershed

Fuel Model	Subwatershed 18 1	Subwatershed 18 2	Subwatershed 18 3
FM8--47%	4082 acres	5387 acres	4554 acres
FM10--53%	9069 acres	6075 acres	5136 acres

Table 35 shows the reference fuel models and percentages of each for this watershed. Wilderness acres are included in Table 35 information. Table 36 shows fuel models specific to the wilderness.

Table 35: Reference Fuel Models

Fuel Model	Percent of Watershed
FM8	55
FM10	40
FM5	5

Table 36: Wilderness Fuel Models

Fuel Model	Percent of Wilderness
FM8	70
FM10	40
FM5	5

CURRENT CONDITION

Given the above reference conditions prior to timber harvest and with fire suppression, it is necessary to determine current fuel loading. The same percentages were used for acres not harvested. Table 37 shows harvest acres categorized by fuel model using the same NFFL fuel models used to determine reference conditions. Treated (T) acres are units that were either broadcast burned, underburned, or machine piled and burned. No treatment (NT) includes all acres that do not meet treated unit requirements.

Reference fuel conditions for last 200 years with fire suppression and no timber harvest compared with current conditions with timber harvest and with fire suppression are shown in Table 38.

Table 37: Harvest Acres by Fuel Model

Time Period	Treated?	Fuel Model and %
1960 to present	Not Treated (NT)	FM4 = 17%
1960 to present	Treated (T)	FM5 = 15%
Pre 1960	Not Treated (NT)	FM12 = 1%
Pre 1960	Treated (T)	FM10 = 2%

Table 38: Reference and Current Fuel Conditions

Fuel Model	Reference Conditions	Current Conditions
4	none	17%
5	5%	20%
8	55%	29%
10	40%	33%
12	none	1%

As shown in Table 30, 150 to 200 years ago 26 percent of this watershed was FM5. 50 to 100 years ago 15 percent was mostly FM5. The point here is that caution is needed when comparing current and reference conditions for fuel accumulations. We are currently near conditions that existed 50 to 100 years ago for FM4 and FM5 and below conditions that existed 150 to 200 years ago for the same fuel models. Of most concern should be FM4 and FM12. Most of the historic burns appear to be reburn events that occurred 30 to 100 years after the first event. If history were to repeat itself, these stands would be most at risk. A comparison of reference and current condition shows that early seral stage stands are most at risk due to

their high flammability. Only seral stages SI and SE will be considered since they represent stands less that 100 years of age.

The following three tables (Table 39, 40, & 41) present the reference condition data in several different ways. Table 39 shows the reference condition (percent of acres burned by subwatershed over the last 200 years) for acres in seral stages SI and SE without timber harvest but with fire suppression.

Table 39:

Subwatershed 18 1	Subwatershed 18 2	Subwatershed 18 3
31%	13%	26%

Table 40 shows the reference condition (percent of acres burned by subwatershed excluding fire activity since 1920) for acres in seral stages SI and SE without timber harvest or fire suppression.

Table 40:

Subwatershed 18 1	Subwatershed 18 2	Subwatershed 18 3
20%	31%	34%

Table 41 shows the reference conditions (percent of acres burned by subwatershed over the last 200 years) in 100 year blocks of time. The same data used to produce this table was used for Table 30.

Table 41:

Time Period	Subwatershed 18 1	Subwatershed 18 2	Subwatershed 18 3
present to 100 years ago	20%	11%	29%
50 to 150 years ago	26%	9%	30%
100 to 200 years ago	32%	36%	35%

Table 42 shows the current conditions (percent of acres burned by subwatershed) with fuels treatment on harvest acres and suppression of wildfires included in the data.

Table 42:

Subwatershed 18 1	Subwatershed 18 2	Subwatershed 18 3
42%	20%	28%

Numerous conclusions can be made from this information. In subwatershed 18 3 for example, 100 to 200 years ago 35 percent of the acres burned, 50 to 150 years ago 30 percent burned, and within the last 100 years 29 percent has burned (from Table 41). Subwatershed 18 3 current conditions with timber harvest and fire suppression is estimated to be 28 percent (Table 42). Given the difference of 20 years between 80 and 100 years in the comparison, the current level of seral stages SI and SE are about the same as the historic conditions (Table 40). When compared to reference conditions prior to timber harvest and fire suppression the numbers are further apart. However they do not account for any large fires that have occurred in the last 50 years even though we have had fire suppression. Basically current fuel accumulation conditions in the subwatershed are about the same as historic conditions.

For subwatershed 18 2, depending on which 100 year interval you choose to use, current conditions are either much lower or much higher than reference conditions.

For subwatershed 18 1, current conditions are as much as 10 to 22 percent higher than reference conditions, again depending on which period of time you choose to use.

Fire Occurrence Since 1940

Table 43: Fire Occurrence Since 1940 by Elevation

Elevation Band	Human Caused Events	Lightning Caused Events
1000 to 2999 ft.	5% of acres or 26% of events	12% of acres or 5 % of events
3000 to 3999 ft.	11% of acres or 6% of events	11% of acres or 9% of events
4000 to 4999 ft.	20% of acres or 4% of events	3% of acres or 9% of events
5000 ft. plus	29% of acres or 10% of events	9% of acres or 31% of events

A total of 13,056 acres burned during this period. There were 398 events.

An event is any fire activity in that elevation range. The 9,000 acre Warner Creek fire is counted as an event in each of the elevation ranges that it burned.

Table 44: Percent of the Watershed Burned by Elevation Since 1940

Elevation Band	% of Acres Burned
1000 to 2999 ft.	3
3000 to 3999 ft.	3
4000 to 4999 ft.	4
5000 ft. plus	6

Due to small patch harvesting practices, the likelihood of dry weather conditions occurring each year, the heat generated by a fire in the uncut natural stands, plus the untreated and treated harvested units, a very large stand replacement event could occur in this watershed if an ignition occurred in the right place and at the right time. Units where fuel accumulations were treated may act as buffers or areas where fire intensity would be greatly reduced, but would be at risk of also being destroyed. Harvesting of timber may have been timely to duplicate large fire return interval by removing timber rather than destroying it by fire, but the method of cutting and fuel treatment in no way duplicates history. The patches of remaining late-successional and old-growth stands become significant given this sequence of events due to the fact that as they become older, fuel loadings will and have increased, increasing their vulnerability to wildfire. Areas most vulnerable to fires are any stand less than 80 years of age (seral stages SI an SE), especially those created by harvest without a subsequent fuels reduction treatment. This is about 21 percent of the watershed. Stands with a FM10 are also at risk.

James Agee states in "Fire Effects on Pacific Northwest Forest: Flora, Fuels, and Fauna", 1981, "The impact of effective fire control in western Hemlock/Douglas-fir type has not been nearly as significant as in forest types where fire was frequent. Suppression has been effective for only a fraction of a normal fire return interval in this type."

LOOKOUTS

CURRENT CONDITION

There is one lookout facility on the boundary of this watershed. Waldo Lookout is staffed during high fire danger or lightning activity. This lookout is within the Waldo Wilderness. Two primary concerns for this lookouts are to maintain its 360° view and the need for creation of fuel breaks. Since this facility is ground based, vegetation growth is threatening this view as well as the risk of burning given a fire event. The area surrounding the lookout was once kept clear of brush and vegetation for a distance of 50 to 100 feet. Vegetation now grows within 5 feet of the lookout. Response time by district fire crew to Waldo Lookout is one hour by foot and 30 minutes driving time. Smoke jumpers, if available, take about 30 minutes

Site Productivity

REFERENCE CONDITION

Prior to management activities, site productivity was lowered only by repeated wildfire (reburns) where most of the sites organic material was removed.

Management practices relative to the retention of large woody material (LWM) have varied with time. Most LWM was removed from harvested units from the mid 1970's to mid 1980's. The amount of large woody debris and snag habitat in the historic landscape probably varied within the watershed. In some areas, reburning of previously burned areas tended to remove many of the snags and logs that remained after the original fire. Repeated burning tends to decrease the amount of snags and down wood on the forest floor, particularly on steep south and west facing slopes. Large wood typically would have been retained at higher levels within riparian and aquatic habitats. In other fire areas reburning did not occur and natural levels of snags and logs was high.

CURRENT CONDITION

As mentioned previously, about 28 percent of this watershed has been more or less severely disturbed as the result of regeneration harvesting. Approximately 15 percent of this harvest was accomplished by ground-based skidding machinery that has the potential to compact soils. Past harvesting has most certainly had some affect upon the long-term site productivity.

The amount of large woody debris and snag habitat is variable within the watershed. Some areas, particularly within several hundred feet of roads, and most areas with gentle topography, have been heavily salvaged. In some cases most of the snags have been removed and woody debris has been reduced, both on the forest floor and within riparian and aquatic habitats. In other areas salvage has not occurred and natural levels of snags and logs are present. In managed stands, large woody debris and snag levels vary with the type of harvest and the time frame within which harvest occurred. Some of the older (pre-1950) harvested stands have trees that were retained as seed sources. These residual trees contribute to diversity within these otherwise young stands and ultimately provide a source for snag and large wood recruitment. Many of the areas logged prior to 1970 also have very large logs remaining from the original harvest, due to merchantability standards of the time. Later, utilization became an issue and slash treatment became standard practice between 1970 and 1989. Harvested areas were often left with little or no snags, large woody debris, or residual trees big enough to offer recruitment for these habitat structures. As YUM (yard unmerchantable material) and PUM (pile unmerchantable material) requirements were used less and Forest Plan standards for snag and large woody debris retention were adopted (1990), the amount of wildlife tree and down log habitat within harvested areas began to increase. Table 47 of this chapter displays the acreages within the watershed that were treated with intensive harvest treatments prior to 1970, from 1970 to 1989, and from 1990 to 1995.

The spatial and temporal distribution of non-vegetated areas on erosive soils in the watershed has been altered, compared to the historic fire pattern. Stand replacement fires tended to be larger, localized blocks rather than the dispersed patchwork of clearcuts in varying stages of vegetative recovery currently exhibited.

This change in patterns may or may not be beneficial to the system. Larger stand replacement fires would tend to have a high impact to a few drainages until vegetation is reestablished. The dispersed patchwork of clearcut units would tend to have a lower impact, but would be distributed over a larger area.

In contrast to past management practices, the recent change toward the retention of more trees, snags and large woody material comes closest to mimicking historical fire impacts. The residual root strength from the trees and the energy dissipating effect of large woody material on overland flow tend to retain more soil on the hillside.

WILDLIFE

Terrestrial Wildlife Habitat

REFERENCE CONDITION

A historical representation of what was thought to be the pattern of seral stages on the watershed landscape is provided in Figure 28 this chapter (page 48). This can be compared to the current pattern of seral stages presented in Figure 29 of this chapter (page 49).

As described in the Vegetation (Fire History) section of the Characterization chapter, portions of the watershed were exposed to a series of extensive and overlapping stand replacement fires. A majority of the watershed was burned within the past 200 years. In much of the central portions of the watershed however, stand replacement fires within the past 200 years have been in relatively small patches, relatively much less frequent, or absent altogether.

It is surmised that stands in the upper portions of subwatershed 18 1 and the lower portions of 18 2 and 18 3 may have been exposed to stand replacing fires relatively less frequently than stands elsewhere in the watershed, and thus may have been more likely to develop into large tracts of old-growth forest. Stands in the lowest portions of subwatershed 18 1 and the upper reaches of 18 2 and 18 3, being exposed to more frequent stand replacing fires, may have included relatively more extensive tracts of mid seral range forests between major fire events, with relatively small patches of old-growth developing mainly in sheltered areas such as basins, valley bottoms and patches associated with topographic breaks.

Edge Habitat

Species guilds include those groups of species with various home range sizes that prefer specific types and arrangements of habitat. Appendix A (pages 1 through 5) provides lists of species guilds and their habitat associations. Contrast guilds include those species that prefer distinct edges between open areas or early seral stands, and late seral or old-growth forests.

Figure 28:
Historic Seral Stages
by Plant Association

Salmon Creek Watershed Analysis

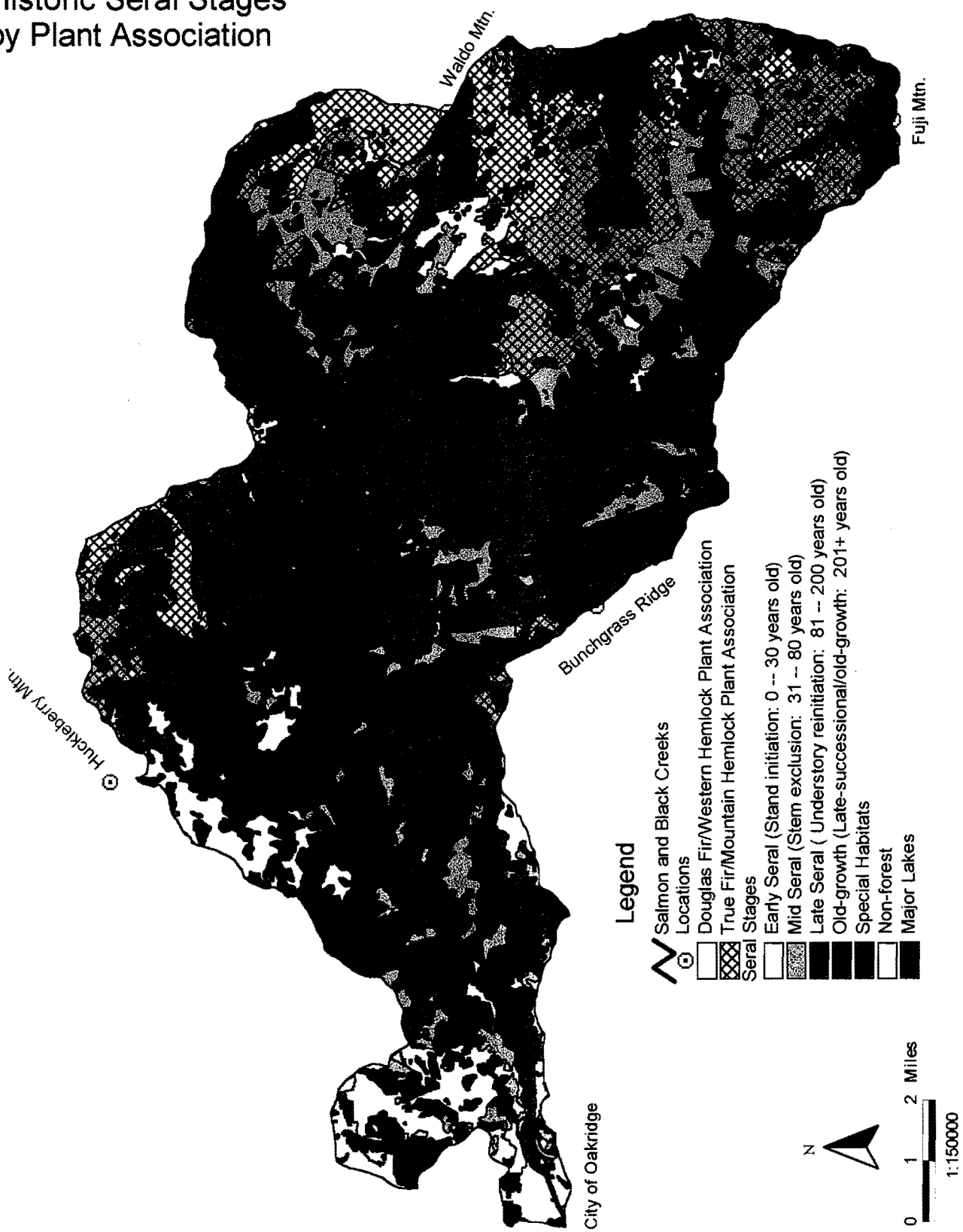
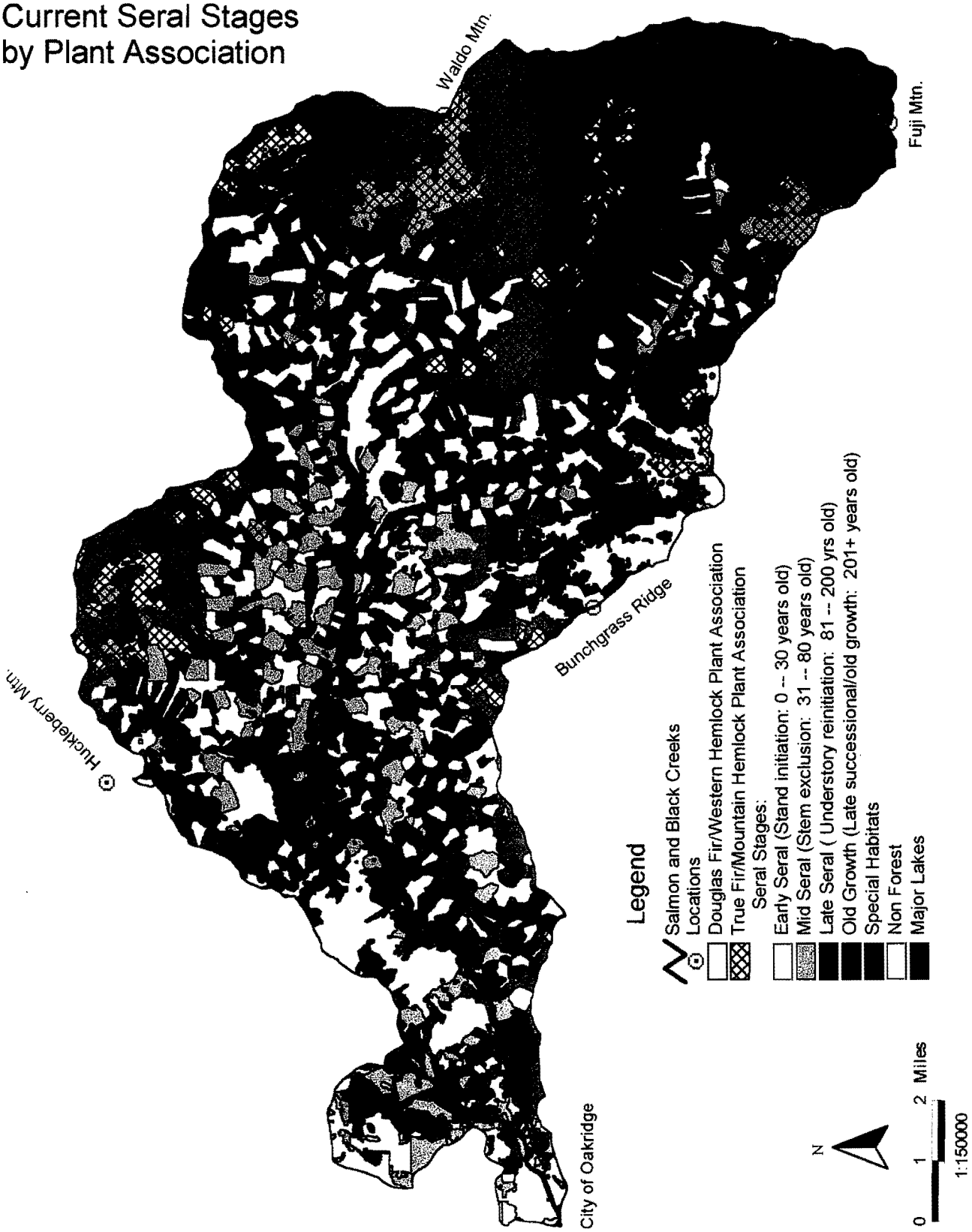


Figure 29: Salmon Creek Watershed Analysis

Current Seral Stages
by Plant Association



Natural edges are formed where forested plant associations meet non-forested areas such as meadows, talus slopes or rock gardens. Transitional edges also occur where stand replacing fires (early seral) adjoin underburned or unburned patches (late seral) within fire areas. Some fires are relatively small, have irregular edges, or have varying levels of crown mortality. Within those areas contrast habitat is abundant, and if appropriate habitat for reproduction and feeding are both present, one would expect populations of contrast species to respond favorably to patchy or variable wildfires. Other areas within the watershed that did not host frequent patchy fires would have had contrast habitat mainly in association with non-forested inclusions in forested stands or along the edges of large natural openings. Appendix A (Figures 1a, 4a, and 7a) presents maps of approximate historic (1920) contrast habitat. The map of large home range contrast (TLC) guild habitat (Figure 30a of this chapter) displays the largest tracts of fire mosaics with early seral components in the early 1900's as well as the larger natural meadow complexes.

Aggregations of fire patches also provide short term benefits to species that use aggregated patches of early seral habitat (early seral mosaic guilds) and species that use combinations of early and mid seral habitat (generalist for early and mid seral guilds). Appendix A (Figures 2a, 5a, 10a, and 11a) contains maps of early seral patch and mosaic guild habitat thought to be present in a historic (1920) landscape. The map of large home range mosaic early seral (TLME) guild habitat is displayed in Figure 31a of this chapter.

As coniferous regeneration becomes established in areas that have not been recently burned over, landscapes lose the contrast habitat. Fire regenerated stands transition to closed canopy sapling and pole stands. At this point in development the habitat becomes best suited for generalist guild species (those species that use a combination of various habitat types). As these fire stands mature, they provide habitat for mid and late seral guilds.

In the historic landscape, elk habitat in the central portion of the watershed was likely limited by forage areas. Effective forage areas included natural openings and the recently burned patches. In the westernmost and northeast portions of subwatershed 18 1 and the eastern higher elevation sections of subwatersheds 18 2 and 18 3, elk habitat was likely not limited by forage due to fire frequency, abundance of natural openings, and/or relatively slow coniferous cover development. The interspersion of effective cover in large burned over areas may have resulted in temporary habitat limitations for elk within those portions of the watershed. Road density was not an issue in the historic landscape.

Interior Forest Habitat

Natural patterns of disturbance often involved large sections of the landscape. As these stands regenerated and developed into mature stands, suitable habitat for large and medium home range species in the late seral mosaic, late seral patch , and generalist for mid and late seral guilds was provided (see Appendix A , Figures 3a and 6a). Figure 32a of this chapter displays a potential historic (1920) map for terrestrial large home range mosaic late seral (TLML) guild habitat. This map depicts areas within the watershed that provided the highest amounts of the largest patches of late seral and old-growth habitat.

Habitat Structure

The amount of large woody debris and snag habitat in the historic landscape varied widely within the watershed. In some areas reburning of previously burned areas removed many of the snags and logs that remained after the original fire. Repeated burning lowered the amount of snags and down wood on the forest floor, particularly in areas on steep south and west facing slopes. In other fire areas, reburning did not occur and "natural" levels of snags and logs were high. Large wood typically was retained at higher levels within riparian and aquatic habitats.

Connectivity and Dispersal

Connectivity of habitat on the landscape varied with historic fire intensity and extent. However, higher order riparian areas typically served as key connectors between unburned or underburned patches within more fire-prone areas. Later seral habitats were contiguous through all but the highest and lowest reaches of the watershed from ridge lines to riparian zones in most areas. Figure 28 of this chapter displays a potential map of historic (1920) late seral and old-growth forest blocks.

Non-Native Species
No non-native species are known to have been present prior to European colonization. Native species had co-evolved to maintain their individual viability, though fluctuation in habitat conditions caused fluctuations in species populations, favoring some and disfavoring others.

CURRENT CONDITION
Edge Habitat
Portions of the watershed have become highly fragmented as a result of scattered setting timber harvest using regeneration harvest (commonly clearcut) methods within the past 5 decades. Within those areas contrast habitat is abundant. As long as habitat for reproduction and feeding are both present, populations of contrast species have responded favorably to recent management activities. Other areas within the watershed have not been treated with scattered setting clearcuts, or have had minimum fragmentation timber management strategies applied. In these areas, contrast habitat may not be as prevalent as in the more fragmented sections of the watershed, unless numerous natural openings are interspersed among forested areas. Appendix A (Figures 1b, 4b, and 7b) presents maps of current contrast habitat. The map of large home range contrast (TLC) guild habitat (Figure 30b of this chapter) displays the largest tracts of highly fragmented habitat along with the larger forest-meadow complexes.

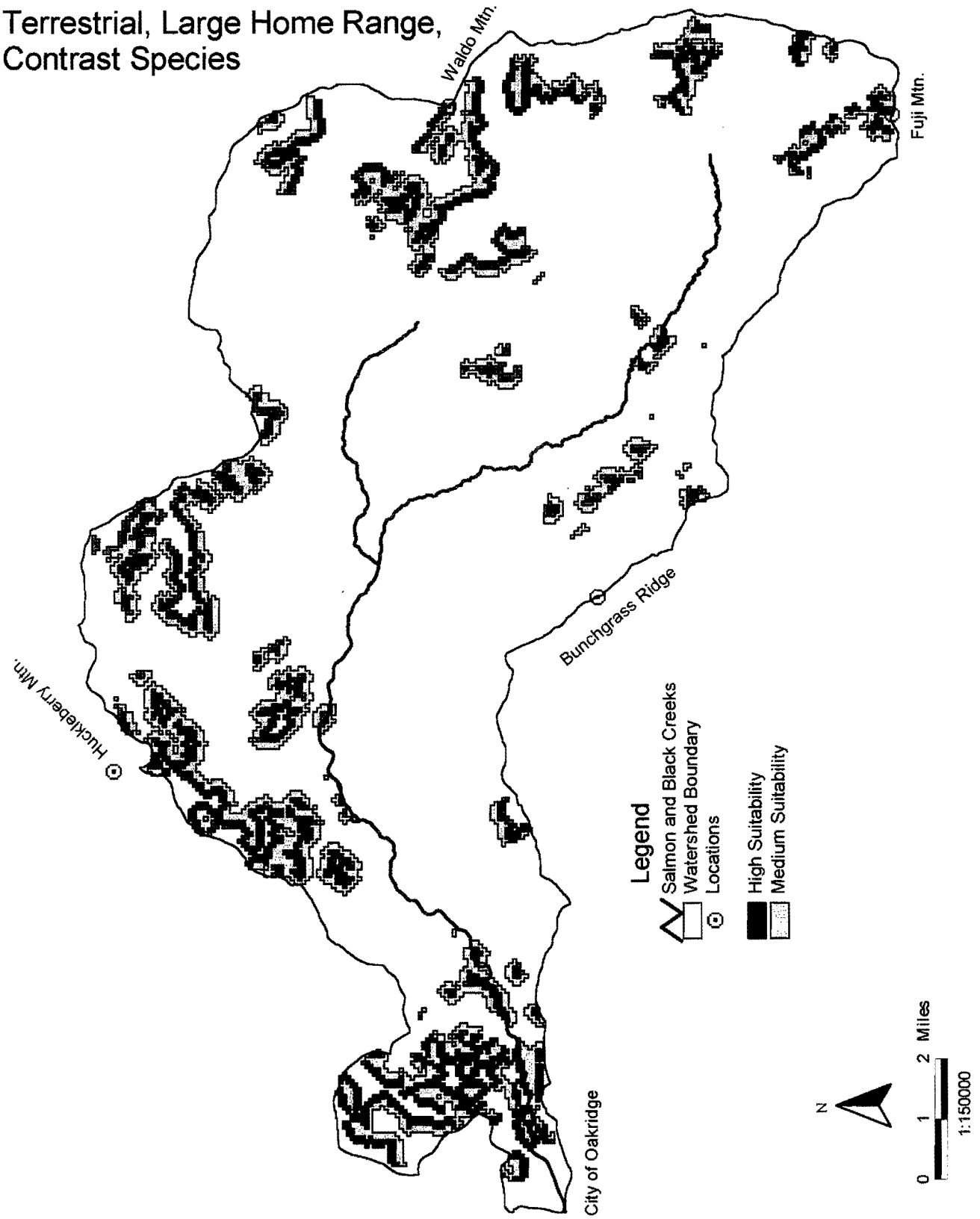
Forest fragmentation may also provide short term benefits to species that aggregate patches of early seral habitat (early seral mosaic guilds) and species that use combinations of early and mid seral habitat (generalist for early and mid seral guilds). Appendix A (Figures 2b, 5b, 10b, and 11b) contains maps of current early seral patch and mosaic guild habitat. Compare current large home range mosaic early seral (TLME) habitat (Figure 31b of this chapter) with reference TLME habitat (Figure 31a of this chapter).

Areas within the watershed that have not recently experienced regeneration harvest or wildfire have lost the contrast habitat as harvested areas transition into closed-canopy sapling and pole stands. At this point in development the habitat is best suited for generalist guild species (those species that use a combination of various habitat types). Although minimum fragmentation harvest strategies do not create as much edge habitat for contrast species, they do provide suitable habitat for many generalist guilds, and may promote medium and large home range mosaic and generalist habitats in the long term.

Elk are considered to be large home range contrast species. They forage primarily in open areas and seek shelter in late seral or old-growth forests. Up to a certain point, elk habitat capability is generally enhanced by scattered setting regeneration harvests (forest fragmentation). When cover becomes limiting and edge habitat decreases through continued cover removal in heavily harvested areas, elk habitat capability declines. The current condition of elk habitat within the watershed varies with harvest intensity and road building history as well as naturally occurring features, such as meadows and other non-forested areas. Habitat effectiveness may also have been altered by fire suppression which may have changed the abundance and arrangement of natural foraging areas.

Current Habitat Effectiveness Indices for the 11 Elk Emphasis Areas in this watershed are summarized in Table 45 of this chapter.

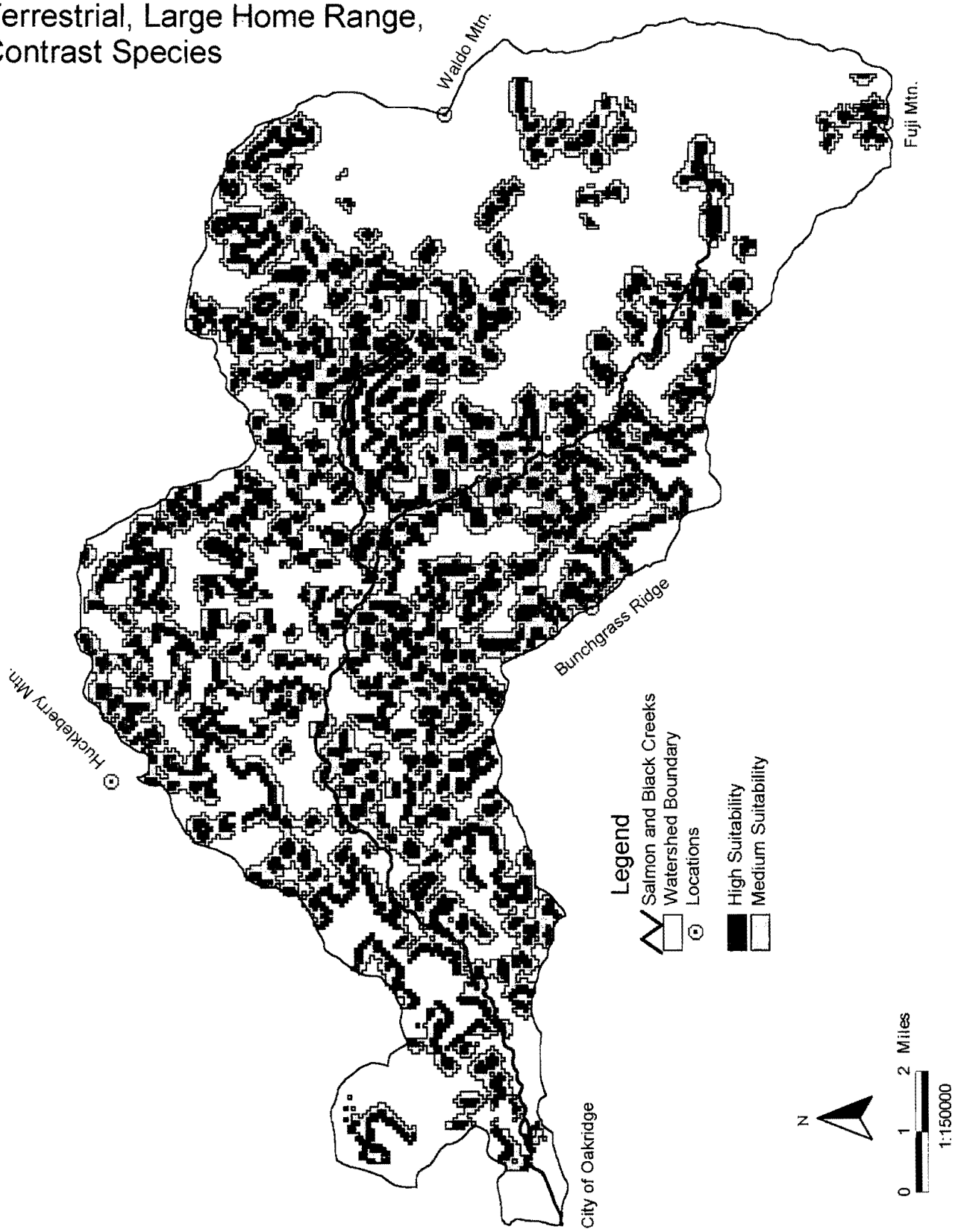
Figure 30a:
Historic
Terrestrial, Large Home Range,
Contrast Species



Reference / Current Conditions

Figure 30b: Salmon Creek Watershed Analysis

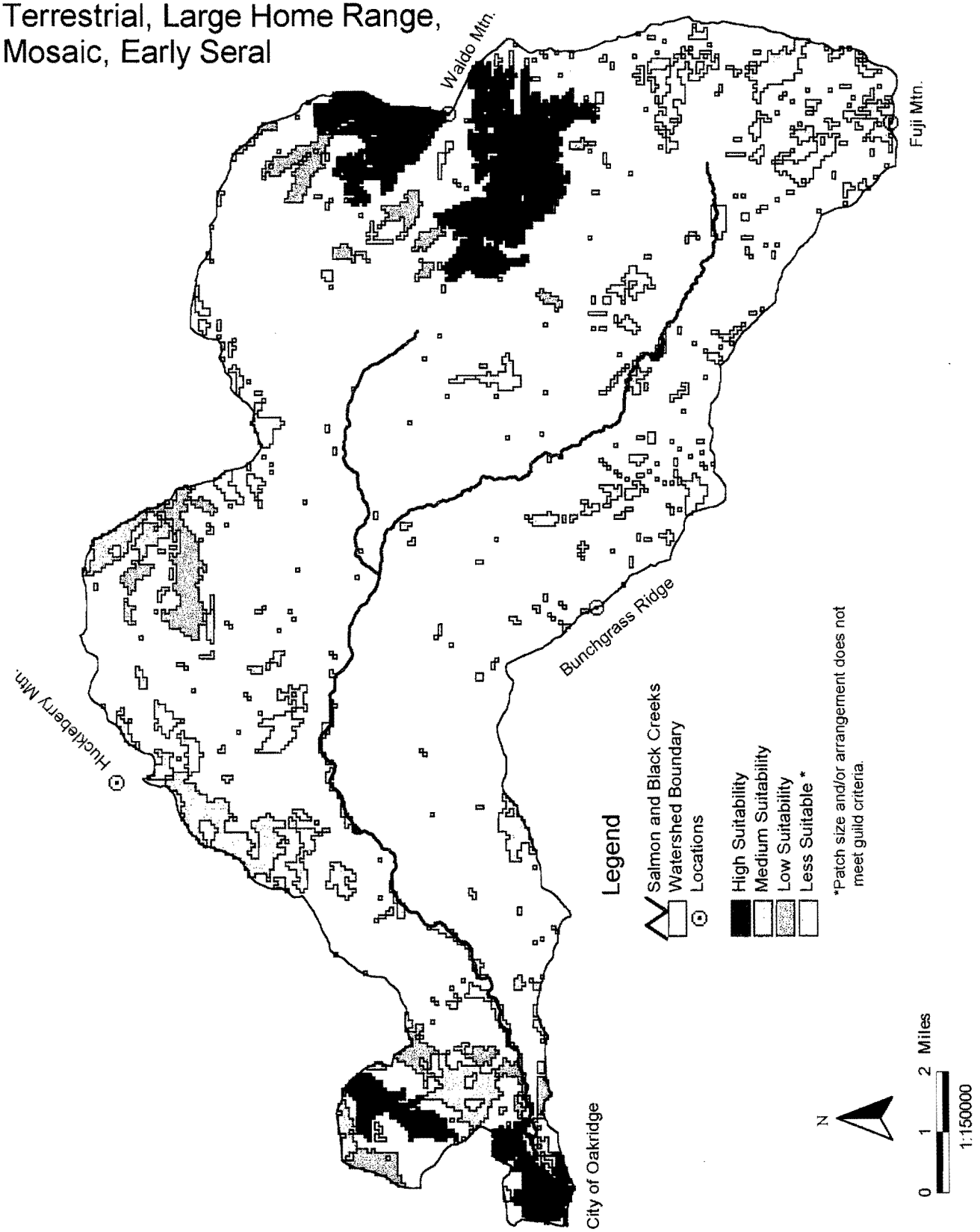
Current
Terrestrial, Large Home Range,
Contrast Species



Reference / Current Conditions

Figure 31a: Salmon Creek Watershed Analysis

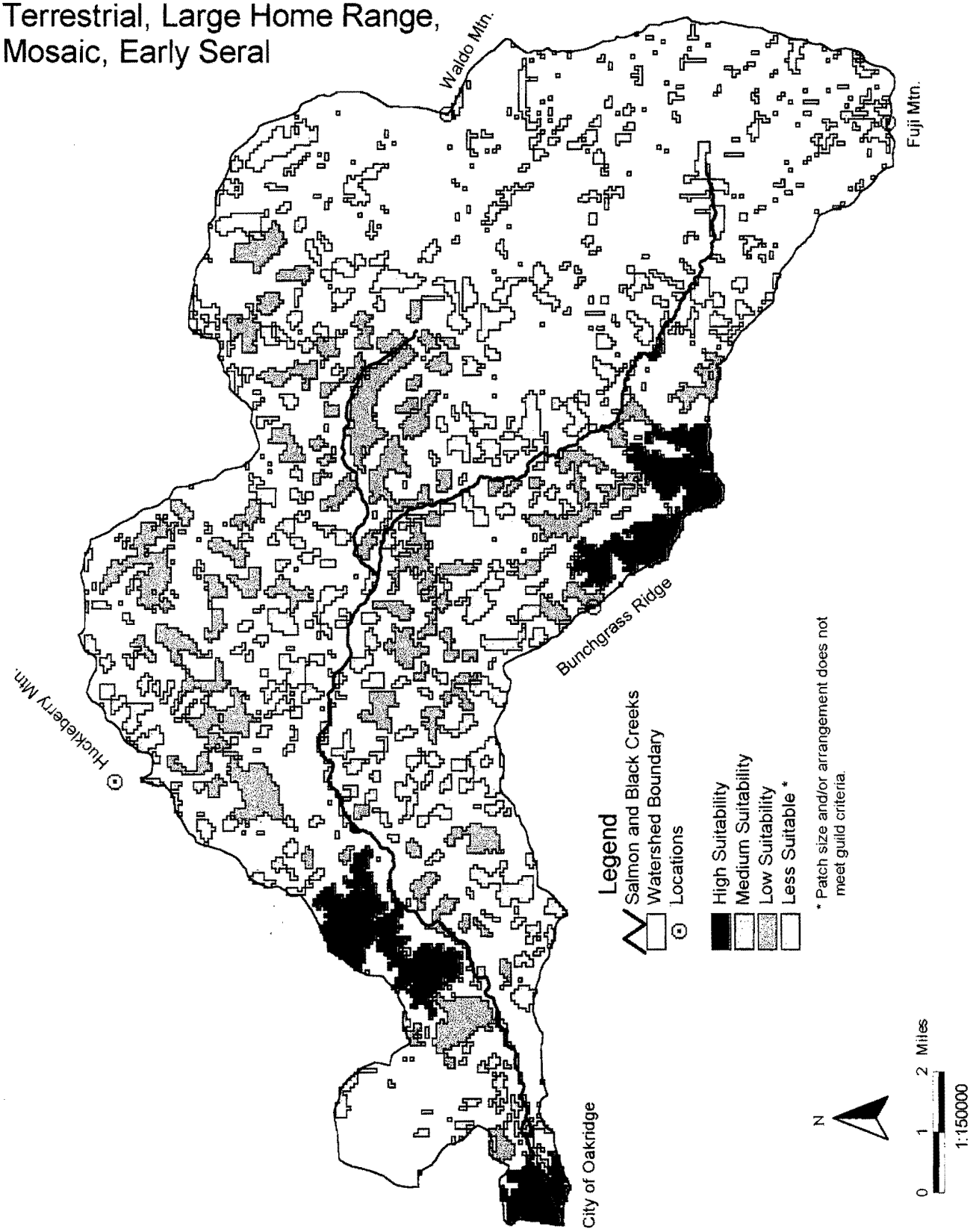
Historic
Terrestrial, Large Home Range,
Mosaic, Early Seral



Reference / Current Conditions

Figure 31b: Salmon Creek Watershed Analysis

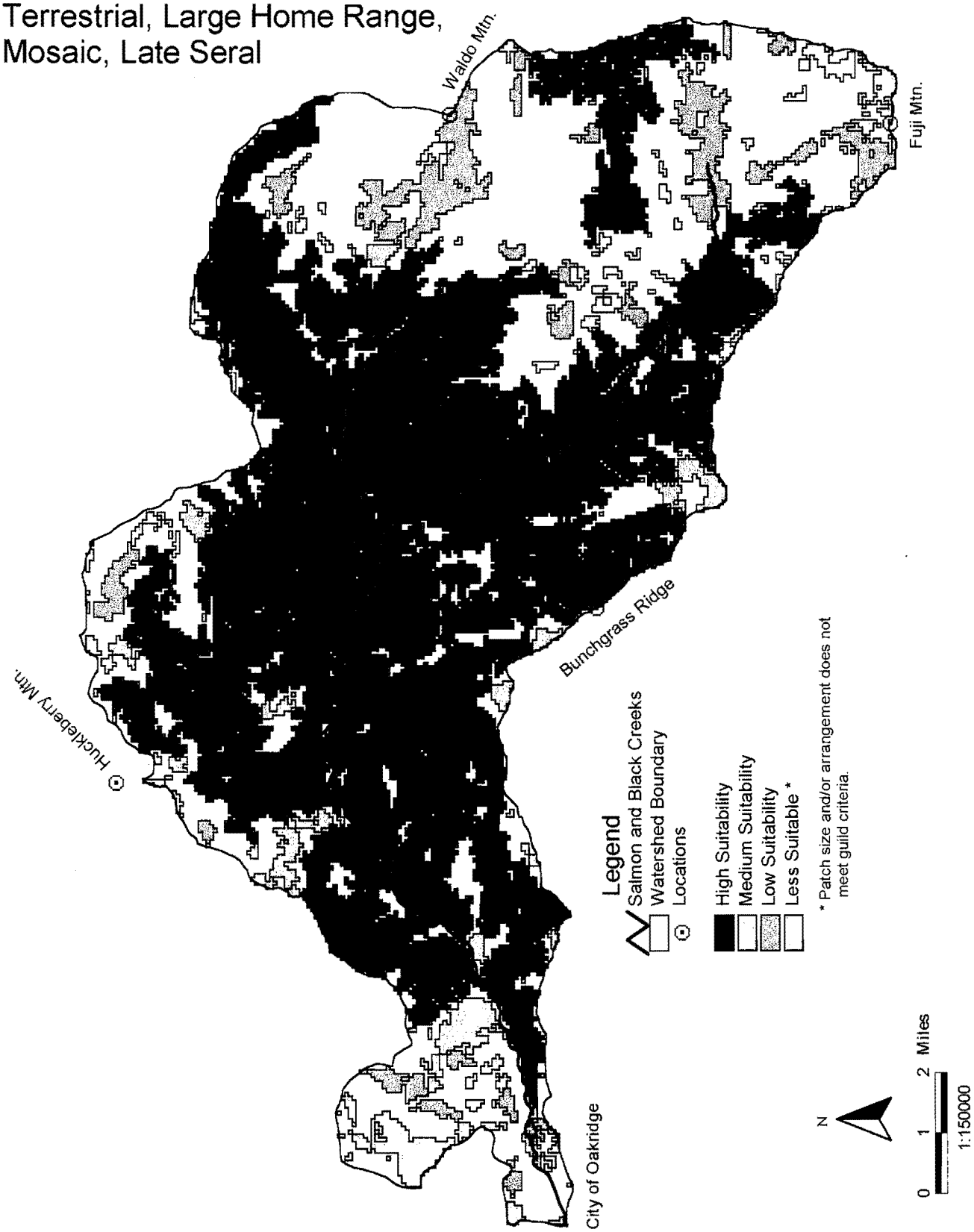
Current
Terrestrial, Large Home Range,
Mosaic, Early Seral



Reference / Current Condition

Figure 32a: Salmon Creek Watershed Analysis

Historic
Terrestrial, Large Home Range,
Mosaic, Late Seral



Reference / Current Conditions

Figure 32b: Salmon Creek Watershed Analysis

Current
Terrestrial, Large Home Range,
Mosaic, Late Seral

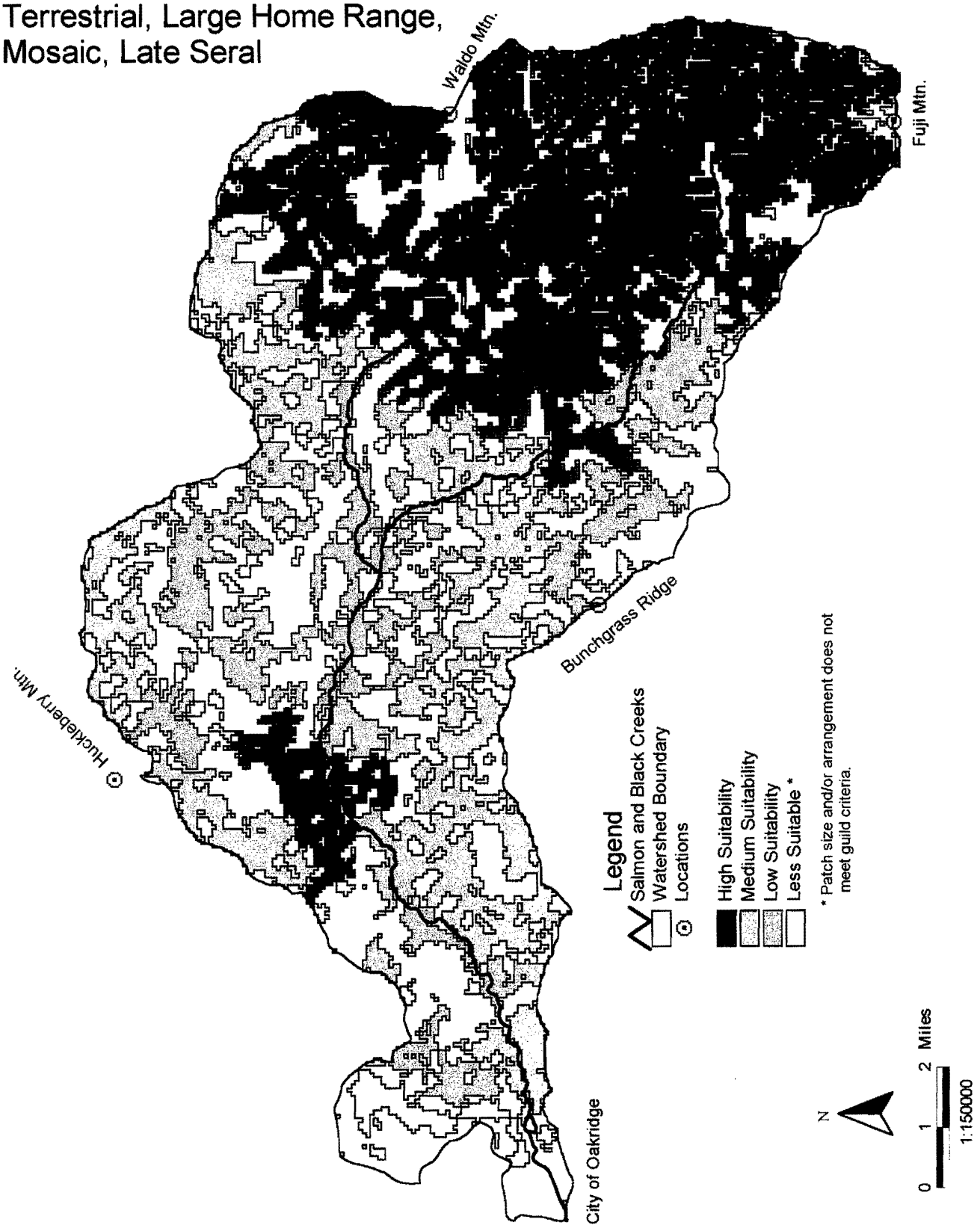


Table 45: Current Elk Habitat Effectiveness

BGEA	Emphasis	Individual Indices				Overall Index
		HEs	HEr	HEc	HEf	HEI
Bingo	High	.69	.97	.62	.38	.63
Flat	Low	.76	.01	.51	.51	.21
Furnish Head	Moderate	.76	.50	.64	.46	.58
Hatchery	Moderate	.78	.39	.66	.50	.56
Kelsey	Moderate	.75	.39	.67	.52	.57
Long Black	Moderate	.78	.45	.79	.47	.60
Pitch	Moderate	.84	.32	.67	.54	.56
Ranger	Moderate	.78	.39	.61	.49	.55
Salmon Head	Moderate	.55	1.00	.57	.49	.63
Shitepoke	Low	.79	.30	.58	.48	.51
Wallhead	Moderate	.81	.38	.59	.51	.55

Emphasis Ratings: (from Willamette National Forest Land Management Plan)

Standards & Guidelines: High from S&G FW-148, Moderate from S&G FW-151, Low from S&G FW-153

Individual Index:
High > 0.5
Moderate > 0.4
Low > 0.2

Overall Index:
High > 0.6
Moderate > 0.5
Low - increase if any variable is below 0.2

Index Definitions:
HEs - size & spacing
HEr - road density
HEc - cover quality
HEf - forage quality
HEI - overall

Interior Forest Habitat

Forest fragmentation, as described above, tends to reduce habitat suitability for species in late seral mosaic, late seral patch, and generalist for mid and late seral guilds for all home range sizes (Appendix A, Figures 3b, 6b, 9b, and 12b). Minimum fragmentation strategies tend to retain habitat suitability for these guilds in areas where harvest is avoided, but habitat is removed in harvested areas. Appendix A (pages 1 through 5) contains a list of which species belong to which guilds.

Northern spotted owls are representative of species that select for late seral and old-growth interior forest habitat. Spotted owls are considered to be within the large home range mosaic late seral guild (TLML). Figure 32b of this chapter displays a map for this guild. That map depicts areas within the watershed that provide the highest amounts of the largest patches of late seral and old-growth habitat within approximate home ranges (about 3000 acres) for this species. However, the map does not distinguish plant associations (vegetative communities), thus not all of the area mapped in the watershed would be best suited for northern spotted owls; for example, those areas in true-fir and mountain hemlock associations. Late seral and old-growth true-fir and mountain hemlock are better utilized by species such as marten, and black-backed and three-toed woodpeckers. The map in Figure 29 of this chapter depicts current seral stages by plant association for the watershed, and should be referenced to distinguish this biofeature.

A commonly accepted way to assess habitat conditions for northern spotted owls is to describe the conditions of the individual home ranges for each habitat activity center (HAC). The amount of habitat within an average size home range for the Oregon Cascades Province (1.2 mile radius or approximately 2900 acres) should be above 40 percent of the area within the home range in order to maintain reproductive viability of the site. Current amounts of suitable habitat within the provincial radius of known spotted owl sites within this watershed are displayed in Table 46 of this chapter.

Table 46: Current Spotted Owl Home Range Conditions (Acres of Suitable Habitat)
Watershed 18: (50 activity centers)

Owl MSN	0.7 Mile Habitat	1.2 Mile Habitat	LSR No.
1117	385.22	1381.52	1117
1118	684.15	1895.20	1118
1119	556.95	1528.25	1119
1120	739.77	1994.31	1120
1125	576.62	1325.48	RO220
1130	640.12	1841.15	1130
1134	557.70	1610.08	RO220
1138	518.80	1616.80	RO220
1139	477.59	1377.00	RO220
1140	512.74	1468.09	RO220
1141	599.22	1719.97	RO220
1142	647.86	1455.34	1142
1143	578.06	1983.39	1143
1152	482.33	1532.33	RO220
2741	462.52	1207.69	RO220
2742	441.66	1407.49	2742
2743	656.89	1291.49	2743
2774	724.93	1930.07	2774
2775	682.91	1853.95	2775
2780	623.24	1596.29	2780
2782	552.46	1559.44	RO220
2786	685.77	1651.84	2786
2792	547.47	1684.86	2792
2793	502.67	1584.11	2793
2794	554.98	1659.46	2794

Owl MSN	0.7 Mile Habitat	1.2 Mile Habitat	LSR No.
2795	560.26	1828.53	2795
2796	560.01	1542.57	RO220
2802	562.29	1675.99	RO220
2803	412.61	1356.43	2803
2810	797.52	2023.37	2810
2813	306.98	1071.81	2813
2822	672.88	1702.22	2822
3568	616.79	1312.71	RO220
3569	556.80	1546.52	RO220
3571	418.19	1241.47	RO220
3572	456.20	1011.84	3572
3575	674.04	1635.27	RO220
3576	566.89	1520.71	3576
3577	602.95	1681.76	RO220
3578	509.14	1547.23	RO220
3988	430.40	1405.56	RO220
3989	721.26	2057.77	K406
3990	381.23	1235.79	3990
3991	656.97	2005.34	N.A.
3993	319.94	1025.94	RO220
4103	318.52	359.83	N.A.
4343	499.36	1430.60	RO220
4344	410.93	1224.57	RO220
4345	475.09	1099.04	RO220
4390	681.26	1933.38	K506

highlighted values indicate suitable habitat below 40 percent

Key: MSN = Master Site Number
LSR = Late-Successional Reserve
N.A. = Not Applicable (not in an LSR)

Habitat Structure

The amount of large woody debris and snag habitat is variable within the watershed. Some areas, particularly within several hundred feet of roads, and most areas with gentle topography, have been heavily salvaged. In some cases most of the snags have been removed and woody debris has been reduced both on the forest floor and within riparian and aquatic habitats. In other areas salvage has not occurred and natural levels of snags and logs are present. In managed stands large woody debris and snag levels vary with the type of harvest and the time frame within which harvest occurred. Some older harvested stands have residual trees within them, and shelterwood stands now within LSR0220 will carry this overstory component into the future. These residual trees contribute to diversity within otherwise uniform young stands and will ultimately provide a source for snag and large wood recruitment. Many of these older harvest units (logged prior to 1970) also have very large logs remaining from the original harvest, due to merchantability standards of the time. Later, utilization became an issue and slash treatment became standard practice between 1970 and 1989. Harvested areas were often left with little or no snags, large woody debris, or residual trees big enough to offer recruitment for these habitat structures. As YUM (yard unmerchantable material) and PUM (pile unmerchantable material) requirements were used less frequently and Forest Plan standards for snag and large woody debris retention were adopted (1990), the amount of wildlife tree and down log habitat began to increase. Table 47 of this chapter displays acreage totals within the watershed that were treated with intensive harvest treatments prior to 1970, from 1970 through 1989, and from 1990 to present.