led to an overall reduction in the number of snags that would have been created under past fire regimes within portions of this watershed. In addition, the majority of dead trees that resulted from fires have not been salvaged recently.

## RIPARIAN RESERVES

### REFERENCE CONDITION

The reference condition of riparian reserves was one of relatively little fragmentation, specifically due to the lack of roads and timber harvest. Fires within the watershed may have fragmented riparian zones, but remaining snags may have contributed large woody material to streams.

### CURRENT CONDITION

Approximately 22,880 acres (32 percent) of the Salt Creek watershed is within riparian reserves. The number of acres recognized as riparian reserves will likely increase as more detailed stream mapping is completed within the watershed. Tables 3.4-2, 3.4-4, and Figures 3.4-3, and 3.5-7 show the amount of riparian reserves for each subwatershed and the area harvested within these reserves. Subwatershed 20 1 has had the highest percentage (33 percent) of harvest in riparian reserves.

Management activities in riparian areas have occurred in varying degrees during the last century. Harvest impacts within riparian reserves increased substantially during the decade beginning in 1950 and generally continued to do so until 1990. Figure 3.4-3 and Table 3.4-2 show the number of acres of riparian reserves harvested by decade in each subwatershed.

**Table 3.4-2.** Riparian Reserve Acres Harvested by Decade by Subwatershed

| | Decade of Harvest | | | | | | Total Riparian Acres Harvested by Subwatershed |
|---|---|---|---|---|---|---|---|
| **Subwatershed** | **40-49** | **50-59** | **60-69** | **70-79** | **80-89** | **90-95** | |
| **20 1** | 81 | 452 | 549 | 497 | 693 | 63 | 2,335 |
| **20 2** | 167 | 51 | 400 | 433 | 985 | 117 | 2,153 |
| **20 3** | 0 | 0 | 9 | 206 | 974 | 613 | 1,802 |
| **Total Acres by Decade** | **248** | **503** | **958** | **1,136** | **2,652** | **793** | **6,290** |

**Figure 3.4-3** Acres of Riparian Reserve Harvest by Subwatershed and Decade

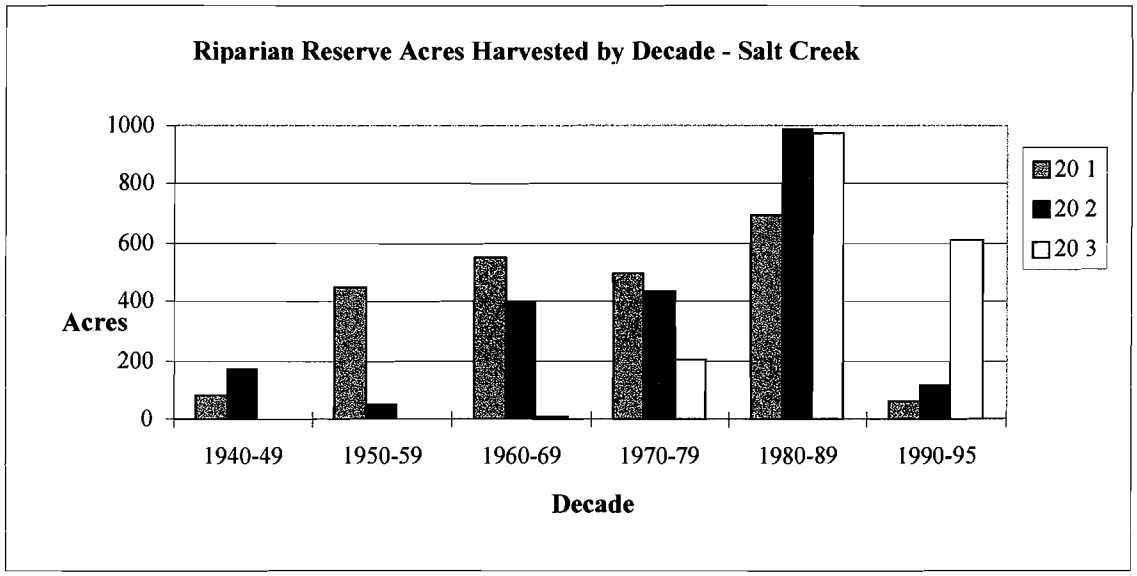
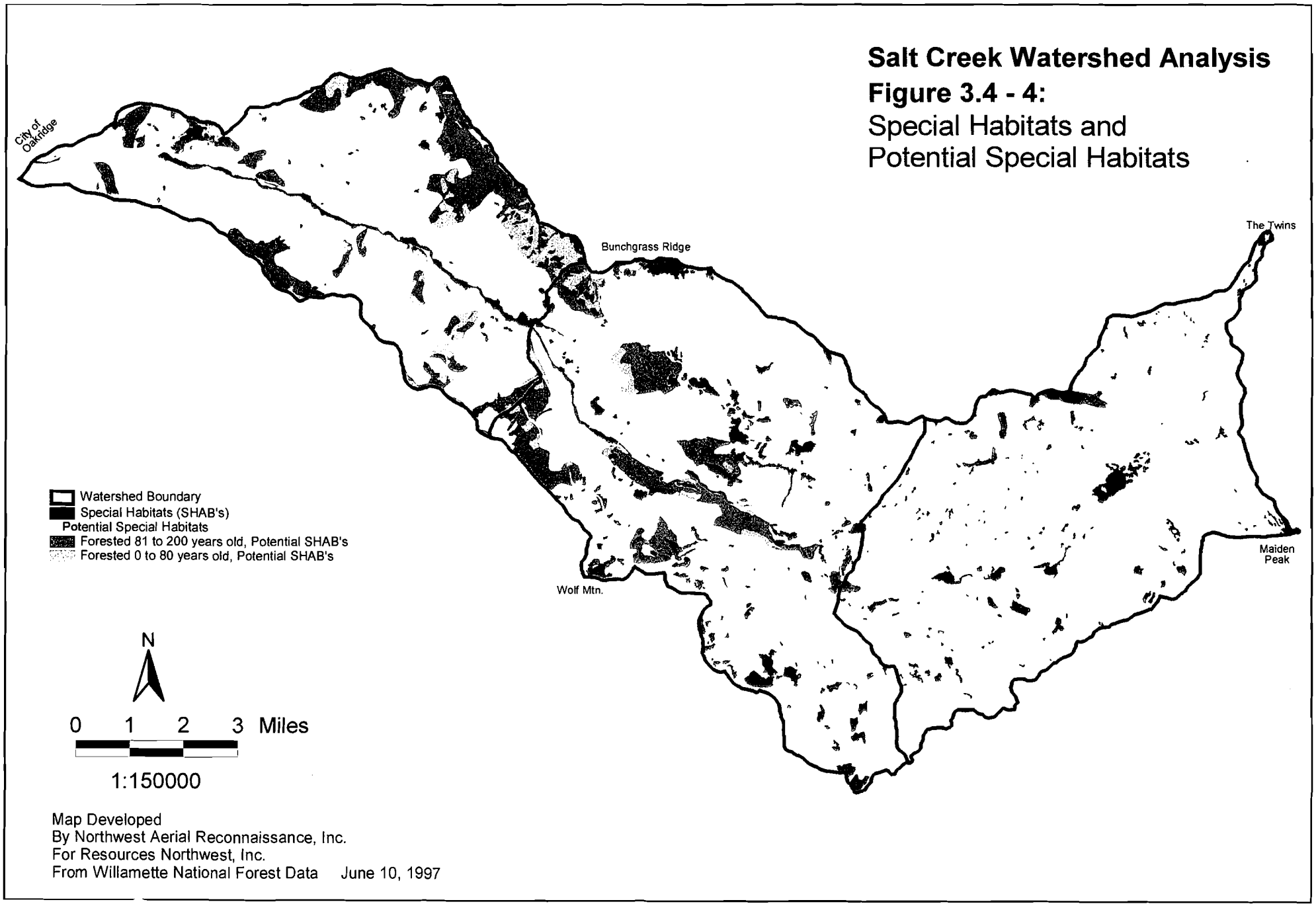



**Table 3.4-3.** Area and Percent of Land Within One half and One mile of Roads

| Subwatershed | Total Acres | Total Acres within 0.5 mi of Roads | Percent of Total | Total Acres within 1.0 mi of Roads | Percent of Total |
|---|---|---|---|---|---|
| 20 1 | 20,156 | 19,073 | 95% | 20,061 | 100% |
| 20 2 | 27,351 | 22,724 | 83% | 25,738 | 94% |
| 20 3 | 24,263 | 11,927 | 49% | 17,571 | 72% |
| **Totals** | **71,770** | **53,724** | **75%** | **63,370** | **88%** |


Salt Creek Watershed Analysis
Figure 3.4 - 4:
Special Habitats and
Potential Special Habitats
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Special Habitats (SHAB's)
Potential Special Habitats
Forested 81 to 200 years old, Potential SHAB's
Forested 0 to 80 years old, Potential SHAB's
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

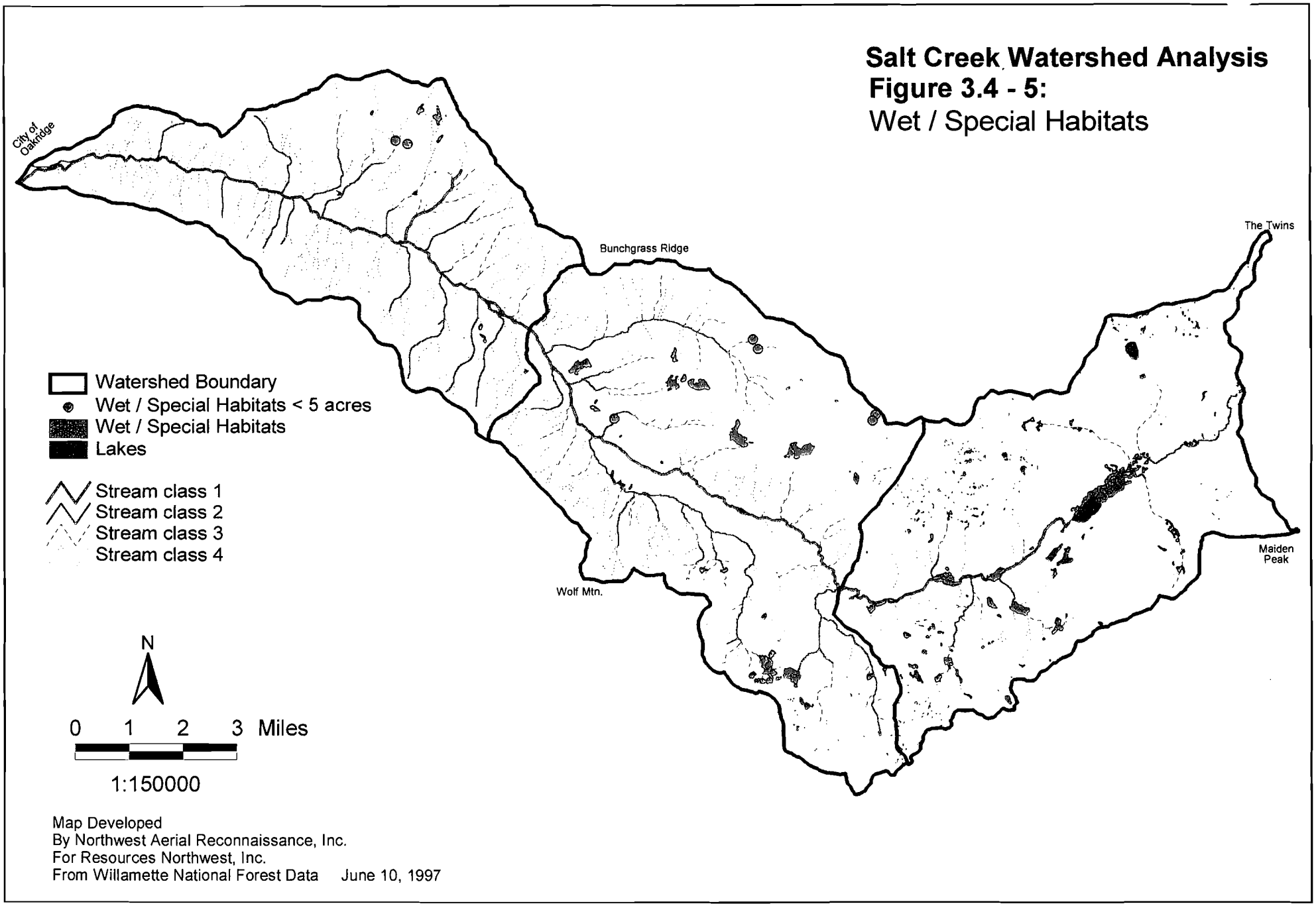

Salt Creek Watershed Analysis
Figure 3.4 - 5:
Wet / Special Habitats
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Wet / Special Habitats < 5 acres
Wet / Special Habitats
Lakes
Stream class 1
Stream class 2
Stream class 3
Stream class 4
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

**Table 3.4-4.** Road Openings, Trails, and Railroads within Riparian Reserves

| Subwatershed | Riparian Reserve Total Acres | Road Type | Acres of Road in Reserves | Percent Reserves in Road Openings | Miles of Trail in Reserves |
|---|---|---|---|---|---|
| 20 1 | 7,160 | Road | 1,704 | 24% | 5.5 |
| | | Railroad | 1,302 | 18% | |
| 20 2 | 8,625 | Road | 1,292 | 15% | 2.3 |
| | | Railroad | 848 | 10% | |
| 20 3 | 7,095 | Road | 525 | 7% | 2.4 |
| | | Railroad | 200 | 3% | |
| **TOTALS** | **22,880** | | **5,871** | **26%** | **10.2** |

## THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

REFERENCE CONDITION

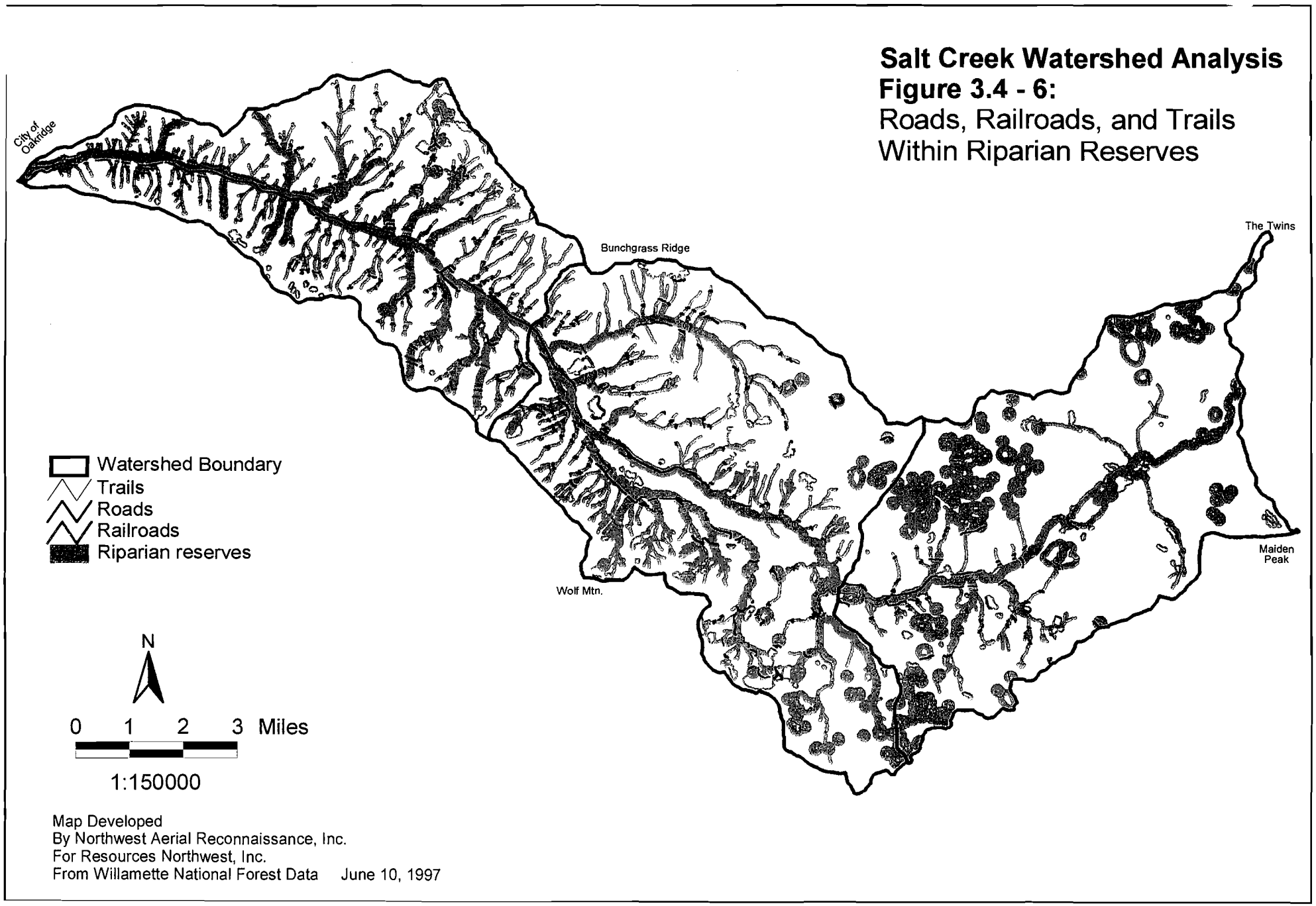
The historic distribution of sensitive and rare plant habitat is assumed to be generally similar to that of today, with some exceptions such as areas prone to frequent stand replacing fires which may have contributed to a higher abundance of non-forested patches, and to underburned areas that may have been maintained by more frequent fire events.

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 D for a list of potential habitats for sensitive plant species in the watershed. Four of these species have been documented in the Salt Creek 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 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. Branching Montia and woodland milkvetch have been documented within 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. Six 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 D for a listing of rare and unique plants in the watershed.


Salt Creek Watershed Analysis
Figure 3.4 - 6:
Roads, Railroads, and Trails
Within Riparian Reserves
City of Oakridge
Bunchgrass Ridge
The Twins
Maiden Peak
Wolf Mtn.
Watershed Boundary
Trails
Roads
Railroads
Riparian reserves
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

## SURVEY AND MANAGE SPECIES: FUNGI, BRYOPHYTES, LICHENS, AND VASCULAR PLANTS

REFERENCE CONDITION

Historically the western portion of the watershed contained large tracts of old-growth forest with patchy fire occurrences, as suggested on the fire history map (Figure 3.4-7) and historic seral stages map (Figure 3.4-1). A majority of Subwatershed 20 3 also consisted of later-seral forest. Species diversity and richness in old-growth and riparian dependent communities, where many of these survey and manage species are found, had more time to develop where fire was less frequent.

CURRENT CONDITION

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

Since fire suppression began in the watershed, longer intervals have occurred between large scale fire events. Species associated with late-seral forests have likely become established in areas where fire suppression has resulted in development of older forest conditions.

Many 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 the near future. 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 D for a list of Survey and Manage Species known to occur in this watershed.

## NOXIOUS WEEDS AND OTHER NON-NATIVE 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 of these effects 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 in this region. 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).

Noxious weeds were absent from the watershed prior to European colonization. Non-native plant species where introduced when settlers began arriving. In the 1930's, when large-scale logging and road building began in the watershed, large increases and the spread of non-native plants occurred. Livestock grazing also contributed to the spread of some noxious weeds.

CURRENT CONDITION

Non-native plant species play a significant role in influencing changes to native plant communities. Weed competition with native plant species is occurring in conifer plantations; wetlands and river flood plains, and road, railroad, and power line right-of-ways. Some weeds have also been documented spreading into natural dry and moist meadow openings and rocky areas. Non-desirable weed species are also outcompeting native plants in many areas by forming dense patches and thickets restricting growth of native species. Many noxious weed species and other non-native invasive plants are found in the watershed. Distribution of some species is currently increasing, largely due to logging and road building practices. Many of these species are widely distributed. See Appendix D for a list of noxious weeds present or with potential to exist in the watershed.

The spread of non-native plants within the watershed poses a serious threat to some native plants. The Willamette National Forest Integrated Weed and Management Environmental Assessment, April 1993, lists seven 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.

Forest roads and other travel right-of-ways serve as noxious weed dispersal corridors and establishment sites. The Willamette Highway (State Highway 58) and the Union Pacific Railroad (UPRR) are both well used travel corridors by vehicles and railroads where seed has been transported. In addition, timber harvested areas, associated roads and landings, trails, and other disturbed openings have created conditions which can increase weed populations. Other possible vectors for spread of weeds include wildlife (birds and mammals), livestock and their feeds, and weed seed contamination of forage and erosion control seeding projects.

Roadside inventories on the Oakridge Ranger District of noxious weeds were conducted by the Oregon Department of Agriculture in 1988 and again in 1993. The results of these inventories have shown that some noxious weed species are spreading 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, pers. comm.).

## DISTURBANCE

Natural disturbance within a landscape can take many forms; fire (natural and human caused) insects, disease, and windthrow. Each of these disturbances can occur at small or large scales with different effects upon the landscape.

### Fire

**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). Area burned within this watershed is displayed in Table 3.4-5. 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 drier sites may burn again after 100 years. Within this subwatershed, the large fire return interval appears to be 30-50 years, with the majority of these occurring within previous fire events. 150 to 200 years ago 74% of this watershed burned, 40% burned between 1840 and 1889, 6% between 1890 and 1939, and 3% since 1940.

The following conditions were found in this watershed:

**Subwatershed 20 1**

Stand replacement fires since 1790 (Figure 3.4-7) have burned approximately 57% of this subwatershed. From 1790 to 1839 approximately 96% of the area north of Salt Creek (south facing aspect) burned and 7% burned in the area south of Salt Creek (north facing aspect). From 1840-1889, approximately 58% burned north of Salt Creek and 18% south of Salt Creek. From 1890-1939, 7% burned north of Salt Creek and 5% burned south of Salt Creek. Since 1940, only 10% burned north of Salt Creek and no major fires have occurred south of Salt Creek. The Pryor and Warner Creek fires account for these acres in the last 50 years. It is interesting to note that the majority of acres burned in this watershed occurred 100-200 years ago and 40 years prior to fire suppression management.

**Subwatershed 20 2**

Approximately 88 percent of Subwatershed 20 2 has burned between 1790 and 1839 of which 96% was north of Sa' Creek (south facing aspect) and 78% burned south of Salt Creek (north facing aspect). Between 1840 and 1889, 49% burned with 47% north of Salt Creek and 52% south of Salt Creek. From 1890-1939, 6% of the subwatershed burned, 7% north of Salt Creek and 4% south of Salt Creek. From 1940 to present, 4% of this area burned, all being north of Salt Creek. These large fire events occurred 40 years before fire suppression management. This subwatershed receives the greatest influence from east wind events.

**Subwatershed 20 3**

Approximately 73 percent of Subwatershed 20 3 burned between 1790 and 1839, with 54% burning the area north of Highway 58 and 95% burning the area south of Highway 58. The area south of Highway 58 receives strong influence by east wind events. Between 1840 and 1889, 27% of the subwatershed burned, 25% north and 30% south of Highway 58. From 1890 to 1939, 8% burned, 5% north and 10% south of Highway 58. No large fires have occurred since 1940. The last large fire event over 1,000 acres occurred 40 years prior to fire suppression management.

**Table 3.4-5.** Acres and Percentage of Salt Creek Watershed Burned by Stand Replacement Fire: Time Period 1790 to Present

| | Subwatershed 20 1 (20,157 acres) | | | | Subwatershed 20 2 (27,351 acres) | | | | Subwatershed 20 3 (24,263 acres) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time period | North | % | South | % | North | % | South | % | North | % | South | % | Total |
| Total Acres | 11,401 | | 8,755 | | 14,550 | | 12,801 | | 12,631 | | 11,632 | | 71,770 |
| 1790 to 1839 | 11,000 | 96 | 588 | 7 | 14,000 | 96 | 10,000 | 78 | 6,775 | 54 | 11,000 | 95 | 53,363 |
| % of Sbshed | 57% | | | | 88% | | | | 73% | | | | 74% |
| 1840 to 1889 | 6,641 | 58 | 1,587 | 18 | 6,838 | 47 | 6,690 | 52 | 3,126 | 25 | 3,483 | 30 | 28,365 |
| % of Sbshed | 41% | | | | 49% | | | | 27% | | | | 40% |
| 1890 to 1939 | 746 | 7 | 443 | 5 | 965 | 7 | 569 | 4 | 691 | 5 | 1,181 | 10 | 4,595 |
| % of Sbshed | 6% | | | | 6% | | | | 8% | | | | 6% |
| 1940 to present | 1,093 | 10 | -- | | 1,161 | 8 | -- | | -- | | -- | | 2,254 |
| % of Sbshed | 5% | | | | 4% | | | | -- | | | | 3% |

Approximately 122% or 87,484 acres of this watershed has burned in the last 200 years. Given the amount of stands greater than 200 years of age, this number is indicative of the amount and extent of reburn events that have occurred in this watershed. In most cases, the lack of large woody material on the ground and fire boundaries are not typical of a single event fire. The fire events of 1790 were probably first event fires which means stands had lots of large woody material standing and on the ground when the fires burned, leaving large quantities of standing dead woody material that over time decayed and fell to the ground. The remaining fire events appear to be second event fires, with most of the fire activity occurring in the same general topographic areas of previous fires and within 30 to 50 years. Given a fire start, this would be expected due to large accumulations of large woody 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).

With this information, it is possible to identify trends in fuel loading over time. Fuel loading was classified into one of the Northern Forest Fire Laboratory (NFFL) fuel modes (FM) used to predict fire behavior. Table 3.4-6 shows the fuel models used in this analysis.

**Table 3.4-6.** Fuel Models

| Fuel Model >> | FM5 | FM8 | FM10 | FM11 | FM12 |
|---|---|---|---|---|---|
| Total fuel load, <3-inch dead and live, tons/acre | 3.5 | 5.0 | 12.0 | 11.5 | 34.6 |
| Dead fuel load, 1/4-inch tons/acre | 1.0 | 1.5 | 3.0 | 1.5 | 4.0 |
| Live fuel load, foliage, tons/acre | 2.0 | 0 | 2.0 | 0 | 0 |
| Fuel bed depth, feet | 2.0 | 0.2 | 1.0 | 1.0 | 2.3 |

Table 3.4-7 shows the Post Fire Fuel Loading by 50 year periods of time (stand age) that will be used to determine fuel loading.

**Table 3.4-7.** Post Fire Event Fuel Loading

| Years after event | 0-30 years | 31-80 years | 81-200 years |
|---|---|---|---|
| 1st event fire | FM5 | FM12 | FM10 |
| 2nd event fire | FM5 | FM11 | 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 (Table 3.4-8). For stands greater than 200 years of age, data was collected from 72 natural stand plots to determine fuel loading. For these stands greater than 200 years of age, FM8 represented 47% of all plots and FM10 represented 53% of all plots. These percentages were then applied to each time period. The last 50 years (1940 to present) was considered current condition for this analysis.

Beginning in 1939, the following conditions were estimated to have existed in this watershed:

**Table 3.4-8.** Fuel Models - 1790-1939.

**North Side Salt Creek (South Facing Aspect)**

38,582 Total Acres

| Fire Events | Acres | Fuel Model | Percent |
|---|---|---|---|
| 1790-1839 | 6,078 | FM8 | 16 |
| 1840-1889 | 16,605 | FM11 | 43 |
| 1890-1939 | 2,402 | FM5 | 6 |
| Total Acres Burned | 25,085 | | 65 |
| Total Acres Not Burned | 13,497 | | 35* |

FM8 = 47%x13,497 = 6,344 acres
FM10 = 53%x13,497 = 7,153 acres

**South Side Salt Creek (North Facing Aspect)**

33,190 Total Acres

| Fire Events | Acres | Fuel Model | Percent |
|---|---|---|---|
| 1790-1839 | 4,515 | FM8 | 14 |
| 1840-1889 | 11,760 | FM11 | 35 |
| 1890-1939 | 2,193 | FM5 | 7 |
| Total Acres Burned | 18,468 | | 56 |
| Total Acres Not Burned | 14,722 | | 44* |

FM8 = 47%x14,722 = 6,919 acres
FM10 = 53%x14,722 = 7,803 acres

*Greater than 200 years of age

**Table 3.4-9.** Summary of Fuel Loading Acreage 1790 to 1939.

| Fuel Model | Acres | Percent |
|---|---|---|
| FM5 | 4,595 | 6 |
| FM11 | 28,365 | 40 |
| FM8 | 23,856 | 33 |
| FM10 | 14,956 | 21 |
| FM12 | 0 | 0 |

Prior to 1890 (100 years ago), the following conditions were estimated to have existed (Table 3.4-10):

**Table 3.4-10.** Fuel Models - 1790-1889.

| North Side Salt Creek (South Facing Aspect) | | | |
|---|---|---|---|
| | 38,582 Total Acres | | |
| Fire Events | Acres | Fuel Model | Percent |
| 1790-1839 | 2,402 | FM11 | 6 |
| 1840-1889 | 16,605 | FM5 | 43 |
| Total Acres Burned | 19,007 | | 49 |
| Total Acres Not Burned | 19,575 | | 51* |
| FM8 = 47%x19,575 = 9,200 acres | | | |
| FM10 = 53%x19,575 = 10,375 acres | | | |

*Greater than 200 years of age

| South Side Salt Creek (North Facing Aspect) | | | |
|---|---|---|---|
| | 33,190 Total Acres | | |
| Fire Events | Acres | Fuel Model | Percent |
| 1790-1839 | 4,515 | FM11 | 14 |
| 1840-1889 | 11,760 | FM5 | 35 |
| Total Acres Burned | 16,275 | | 49 |
| Total Acres Not Burned | 16,915 | | 51* |
| FM8 = 47%x14,722 = 7,950 acres | | | |
| FM10 = 53%x14,722 = 8,965 acres | | | |

**Table 3.4-11.** Summary of Fuel Loading Acreage 1790 to 1889.

| Fuel Model | Acres | Percent |
|---|---|---|
| FM5 | 28,365 | 40 |
| FM11 | 6,917 | 10 |
| FM8 | 17,150 | 24 |
| FM10 | 19,340 | 26 |
| FM12 | 0 | 0 |

**Table 3.4-12.** Fuel Models - 1790-1839.

| North Side Salt Creek (South Facing Aspect) | | | |
|---|---|---|---|
| | 38,582 Total Acres | | |
| Fire Events | Acres | Fuel Model | Percent |
| 1790-1839 | 31,775 | FM12 | 82 |
| Total Acres Not Burned | 6,887 | | 18 |
| FM8 = 47%x6,887 = 3,237 acres | | | |
| FM10 = 53%x6,887 = 3,650 acres | | | |

| South Side Salt Creek (North Facing Aspect) | | | |
|---|---|---|---|
| | 33,190 Total Acres | | |
| Fire Events | Acres | Fuel Model | Percent |
| 1790-1839 | 21,588 | FM12 | 65 |
| Total Acres Not Burned | 11,602 | | 35 |
| FM8 = 47%x11,602 = 5,452 acres | | | |
| FM10 = 53%x11,602 = 6,150 acres | | | |

**Table 3.4-13.** Summary of Fuel Loading Acreage 1790 to 1839.

| Fuel Model | Acres | Percent |
|---|---|---|
| FM5 | 0 | 0 |
| FM11 | 0 | 0 |
| FM8 | 8,689 | 12 |
| FM10 | 9,800 | 14 |
| FM12 | 53,363 | 74 |

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 for stands greater then 200 years of age were used for acres not harvested. Table 3.4-14 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, hand piled and burned, or machine piled and burned. No treatment (NT) includes all acres that do not meet treated unit requirements. Table 3.4-14 identifies fuel model to type of treatment and specified time periods.

**Table 3.4-18.** Percent of Watershed Burned by Elevation Since 1940

| Elevation (feet) | Percent of Acres Burned |
|---|---|
| 1000 to 1999 | <1 |
| 2000 to 2999 | 10 |
| 3000 to 3999 | 14 |
| 4000 to 4999 | 11 |
| 5000+ | 3 |

**Insects and Disease**

Insects and diseases are part of the natural ecosystem which have caused disturbances on the landscape. Native insects and diseases occur at normal levels, however, occasionally these infestations reach epidemic levels. The effects of these outbreaks can be serious at the stand or landscape level, affecting a few trees or entire watersheds.

REFERENCE CONDITION

Insects and disease likely affected the reference watershed by altering forest vertical and horizontal structural diversity and species composition. Trees killed or damaged by insects and disease created snags and downed wood that provided habitat to many wildlife species, and contributed to nutrient cycling. Gaps in the forest canopy increased the amount of light reaching the forest floor which affected species composition and vegetation growth rates. In addition, insects provided food for some wildlife species.

Very little is know about the amount and distribution of past outbreaks of insects and diseases within the watershed. However, some insects and diseases are not native to the Pacific Northwest and are new disturbance agents to the ecosystem. These disturbances may have occurred at various levels, however no serious outbreaks are known to have occurred in this watershed.

CURRENT CONDITION

No serious outbreaks of insects or diseases are present within the watershed. Only localized pockets of infestations are present affecting small areas of generally a few acres (less than 2 acres). The following forest insects (Table 3.4-19) and forest tree diseases (Table 3.4-20) have been documented or may be suspected within the watershed.

**Table 3.4-19.** Forest Insects Documented or Suspected within the Salt Creek Watershed

| Common Name | Species | Documented or Suspected Within the Watershed |
|---|---|---|
| Balsam woolley adelgid[a] | *Adelges piceae* | yes |
| Douglas-fir beetle | *Dendroctonus pseudotsugae* | yes, almost exclusively associated with Phellinus |
| mountain pine beetle | *Dendroctonud ponderosae* | yes |
| fir engraver beetle | *Scolytus ventralis* | yes |
| silver fir beetle | *Pseudohylesinus sericeus* | unknown |
| Douglas-fir engraver | *Scolytus unispinosus* | yes (low risk) |
| Western Balsam fir bark beetle | *Dryocoetes confusus* | probable |

[a] *introduced species*

**Table 3.4-20.** Forest Tree Diseases Documented or Suspected within the Salt Creek Watershed

| Common Name | Species | Documented or Suspected Within the Watershed |
|---|---|---|
| laminated root rot | *Phellinus weirii* | yes |
| armillaria root rot | *Armillaria ostoyae* | yes |
| annosus root rot | *Heterobasidion annosum* | probable |
| dwarf mistletoe | *Arceuthobium tsugense* | yes |
| white pine blister rust[a] | *Cronartium ribicola* | yes |
| western gall rust | *Peridermium harknessii* | unknown |

[a] *introduced species*

### Windthrow

REFERENCE CONDITION

Wind served as a natural disturbance mechanism across the watershed when it was strong enough to topple trees. It has played a role in recycling some forest stands - renewing and maintaining stand diversity. Windthow induced gaps or openings in the forest canopy provided light and growing space for many types of vegetation, including tree regeneration. Smaller gaps may have stimulated regeneration of shade tolerant species, while larger more contiguous openings could have developed into even-aged stands of mostly shade-intolerant species. Areas of partial windthrow with irregular patterns of windthrown trees resulted in greater species diversity and vertical and horizontal heterogeneity. The amount of windthrow likely varied from a few scattered trees to large, contiguous patches of possibly several hundred acres in size.

Another effect of windthrow was disturbance of the soil profile. After a tree has blown down, soil and rocks are generally exposed which provide microhabitats used by some plant and animal species. Some windthrow areas may have also contribute to soil movement and debris avalanches.

Windthrown trees have provided downed wood, an important component to both forest and stream ecosystems. It can be the primary means of large woody material entering into stream ecosystems, providing nutrient input and invertebrate habitat, and creating pools and other fish habitat. Stream channel morphology and water temperatures are also affected by trees blown down in riparian areas.

CURRENT CONDITION

Windthrow has occurred at various levels throughout the watershed in recent decades. A major wind event occurred in December 1983. Approximately 3,000 acres were affected in what meteorologists described as an unusual set of conditions where an extreme downdraft occurred in the jet-stream. Smaller scale windthrow (less than a few acres) periodically occurs affecting a few acres at a time, especially along abrupt edges adjacent to clearcuts. High winter storm winds traveling up the drainage from the west have resulted in windthrow in some exposed areas. Relatively strong east winds also typically occur in the summer and early fall causing some occasional minor windthrow, although the major impact of these winds is increased fire danger.

Localized small scale (less than a few acres) windthrow, especially adjacent to exposed areas and adjacent to clearcuts will likely continue. However as these areas become more windfirm, and adjacent younger stands grow, windthrow frequency will likely decrease. Areas adjacent to new openings created in the forest will however be more susceptible to increased windthrow.

## SITE PRODUCTIVITY

REFERENCE CONDITION

Wildfires, especially frequent fires reduce organic materials on the forest floor. Prior to timber management activities, wildfires were the primary factor influencing site productivity in the watershed.

Historically, the amount of large woody material (large logs) and snag habitat in the landscape probably varied within the watershed. Fire stands, especially areas repeatedly burned, may have had a decreased amount of snags and down wood on the forest floor. LWM typically was more abundant in areas with less favorable burning conditions such as riparian areas and north and east facing slopes. Generally, areas with infrequent fires or where they have not occurred have greater number of large snags and logs.

CURRENT CONDITION

Retention of large woody material (LWM) has varied over time with management practices. Approximately 25 percent of this watershed has been disturbed as the result of intensive harvest methods. The presence of large woody material and snag habitat varies within the watershed depending on past fires and harvest activity. Generally areas with better access and gentle topography, have been heavily salvaged in the past. In many areas snags and large logs have been harvested on the forest floor and within riparian and aquatic habitats, while other areas have had little salvage activity resulting in higher levels of snags and logs. The amount of large woody material and snag levels remaining after harvest has varied with the type of harvest and the time frame within which harvest occurred. Some areas harvested before 1950 had seed trees dispersed throughout harvested stands to serve as seed sources. These residual trees contribute to diversity within young stands and ultimately provide a source for snag and large wood recruitment.

Many of the areas logged prior to 1970 also have 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 3.5-2 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 when 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 may tend to have a higher impact to a few drainages until vegetation is re-established. The dispersed patchwork of smaller clearcut units may 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.

## TERRESTRIAL WILDLIFE AND HABITAT, TES SPECIES

### THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Emphasis on species listed as Federally threatened, endangered, proposed, or Forest Service sensitive (TES) has had a significant role in shaping agency management direction. Significant shifts have occurred over Forest Service management guidelines since the 1990 listing of the northern spotted owl as a federally threatened species in the Pacific Northwest. Management of the entire forest ecosystem continues to evolve with less emphasis on single species and a shift to groups or guilds of species using similar habitats and life requirements. However, emphasis on specific rare species will continue to be important especially with their unique habitat requirements.

Threatened, endangered, and sensitive terrestrial wildlife species documented, suspected, or that may be expected to occur within the watershed are listed in Appendix E. Terrestrial wildlife species confirmed or documented within the watershed will be discussed below. These species have been grouped according to similar home range size, habitat use, or habitat characteristics. Their guild association can be found in Appendix E.

The following two species have been associated with aquatic habitat of rivers and streams.

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

REFERENCE CONDITION

Red-legged frogs were likely inhabitants of suitable habitat throughout the watershed during the reference era. Natural disturbance events, particularly fire, may have affected spatial and temporal distribution for local populations of this species.

CURRENT CONDITION

Red-legged frogs have been documented at numerous sites in the watershed associated with both breeding and foraging habitat. Current habitat and habitat use may have been altered by management activities that have changed features of aquatic habitats and/or shade and humidity of terrestrial habitats.

### Harlequin Duck (*Histrionicus histrionicus*)

REFERENCE CONDITION

Riparian conditions associated with Salt Creek during reference conditions provided suitable habitat most likely occupied by harlequin ducks during the breeding season. Periodic flood events may have affected nesting habitat in some areas for this species.

CURRENT CONDITION

Harlequin ducks are known to occupy habitat in the watershed during breeding season and successful reproduction of this species has been documented.

Salt Creek has been impacted by past management practices, especially timber harvest and salvage activity in riparian areas and from construction and maintenance practices associated with Highway 58 and the Union Pacific Railroad. In the past, large woody material within the river and associated riparian areas was removed, adversely affecting breeding habitat. Recent heavy debris flows over the last few years (particularly in November 1996) have replaced some woody material in aquatic and riparian habitats.

The following two species have been assigned to large home range guilds.

### California Wolverine (*Gulo gulo*)

REFERENCE CONDITION

Habitat conditions in the watershed during the reference era favored the likelihood of occupancy by wolverine as it is located well within the historic range for this species, and would have been relatively free from human disturbance especially during early breeding season.

CURRENT CONDITION

Numerous sightings of wolverine have been reported in recent years in the higher elevation eastern portions of the watershed. Confirmation of habitat occupancy by this species has not yet occurred. If they do occur in the watershed, human disturbance would be the greatest threat to successful reproduction and long-term occupancy.

### Northern Spotted Owls (*Strix occidentalis caurina*)

REFERENCE CONDITION

Northern spotted owls are generally associated with late-seral and old-growth interior forest habitat. Spotted owls are considered a large home range mosaic late-seral guild species (TLML) whose habitat is shown in Figure 3.5-5 of this section. Areas within the watershed that had large patches of late-seral and old-growth habitat within the median home range (about 3,000 acres) are shown in this map. However, plant associations (vegetative communities) are not identified on this map; therefore not all of the area mapped in the watershed was necessarily suitable for northern spotted owls (i.e., high elevation areas composed of true-fir and mountain hemlock plant associations).

Wildfire was the major disturbance affecting northern spotted owl habitat, population densities, and distributions in the watershed prior to the influence of man. Periodic stand replacement fire events affected relatively large areas (refer to Fire History, page 39). As a result of large fires many of these stands were unsuitable for spotted owl use for up to several decades. The distribution of spotted owls likely shifted with suitable habitats. There are no estimates of th historic numbers of spotted owls.

CURRENT CONDITION

Intensive timber harvesting began in the 1940's primarily within late-seral Douglas-fir and western hemlock in lower elevation forests. These high volume stands contained very large diameter trees which also provided high quality nesting, roosting, and foraging habitat for spotted owls. Extensive harvesting has occurred over the last five decades within Subwatersheds 20 1 and 20 2 (see Figure 3.5-7 and Table 3.5-4) and within the last three decades in 20 3.

Prior to intensive harvesting in the 1940's, approximately 16,000 acres (23 percent of the watershed) of late-seral forest habitat (average dbh greater than 21 inches) may have been present in the watershed. Currently, there are approximately 21,528 acres (30 percent) of late-seral forests present in the watershed providing nesting, roosting, and foraging habitat for spotted owls. In the western and central portion of the watershed, most suitable habitat has been heavily fragmented. The eastern portion of the watershed is relatively unfragmented, however, much of this area is high elevation forests which are marginal or unsuitable for spotted owls.

Approximately 30,680 acres (42 percent) in the watershed are mid-seral forests including closed pole and small saw timber averaging less than 21 inches dbh. These stands may serve as dispersal habitat. Many of these stands, especially under 5,200 feet in elevation may become suitable spotted owl habitat over time if permitted. This change in the amount and distribution of suitable habitat within the watershed may have had adverse impacts on spotted owl prey base, population densities, reproductive rates, and their distribution within the watershed.

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 2,900 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 3.5-1 of this chapter.

**Table 3.5-1.** Current Spotted Owl Home Range Conditions (Acres of Suitable Habitat) in the Salt Creek Watershed (32 activity centers).

| Owl MSN | 0.7 Mile Habitat | 1.2 Mile Habitat | LSR No. |
|---|---|---|---|
| 1131 | 669 | 2,042 | 1131 |
| 1132 | 627 | 1,729 | 1132 |
| 1133 | 829 | 2,224 | 1133 |
| 1136 | 691 | 2,112 | 0220 |
| 1137 | 483 | 1,550 | 0220 |
| 1146 | 522 | 1,395 | 1146 |
| 1148 | 549 | 1,613 | 1148 |
| 1149 | 581 | 1,229 | 1149 |
| 1789 | 622 | 2,102 | 1789 |
| 2769 | 449 | 1,074 | 0220 |
| 2773 | 338 | 1,184 | 2773 |
| 2778 | 689 | 1,686 | 2778 |
| 2787 | 644 | 1,895 | 2787 |
| 2790 | 677 | 1,806 | 2790 |
| 2800 | 415 | 1,747 | 2800 |
| 2805 | 726 | 1,951 | 2805 |

MSN = Master Site Number LSR = Late-Successional Reserve

| Owl MSN | 0.7 Mile Habitat | 1.2 Mile Habitat | LSR No. |
|---|---|---|---|
| 2806 | 326 | 886 | 2806 |
| 2811 | 589 | 1,507 | 2811 |
| 2812 | 471 | 1,535 | 2812 |
| 2816 | 760 | 2,210 | 2816 |
| 3094 | 459 | 1,405 | 3094 |
| 3574 | 466 | 1,003 | 3574 |
| 3579 | 770 | 1,771 | 0220 |
| 3984 | 278 | 1,092 | 3984 |
| 3985 | 644 | 1,243 | 3985 |
| 3986 | 645 | 1,905 | 3986 |
| 3992 | 606 | 1,291 | 3992 |
| 4100 | 821 | 1,828 | 4100 |
| 4423 | 355 | 932 | - |
| 9006 | 431 | 1,200 | 9006 |
| 9010 | 574 | 1,582 | 9010 |
| 9807 | 796 | 1,714 | - |

*Highlighted values indicate suitable habitat at or below 40 percent*

The following two species could occur in some special and unique habitats shown in Figure 3.4-2.

**Peregrine Falcon (*Falco peregrinus anatum*)**

REFERENCE CONDITION
It is highly probable that active peregrine falcon nest sites existed in the watershed under reference conditions. High quality nesting habitat was present at numerous locations. It is known that aboriginal activity in some areas may have potentially resulted in human disturbance to peregrines during the breeding season.

CURRENT CONDITION
There are currently three known peregrine falcon nest sites located within this watershed. Portions of management areas for these nest sites extend into adjacent watersheds. Portions of management areas for two peregrine nest sites in adjacent watersheds include areas within this watershed. Recent wildfires have significantly affected habitat conditions to varying degrees in portions of all five of these management areas. Habitat and use of habitat may have been altered by management activities and human disturbance.

**Pacific western big-eared bat (Townsend's big-eared bat) (*Corynorhinus townsendii*)**

REFERENCE CONDITION
Presence of Pacific western big-eared bat has not been historically documented within the watershed, however they probably occurred in the past. There are some known (and probably many more unknown) caves that could have been used as maternity and nocturnal roosts. Aboriginal use of some caves could have resulted in disturbance to the species. This species also likely utilized large hollow snags in the watershed.

CURRENT CONDITION
Even though presence of this species has not been documented in the watershed, it is likely to occur. No known caves are used for breeding, however, they are likely to exist. Habitat and use of habitat may have been altered by management activities; removal of large hollow snags, rock fissures or caverns; construction of shelters or bridges; modification of open water habitats. Bats may have been impacted by human disturbance (especially during hibernation or at maternity roosts). Protection measures limiting disturbances at known locations are essential for this species.

**SURVEY, MANAGE, AND PROTECTION BUFFER SPECIES**

The Northwest Forest Plan Record of Decision (ROD) identified survey and manage amphibian, mammal, bryophyte, mollusk, vascular plant, fungi, lichen, and arthropod species in Table C-3 beginning on page C-49. Very little is known about the historic populations and distribution of most of these species. Some of these species require very specific habitat conditions to survive. The ROD also identified other wildlife species requiring additional buffers for protection listed on pages C-19 to C-21 and C-45 to C-48. Many of these species may occur within the watershed, however comprehensive surveys have not been conducted. Species documented to occur in the watershed are addressed below. (See also discussion on Survey and Manage Species, page 38)

REFERENCE CONDITION
Great gray owls (*Strix nebulosa*) were likely common in mixed coniferous forests adjacent to meadows and burned over areas. These owls foraged in meadows and openings and generally nested in later-seral forest stands with large broken top trees or snags. Historic habitat for this species is displayed in Figure 3.5-1. The primary factor influencing great gray owl populations may have been prey base habitat. Thus, primary habitat for this species was closely associated with fire events (See Figure 3.4-7) and the relatively less abundant large meadow complexes (see Figure 3.4-4).

Whiteheaded woodpeckers (*Picoides albolarvatus*) are typically found in sugarpine, ponderosa pine or true fir mixed coniferous forests with relatively open canopies. They forage on insects and pine seeds. Habitat for this species may have been promoted by effects of fire such as maintenance of open pine stands and creation of snags.

Black-backed Woodpeckers (*Picoides arcticus*) inhabit lodgepole pine, ponderosa pine, and mixed conifer forests with a preference for late-seral stands and fire or insect damaged stands. This species was likely not widespread in the watershed, occurring in smaller localized populations in the eastern portion of the watershed. Their habitat may have been closely associated with old burns, windthrow areas, and insect infestations which supported sufficient populations

of woodboring insects for foraging. Pine beetle infestations may have been important to this species (See Appendix E for guild information and habitat map).

CURRENT CONDITION

As shown in Figure 3.5-2 contrast habitat has become more abundant and widespread, especially in the western 2/3 of the watershed. Great gray owls have been observed foraging in harvested areas and have responded from timber stands adjacent to harvested stands.

Though ponderosa pine and sugar pine are not as prevalent in the watershed as in areas to the east and south, these species have been included in reforestation stock used on south and west facing slopes in this watershed. In some areas fire suppression may have reduced the occurrence of pine dominated patches and the openness of late seral stands that may have otherwise underburned. Management activities have reduced the number of large trees, diseased and defective trees and snags, especially in the western 2/3 of the watershed. Whiteheaded woodpeckers have been observed foraging in some higher elevation habitat in the southeastern portion of the watershed.

The majority of the area expected to be occupied by black-backed woodpeckers has been exposed to relatively little timber harvest activity. In portions of potential habitat however, snag density has likely been substantially reduced. Fire suppression has likely increased the amount of late-seal forest within the expected range of this species. However in the event of a future fire, the accumulation of fuels that has resulted from fire suppression may increase the risk of loss of larger trees and snags, which are important to this species.

## NON-NATIVE ANIMAL SPECIES

REFERENCE CONDITION

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

Non-native wildlife species are found within the watershed. The effect of their presence on native species is unknown. They may act as competitors for similar habitats, may prey upon or provide food for native species, or parasitize them.

The opossum (*Didelphis marsupialis*) may have been introduced to the Oakridge area in the 1930's by folks immigrating to the area during the great depression. During this period of time the animals were frequently raised as a cheap source of meat. Opossums are typically found in close proximity with humans such as residential or agricultural areas, and have likely established a small population in the lower elevation western portion of the watershed. The opossum is an opportunist and will feed on essentially anything it can kill and eat or scavenge. Rock doves, European starling and brown-headed cow birds have successfully established populations in low elevation areas within the watershed.

In the early 1960's the barred owl (*Strix varia*) began to expand its range into the range of the spotted owl in the Pacific Northwest. The first record of barred owls in Oregon was documented in 1974. Although barred owls and spotted owls have been listed in the same Habitat Species Guild, vegetation manipulation during the past decades has seemed to favor the barred owl. Barred owls have been documented at numerous sites throughout this watershed suggesting the species has successfully exploited a niche for itself in fragmented areas.

Introduced game birds (ring-necked pheasants and wild turkeys) may have established small, localized populations in low elevation areas within the watershed.

Feral house cats are occasionally reported at random locations in the watershed. Other species have been occasionally been reported lost or abandoned in the watershed. It is unknown whether these species have established local populations or what effect they may be having on native species.

Refer to discussions of introduced plant and aquatic species, pages 38 and 99.

## HABITAT STRUCTURE AND COMPOSITION

REFERENCE CONDITION

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 except on very steep Class IV draws that may have acted like chimneys during fire events.

A historical representation of what was thought to be the pattern of seral stages on the watershed landscape is provided in Figure 3.4-1. Figure 3.4-7 provides spatial information on fire history. As shown by these maps, fire burned over large areas in the watershed (north half of 20 1, east half of 20 2, southwest end of 20 3). In these areas snag and large wood levels may have varied considerably with fire intensity and extent of reburn. Areas that were less prone to frequent fires such as the south half of 20 1, likely provided more uniform abundance and distribution of snags and down wood as stands developed.

CURRENT CONDITION

The amount and distribution of large woody material and snags varies within the watershed. Salvage of large logs, snags, and dying trees, has been concentrated near roads and gentle slopes. Snags and woody material have been removed on the forest floor, riparian areas, and aquatic habitats. Areas that have not had salvage or other harvest activity may have higher snag and log numbers. The amount of snags and large woody material in managed stands varies with the type of harvest and when this activity occurred. Some stands have residual trees within them. Shelterwood stands contain larger diameter trees providing overstory structure and future snag and large woody material recruitment. These residual trees contribute to diversity within otherwise uniform young stands. (Many older harvest units (logged prior to 1970) also have very large logs remaining from the original harvest, due to merchantability standards of the time. See Figure 3.5-7.)

Utilization standards changed and treatment of slash became standard practice during the period between 1970-90. Most of the existing snags, large woody material, and residual trees which could provide for recruitment of these habitat structures were removed. Forest Plan standards for snag and large woody material retention were adopted in 1990, resulting in an increased amount of wildlife tree and down log habitat left in harvest areas. Table 3.5-2 lists acres within the subwatersheds having intensive harvest treatments prior to 1970, from 1970 through 1989, and from 1990 to present. Figure 3.5-7 illustrates where harvest activity has occurred and can be applied to these three timeframes.

**Table 3.5-2.** Acres of Intensive Harvest Treatment for Three Timeframes

| Harvest Years | Harvest Code | Subwatershed Acres 20 1 | 20 2 | 20 3 | Total Acres | Sum Total 20(%) |
|---|---|---|---|---|---|---|
| ≤ 1969 | 110 | 2,660 | 1,727 | 66 | 4,453 | |
| | 130 | 0 | 67 | 10 | 77 | |
| | 141 | 0 | 0 | 0 | 0 | |
| | 143 | 0 | 0 | 0 | 0 | |
| | 150 | 0 | 0 | 0 | 0 | **4,753 (6.6%)** |
| | 160 | 56 | 0 | 0 | 56 | |
| | 231 | 151 | 16 | 0 | 167 | |
| | 232 | 0 | 0 | 0 | 0 | |
| | **total** | **2,867** | **1,810** | **76** | **4,753** | |
| **Percent of Watershed** | | | | | | |
| 1970 - 1989 | 110 | 1,685 | 1,442 | 463 | 3,590 | |
| | 130 | 197 | 452 | 364 | 1,013 | |
| | 141 | 18 | 0 | 0 | 18 | |
| | 143 | 0 | 137 | 0 | 137 | |
| | 150 | 0 | 3 | 0 | 3 | **10,543 (14.7%)** |
| | 160 | 594 | 325 | 688 | 1,607 | |
| | 231 | 804 | 1,170 | 1,726 | 3,700 | |
| | 232 | 0 | 475 | 0 | 475 | |
| | **total** | **3,298** | **4,004** | **3,241** | **10,543** | |
| **Percent of Watershed** | | | | | | |
| ≤ 1990 | 110 | 177 | 150 | 10 | 337 | |
| | 130 | 0 | 20 | 0 | 20 | |
| | 141 | 13 | 31 | 0 | 44 | |
| | 143 | 0 | 138 | 0 | 138 | |
| | 150 | 0 | 0 | 0 | 0 | **2,629 (3.7%)** |
| | 160 | 6 | 0 | 9 | 15 | |
| | 231 | 0 | 285 | 1,757 | 2,042 | |
| | 232 | 0 | 33 | 0 | 33 | |
| | **total** | **196** | **657** | **1,776** | **2,629** | |
| **Percent of Watershed** | | | | | | **17,925 (25%)** |
| Total Watershed Acreage | | | | | | **71,770** |

*Table Legend (harvest codes): 110 = clearcut 130 = shelterwood cut 141 = shelterwood removal 143 = overstory removal 150 = Selection cut 160 = Partial removal 231 = Mortality salvage 232 = Sanitation salvage*

## WILDLIFE GUILDS

Species guilds include those groups of species with various home range sizes that prefer specific types and arrangements of habitat. A process (HABSCAPES) was utilized for identifying and mapping habitat for wildlife guilds at a landscape level. This model (Mellen et al. 1994) was run on reference and current vegetation conditions. Mapped results can be compared to determine differences in quality and distribution of guild habitats.

Appendix E provides lists of species and their guild habitat associations as well as guild maps for guilds which are not presented in this chapter (Figures 3.5-1 to 3.5-6). The following guilds are expected to have been most affected by change between reference and current time frames:

## Edge and Early-Seral Habitat

Contrast guilds include those species that prefer distinct edges between open areas or early-seral stands, and late-seral or old-growth forests for breeding and/or foraging. Early seral guilds include species that use open habitats such as non-forested areas and very young forest stands.

REFERENCE CONDITION

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. The map of terrestrial large home range contrast (TLC) guild habitat (Figure 3.5-1) displays the largest tracts of edges of fire mosaics with early-seral components in the early 1900's, as well as the larger natural meadow complexes with adjacent large live tree stands.

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). The map of large home range mosaic early-seral (TLME) guild habitat during reference timeframe is displayed in Figure 3.5-3.

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 depending on how long they developed prior to the next disturbance.

CURRENT CONDITION

Portions of the watershed, especially the western and central areas (Subwatersheds 20 1 and 20 2) have become highly fragmented as a result of intensive harvest, primarily clearcutting, within the past five 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 had little clearcutting activity, resulting in less fragmentation and less contrast habitat (Subwatershed 20 3) and elsewhere in the watershed, unless numerous natural openings are interspersed among forested areas. The map of terrestrial, large home range contrast (TLC) guild habitat (Figure 3.5-2 of this section) shows the largest tracts of highly fragmented habitat along with the larger forest-meadow complexes with timbered edges.

Forest fragmentation and stand replacing fires 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). Compare current terrestrial, large home range mosaic early-seral (TLME) habitat (Figure 3.5-4) with reference TLME habitat (Figure 3.5-3).

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.

## Interior Forest Habitat

REFERENCE CONDITION

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. Figure 3.5-5 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.

CURRENT CONDITION

Forest fragmentation, 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. Minimum fragmentation strategies tend to retain habitat suitability for these guilds in areas where harvest is avoided, but habitat is removed in harvested areas. Current habitat conditions for TLML guild is shown in Figure 3.5-6.

## ELK HABITAT

Elk are large home range contrast species (Guild TLC, see Figure 3.5-1 and 3.5-2). They generally forage in open areas where preferred plant species are found and seek shelter in late-seral or old-growth forests. Elk populations tend to respond most favorably to habitats that contain an abundance of herbaceous and shrub forage species near thermal and hiding cover. The quantity and quality of forage species available will drastically affect where elk spend a majority of time. Open areas with an abundance of herbaceous forage tend to have more elk use (if the area is within their home range, accessible and proximate to cover) compared to areas with lower amounts of forage species. Meadows and forest stands less than approximately 20 years of age: tend to support relatively high quality foraging areas.

REFERENCE CONDITION

The historic distribution of high quality foraging areas within the Salt Creek watershed most likely was a combination of valley floors with open canopies, patches of windthrow and upland burn areas and meadows. The combination of valley floor foraging areas, meadows, and old burned areas that were so prominent more than 100 years ago, probably sustained elk populations. Road density and associated disturbance were not present in reference timeframe though animals were exposed to human activity and hunting pressure at much lower levels than in current condition.

CURRENT CONDITION

During the early 1900's fire control reduced the amount of foraging areas available from fire effects, however clear-cut silvicultural practices that began in the mid 1900's increased the amount and distribution of elk foraging areas. Elk habitat capability can be generally enhanced by increased forest fragmentation if other factors such as disturbance (road densities) and cover are considered. 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 land management practices such as harvest intensity, silvicultural practices, fuels treatments, and road building. Naturally occurring features such as meadows and other non-forested areas also affect elk habitat quality. Habitat effectiveness may also have been altered by fire suppression which may have changed the abundance and arrangement of natural foraging areas.

Big game are negatively affected by high open road densities. Animals may avoid areas with numerous roads or may be exposed to additional stress and energy expenditure triggered by escape response to disturbance. Table 3.4-3 displays landscape area in proximity to roads within this watershed.

Current Habitat Effectiveness Indices for the 10 Elk Emphasis Areas in this watershed are summarized in Table 3.5-3.

**Table 3.5-3.** Current Elk Habitat Effectiveness

| BGEA | Emphasis | Individual Indices (*) | | | | Overall Index (*) |
|---|---|---|---|---|---|---|
| **Name** | **Level** | **HEs** | **HEr** | **HEc** | **HEf** | **HEI** |
| Abernathy | Moderate | .71 | .48 (.43) | .63 | .37 | .53 (.52) |
| Basin | High | .76 | .43 | .61 | .47 | .55 |
| David Douglas | Moderate | .76 | .56 | .75 | .28 | .55 |
| Eagle Head | High | .88 | .42 | .60 | .54 | .59 |
| Fall Creek | High | .62 | .55 | .59 | .46 | .55 |
| Hatchery | Moderate | .90 | .39 | .62 | .41 | .55 |
| Noisy | Low | .84 | .44 | .63 | .38 | .55 |
| Salt Head | Low | .64 | .86 | .64 | .19 | .51 |
| Skyline | High | .68 | .86 | .86 | .27 | .61 |
| Wicopee Fields | Moderate | .83 | .36 | .52 | .43 | .51 |

*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 of cover and forage areas*
*HEr - open road density*
*HEc - cover quality*
*HEf - forage quantity and quality*
*HEI - overall*

*(*) ATM Method*

## HABITAT CONNECTIVITY AND DISPERSAL

### REFERENCE CONDITION

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. Late-seral habitats were contiguous primarily on north slopes of lowest reaches and in glacial valleys and slopes on the highest reaches of the watershed. Figure 3.4-1 displays a potential map of historic (1920) late-seral and old-growth forest blocks.

### CURRENT CONDITION

Landscape connectivity of habitat varies depending on the previous or current management allocation. Areas that have been included as Spotted Owl Management Areas (SOMAs), later replaced by Spotted Owl Habitat Areas (SOHAs), combined with Habitat Conservation Areas (HCAs), presently known as Late-Successional Reserves (LSRs) are relatively less fragmented and often have better connectivity than areas within allocations available for harvest. Areas within wilderness, roadless areas, and other relatively inaccessible areas normally have the highest potential level of connectivity.

Areas that have been historically managed as general forest and scenic management areas typically have lower levels of forest habitat connectivity. Figure 3.4-2 displays a map of areas that are currently unharvested late-seral and old-growth forests. Figure 3.5-8 of this section displays current condition of areas presently under no-harvest allocation including harvested portions by age class.

The current connectivity and riparian habitat condition is presented in Table 3.5-4. The current condition of lands presently under harvest allocation within this watershed is presented in Table 3.5-5.

**Table 3.5-4.** Landscape Connectivity and Amount of Harvest Activity by Decade by Subwatershed

**Subwatershed 20 1**

| Decade of Harvest | Harvest in Riparian (acres) | Harvest in Upland (acres) | Harvest Total (acres) |
|---|---|---|---|
| 1940-49 | 81 | 80 | 161 |
| 1950-59 | 452 | 748 | 1,200 |
| 1960-69 | 549 | 957 | 1,506 |
| 1970-79 | 497 | 900 | 1,397 |
| 1980-89 | 693 | 1,208 | 1,901 |
| 1990-95 | 63 | 134 | 197 |
| **TOTAL** | **2,335** | **4,027** | **6,362** |

**Subwatershed 20 2**

| Decade of Harvest | Harvest in Riparian (acres) | Harvest in Upland (acres) | Harvest Total (acres) |
|---|---|---|---|
| 1940-49 | 167 | 265 | 432 |
| 1950-59 | 51 | 23 | 74 |
| 1960-69 | 400 | 903 | 1,303 |
| 1970-79 | 433 | 867 | 1,300 |
| 1980-89 | 985 | 1,720 | 2,705 |
| 1990-95 | 117 | 540 | 657 |
| **TOTAL** | **2,153** | **4,318** | **6,471** |

**Subwatershed 20 3**

| Decade of Harvest | Harvest in Riparian (acres) | Harvest in Upland (acres) | Harvest Total (acres) |
|---|---|---|---|
| 1940-49 | 0 | 0 | 0 |
| 1950-59 | 0 | 0 | 0 |
| 1960-69 | 9 | 67 | 76 |
| 1970-79 | 206 | 597 | 803 |
| 1980-89 | 974 | 1,464 | 2,438 |
| 1990-95 | 613 | 1,154 | 1,767 |
| **TOTAL** | **1,802** | **3,282** | **5,084** |

**Total Harvested = 17,917 Acres**

**Table 3.5-5.** Current Condition of Lands Available for Programmed Harvest

**Subwatershed 20 1**

| | | Seral Stage | | | |
|---|---|---|---|---|---|
| **Management Allocation** | **Total acres** | **SI (0-30 yrs)** | **SE (31-80 yrs)** | **UR (81-200 yrs)** | **LS/OG (201+ yrs)** |
| 11A | 2,883 | 128 | 16 | 1,909 | 831 |
| 11C | 1,209 | 42 | 0 | 937 | 229 |
| 11E | 194 | 34 | 0 | 89 | 72 |
| 11F | 742 | 52 | 21 | 261 | 409 |
| 14A | 724 | 48 | 6 | 512 | 157 |

**Subwatershed 20 2**

| | | Seral Stage | | | |
|---|---|---|---|---|---|
| **Management Allocation** | **Total acres** | **SI (0-30 yrs)** | **SE (31-80 yrs)** | **UR (81-200 yrs)** | **LS/OG (201+ yrs)** |
| 10A | 153 | 6 | 16 | 88 | 46 |
| 11A | 808 | 65 | 22 | 559 | 163 |
| 11C | 2,417 | 222 | 18 | 1,736 | 441 |
| 11F | 769 | 23 | 15 | 558 | 174 |
| 14A | 3,968 | 268 | 26 | 2,138 | 1,536 |

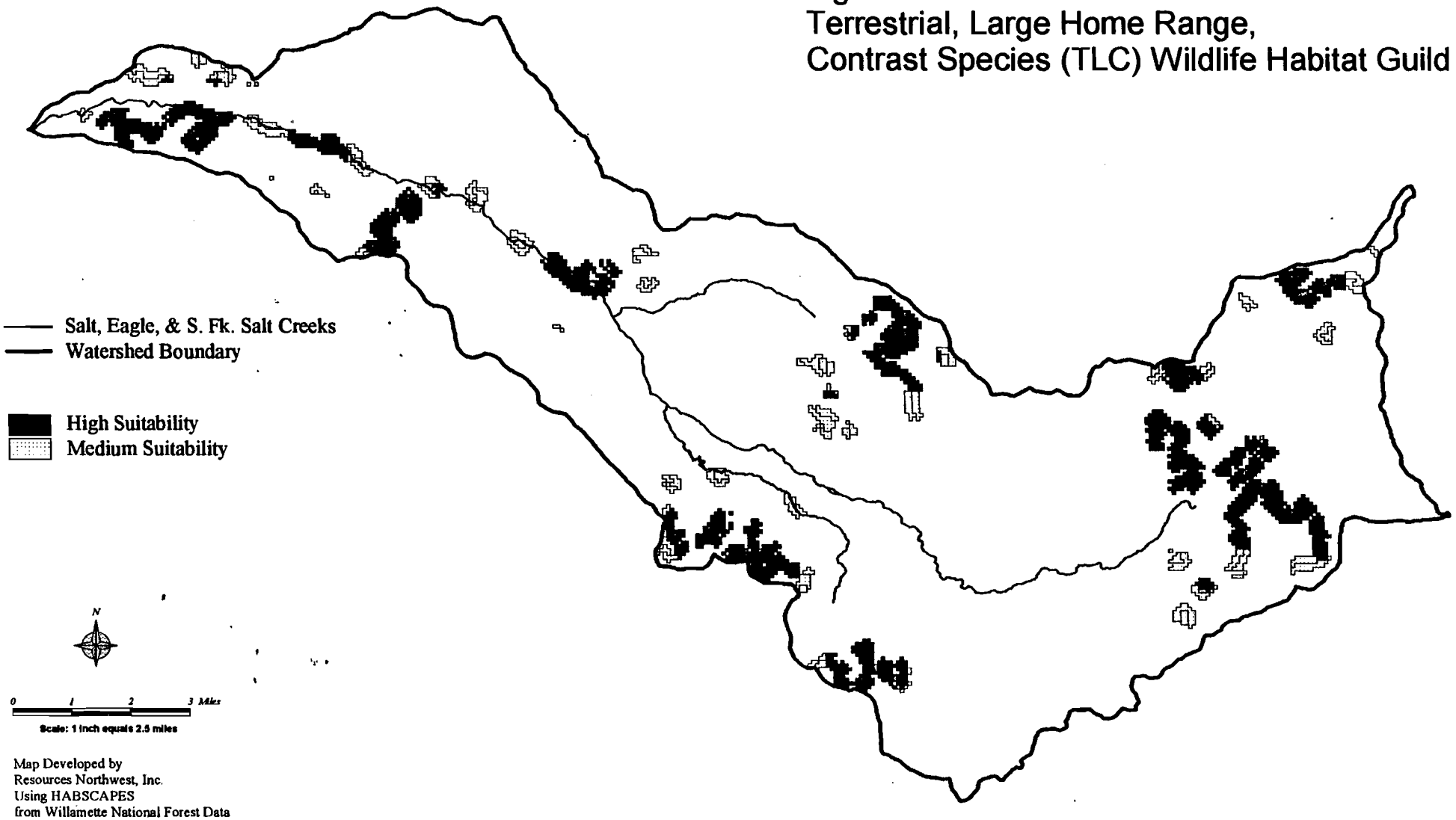
**Subwatershed 20 3**

| | | Seral Stage | | | |
|---|---|---|---|---|---|
| **Management Allocation** | **Total acres** | **SI (0-30 yrs)** | **SE (31-80 yrs)** | **UR (81-200 yrs)** | **LS/OG (201+ yrs)** |
| 11C | 2,051 | 116 | 12 | 932 | 992 |
| 11F | 933 | 171 | 0 | 420 | 341 |

*SI = stand initiation (0 - 30 year old stand)* *SE = stem exclusion (31 - 80 year old stand)*
*UR = understory reinitiation (81 - 200 year old stand)* *LS/OG = late-successional/old-growth (201+ year old stand)*

# Salt Creek Watershed Analysis

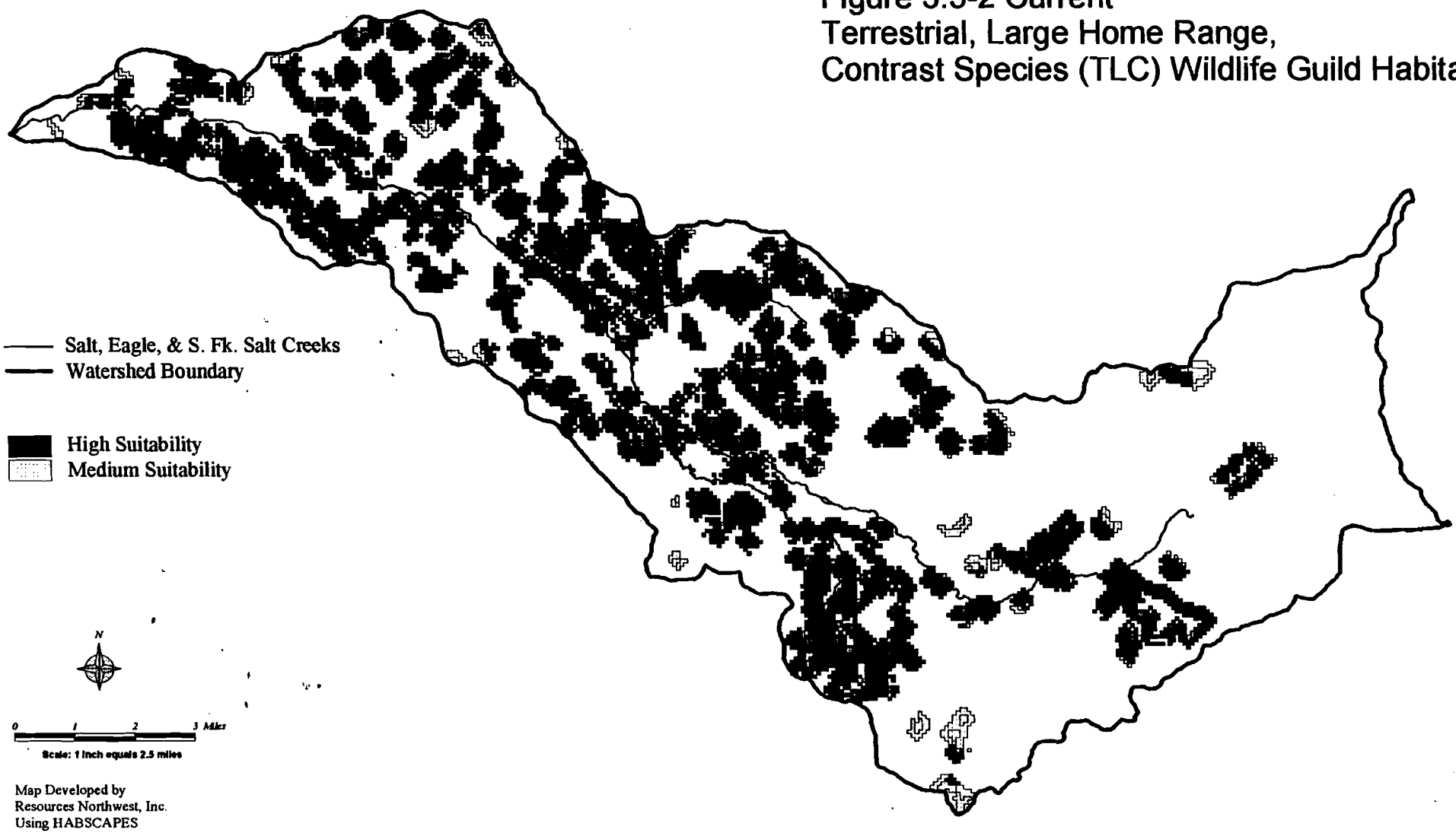
Figure 3.5-1 Historic
Terrestrial, Large Home Range,
Contrast Species (TLC) Wildlife Habitat Guild




Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

# Salt Creek Watershed Analysis

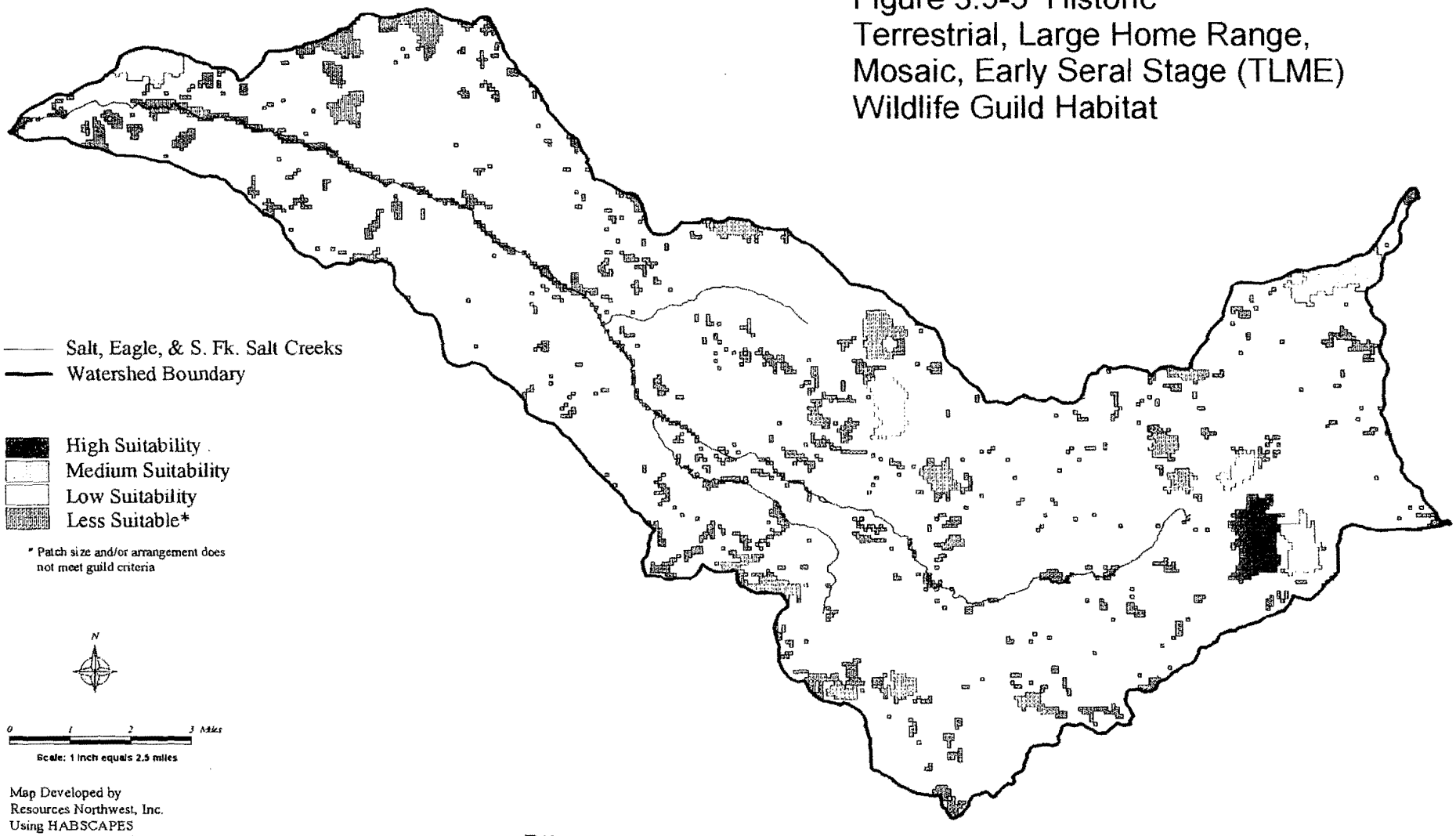
Figure 3.5-2 Current
Terrestrial, Large Home Range,
Contrast Species (TLC) Wildlife Guild Habitat




Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

# Salt Creek Watershed Analysis

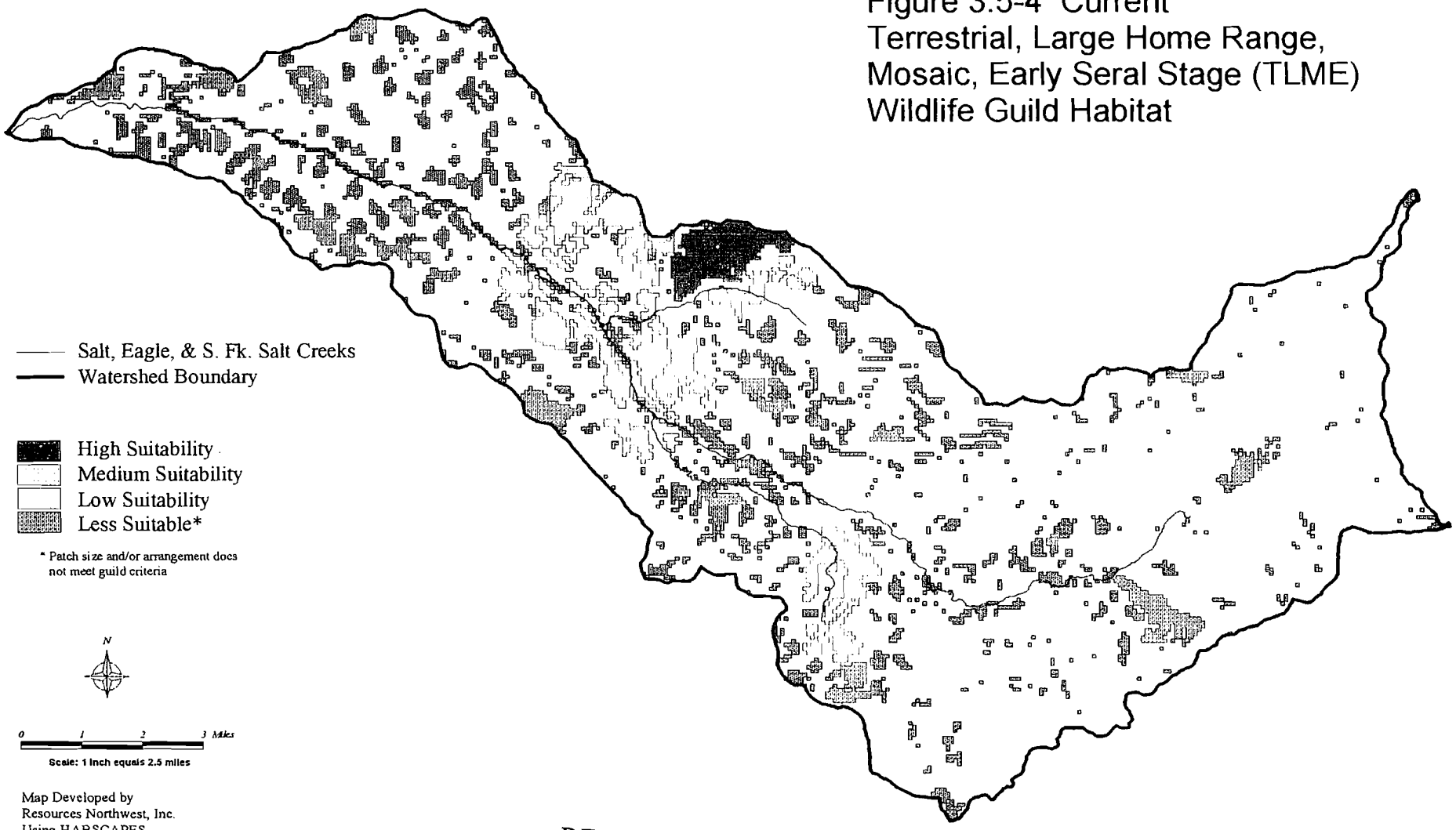
Figure 3.5-3 Historic Terrestrial, Large Home Range, Mosaic, Early Seral Stage (TLME) Wildlife Guild Habitat




Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

# Salt Creek Watershed Analysis

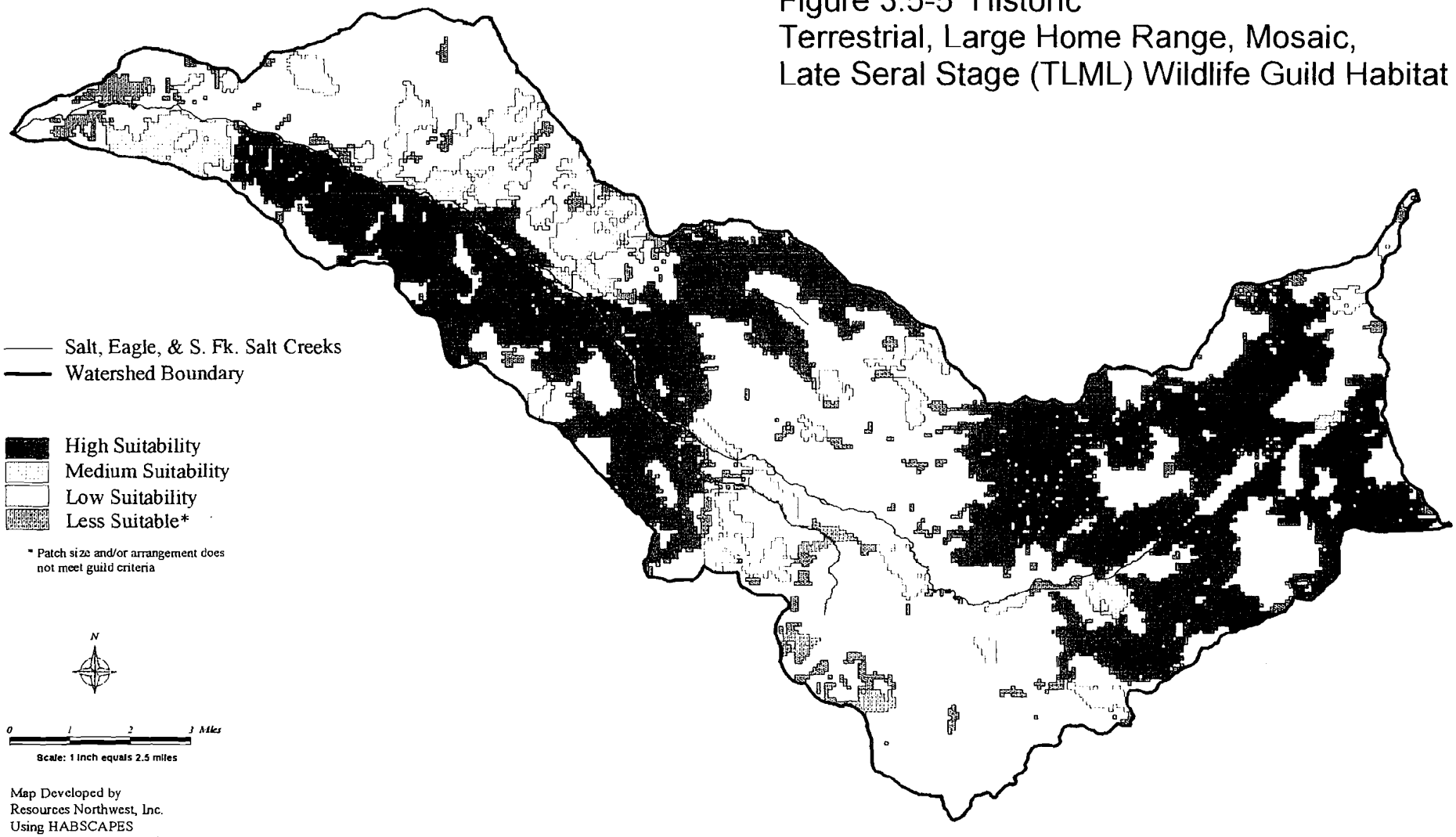
Figure 3.5-4 Current
Terrestrial, Large Home Range,
Mosaic, Early Seral Stage (TLME)
Wildlife Guild Habitat




Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

# Salt Creek Watershed Analysis

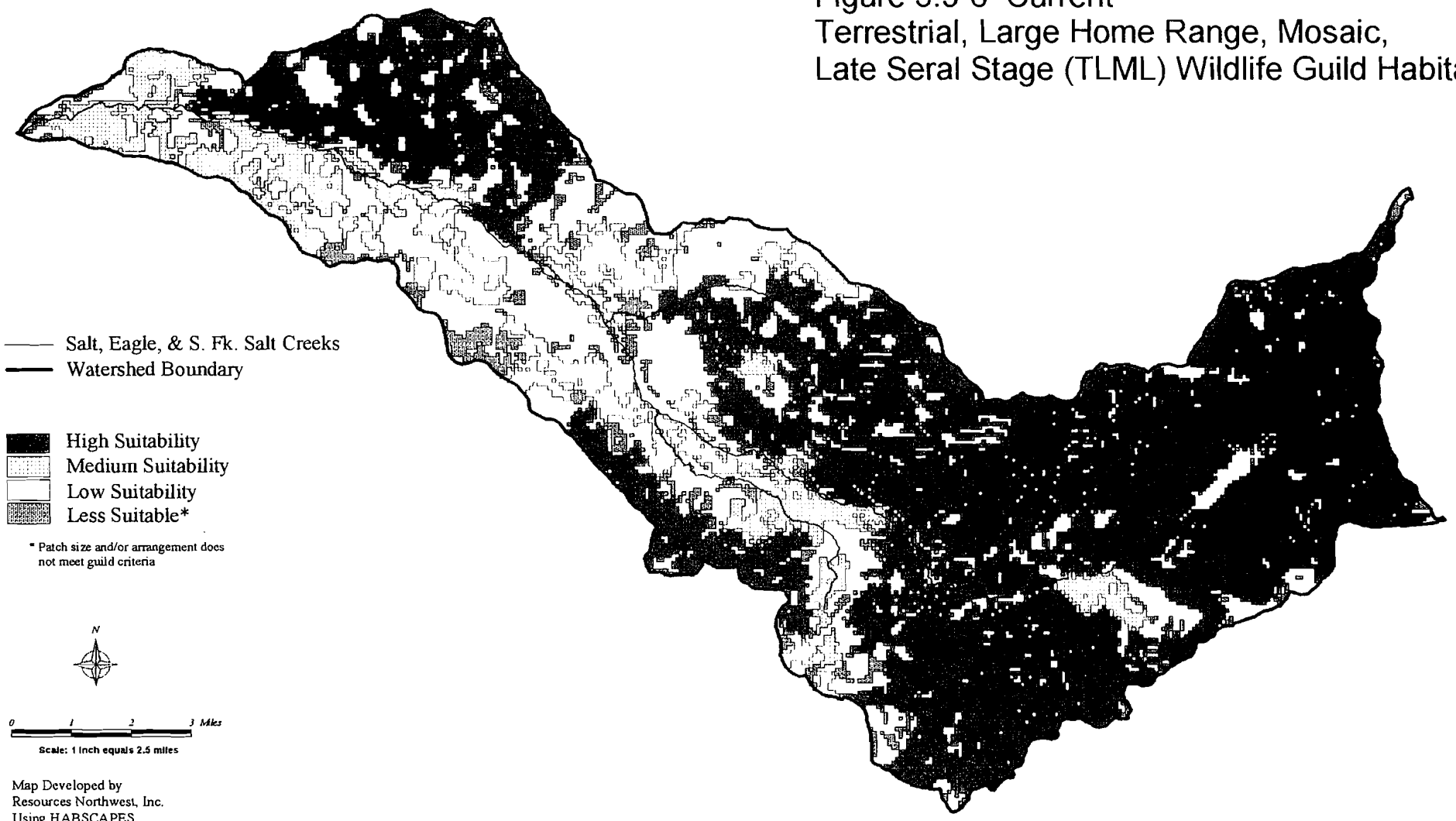
Figure 3.5-5 Historic
Terrestrial, Large Home Range, Mosaic,
Late Seral Stage (TLML) Wildlife Guild Habitat




Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

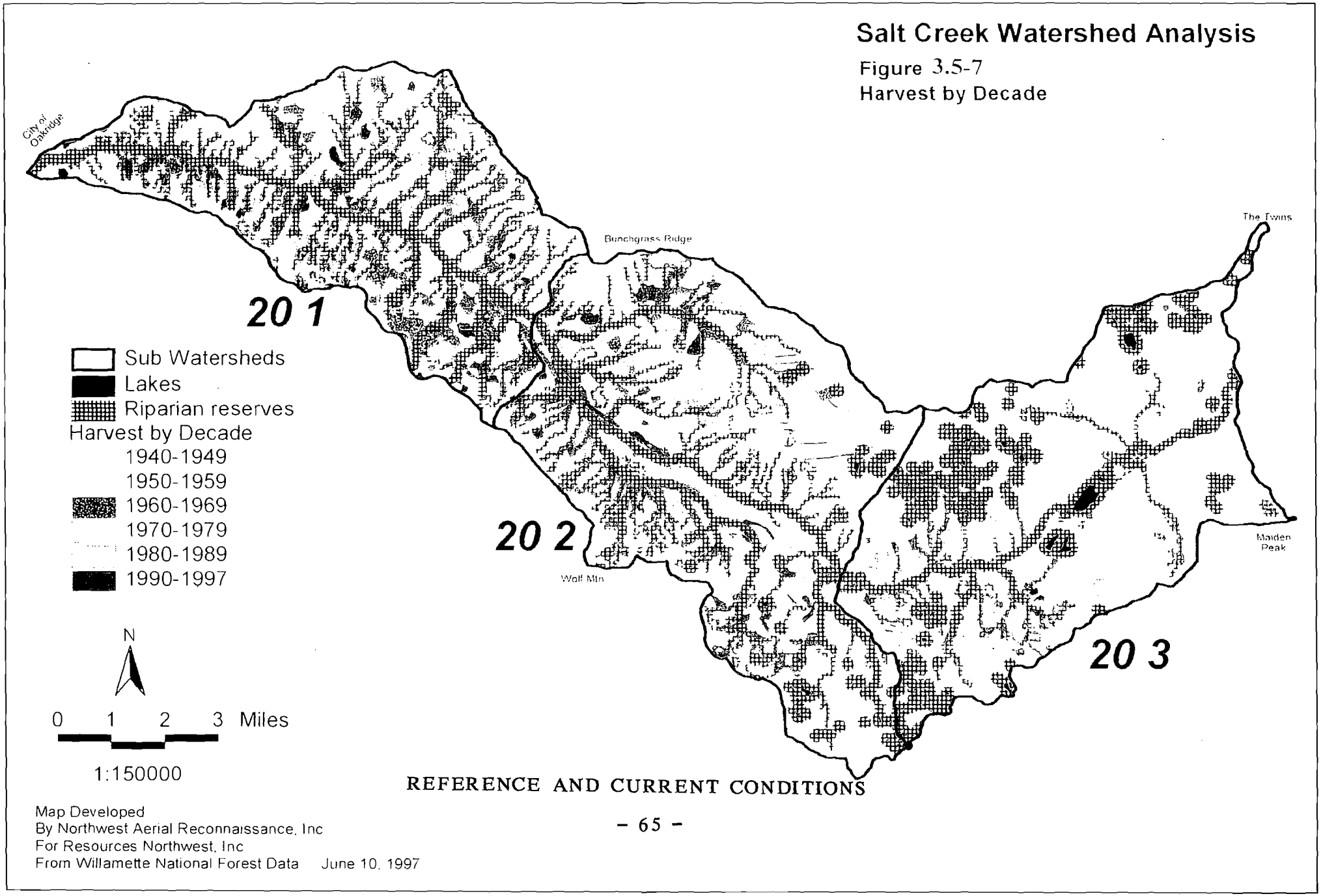
# Salt Creek Watershed Analysis

Figure 3.5-6 Current
Terrestrial, Large Home Range, Mosaic,
Late Seral Stage (TLML) Wildlife Guild Habitat



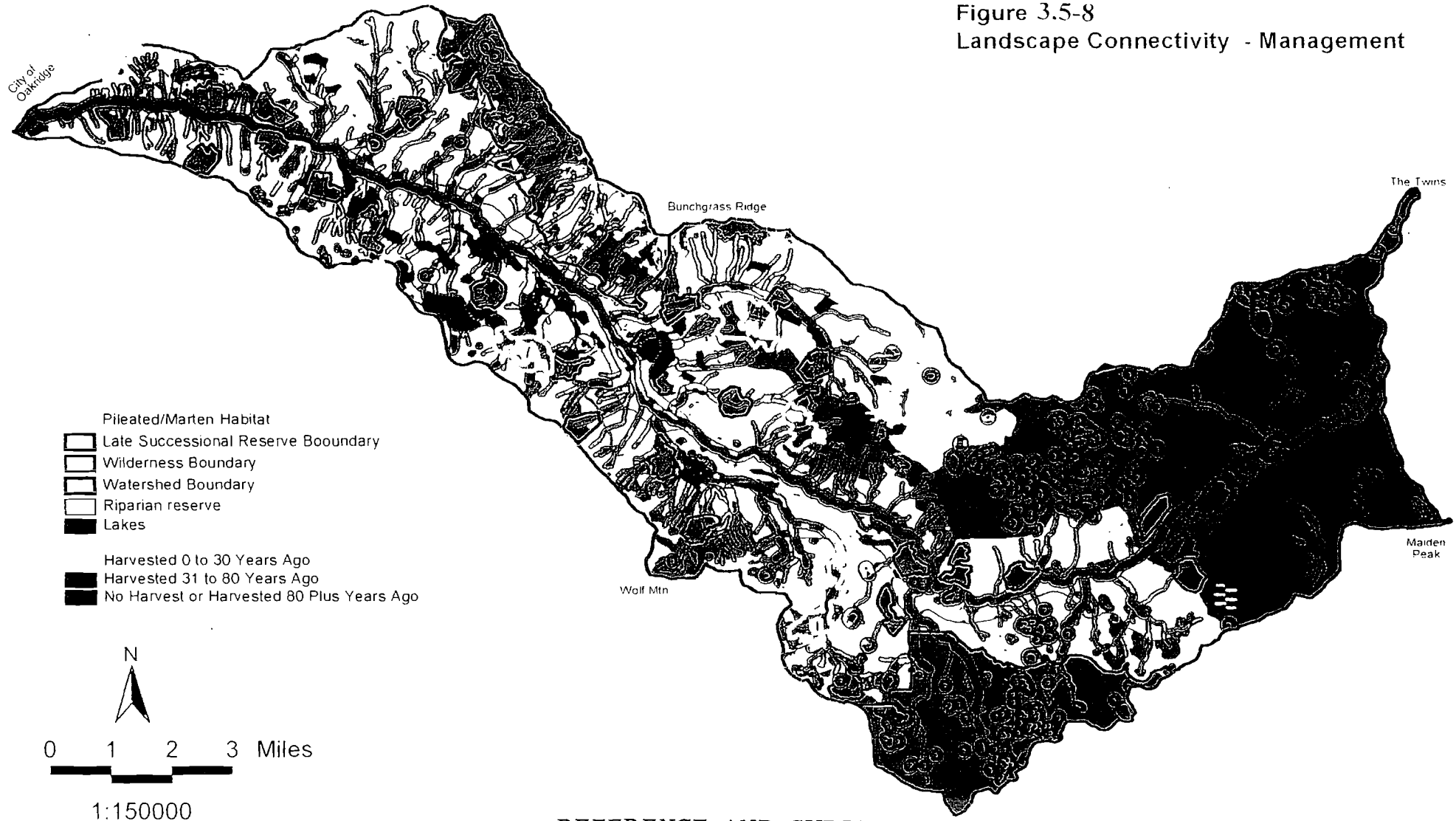

Map Developed by
Resources Northwest, Inc.
Using HABSCAPES
from Willamette National Forest Data
July 30, 1997

REFERENCE AND CURRENT CONDITION


Salt Creek Watershed Analysis
Figure 3.5-7
Harvest by Decade
City of Oakridge
Bunchgrass Ridge
The Twins
Wolf Mtn
Maiden Peak
20 1
20 2
20 3
Sub Watersheds
Lakes
Riparian reserves
Harvest by Decade
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1997
N
0 1 2 3 Miles
1:150000
Map Developed
By Northwest Aerial Reconnaissance, Inc
For Resources Northwest, Inc
From Willamette National Forest Data June 10, 1997

# Salt Creek Watershed Analysis

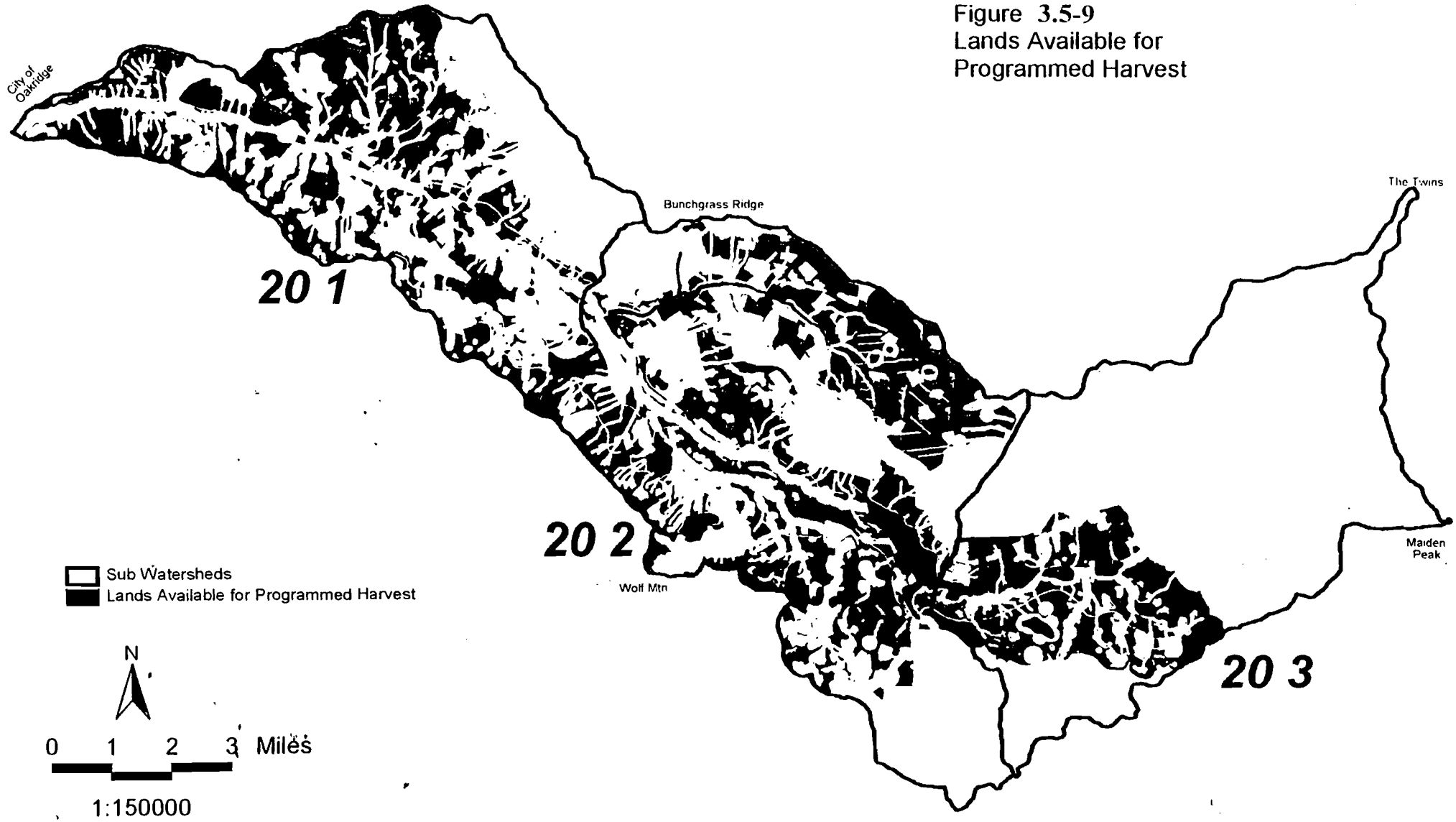
Figure 3.5-8
Landscape Connectivity - Management




Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc
From Willamette National Forest Data June 10, 1997

## Salt Creek Watershed Analysis

Figure 3.5-9
Lands Available for
Programmed Harvest




Map Developed
By Northwest Aerial Reconnaissance, Inc.
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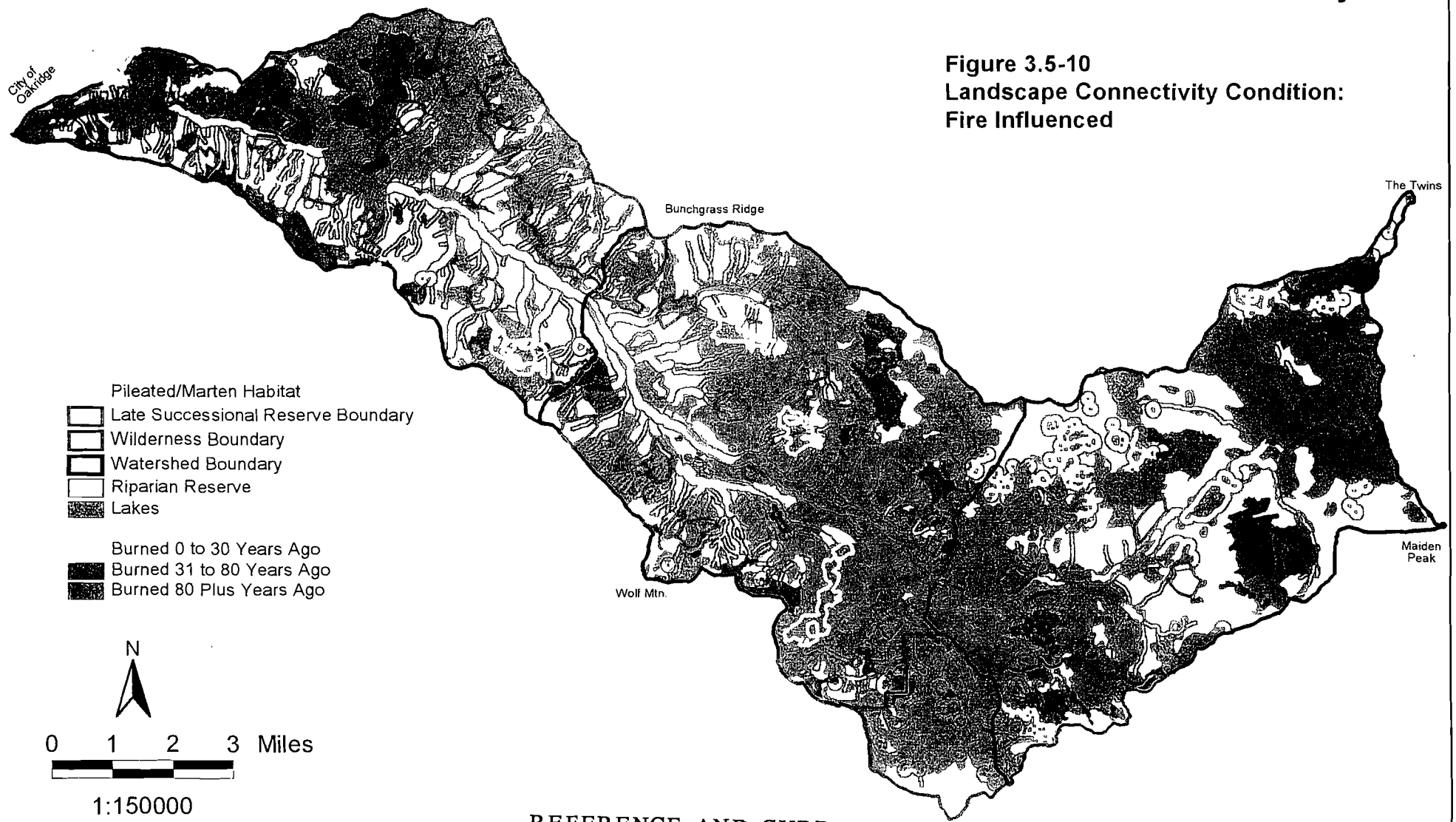
From Willamette National Forest Data June 10, 1997

# Salt Creek Watershed Analysis

**Figure 3.5-10**
**Landscape Connectivity Condition:**
**Fire Influenced**




REFERENCE AND CURRENT CONDITIONS

Map Developed
By Northwest Aerial Reconnaissance, Inc.
For Resources Northwest, Inc.
From Willamette National Forest Data June 10, 1997

## AMPHIBIANS AND REPTILES

REFERENCE CONDITION

There is no historical information regarding amphibians and reptiles. Amphibian populations were presumed abundant and stable at the landscape level during reference timeframe. However, large scale fire events may have significantly influenced localized populations by altering shade, humidity and cover within burned areas and by triggering sediment and ash transport into aquatic habitats.

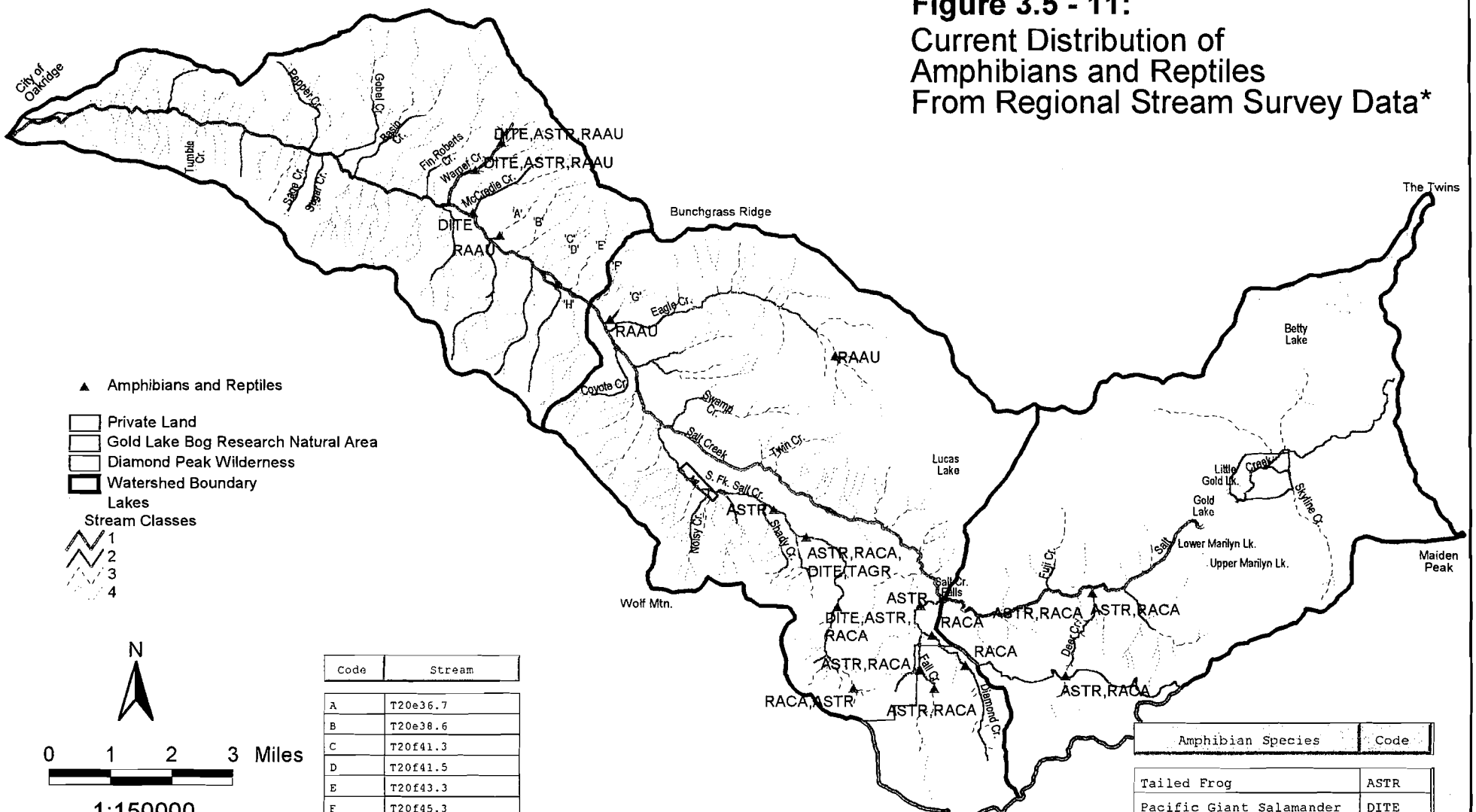
CURRENT CONDITION

Comprehensive surveys for amphibians and reptiles have not occurred in this watershed. Current amphibian distribution data comes from Region 6 stream inventories conducted from 1992 and 1996 (Table 3.5-6). This table does not reflect all species or locations known or potentially occurring in the watershed. Additional information on probable habitat is provided in Appendix G. Current land management practices and fish stocking in naturally fishless lakes from the early 1900's through the 1980's has likely affected native amphibian populations.

**Table 3.5-6.** Amphibian Distribution in the Salt Creek Watershed (Stream Survey Data)

| Common Name | Species Code | Location | Elev. (feet) | Stream Class | Valley Segment Type | Rosgen Channel Type |
|---|---|---|---|---|---|---|
| *Pacific Giant Salamander* | DITE | Warner Creek | 1950-3300 | I | V2, H2 | Aa+ |
| | | S.Fork Salt Creek | 4500 | I | U1 | C |
| *Cascades Frog* | RACA | Deer Creek | 4330-5130 | II | M1, V2, H1 | Aa+, A |
| | | Fall Creek | 4500-5000 | II | V1, U2 | A, G |
| | | S. Fork Salt Creek | 4360-5320 | II | U1, V2 | C, Aa+ |
| *Red-legged Frog* | RAAU | Trib 20e 36.7 | 2050 | III | Valley code 1 | NA |
| | | Trib 20f 46.3 | 2250 | III | H1 | A |
| | | Eagle Creek | 4720 | II | H2 | Aa+ |
| | | Warner Creek | 2640-3300 | I | V2, H2 | Aa+ |
| *Tailed Frog* | ASTR | Deer Creek | 4330-5130 | II | M1, V2, H1 | A, G |
| | | Warner Creek | 2640-3300 | I | V2, H2 | Aa+ |
| | | Fall Creek | 4280-5000 | II | V1, U2 | A, G |
| | | S. Fork Salt Creek | 3000-5400 | II | U1, V2 | C, Aa+ |
| *Rough-skinned Newt* | TAGR | S. Fork Salt Creek | 3000-3860 | II | U1, V2 | C, Aa+ |
| *Spotted Frog* | RAPR | Gold Lake | 4813 | II | | |

# Salt Creek Watershed Analysis
## Figure 3.5 - 11:
Current Distribution of Amphibians and Reptiles From Regional Stream Survey Data*




| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |

| Amphibian Species | Code |
|---|---|
| Tailed Frog | ASTR |
| Pacific Giant Salamander | DITE |
| Red-legged Frog | RAAU |
| Cascades Frog | RACA |
| Rough-skinned Newt | TAGR |

* This map does not reflect all species or locations known or potentially occurring in the watershed. See Appendix G for additional information on probable habitat.

# AQUATIC WILDLIFE AND HABITAT, TES SPECIES

## THREATENED, ENDANGERED, AND SENSITIVE SPECIES

REFERENCE CONDITION

There were no aquatic TES species prior to land management activities in the Salt Creek watershed.

CURRENT CONDITION

There are no current aquatic TES species that occur in the Salt Creek watershed. Bull trout (*Salvelinus confluentus*), currently listed as sensitive by the State of Oregon, are extirpated from the watershed.

## ANADROMOUS AND RESIDENT SALMONIDS

REFERENCE CONDITION

**Anadromous Salmonids**

Existing data reveal the presence of adult chinook salmon (*Oncorhynchus tshawytscha*) during 1937 ground surveys within Salt Creek mainstem (Appendix H). Hatchery spring chinook have been periodically released into the Middle Fork of the Willamette Drainage since 1917. Steelhead trout (*O. mykiss*) an anadromous form of the rainbow trout, are also believed to have occurred in Salt Creek, as steelhead were collected below Dexter Dam on the Middle Fork of the Willamette River between 1957 and 1966 (Hutchinson 1966).

Historically anadromous salmonids were able to use approximately 25 miles of habitat within the mainstem of Salt Creek (up to Salt Creek Falls), South Fork Salt Creek and Eagle Creek as well as the lower reaches of some of the larger tributaries in the basin (Figure 3.6-1).

Noted in the 1937 survey of Salt Creek was a State fish rack (weir) operated by the Oregon State Fish Commission and located on the Middle Fork Willamette river downstream from the confluence of Salt Creek. The fish rack was an adult chinook collection point intended for hatchery propagation, thus this weir prevented upstream migration of chinook adult spawners. The date when the fish rack was operational is unknown. The 1937 surveyor observed adult spawners in Salt Creek because the rack had washed out the previous Spring. The 1937 late August/early September survey counted 87 adult chinook spawners, with the majority observed in the first 13 miles (86 percent of the fish sighted). When the rack was operational, chinook were probably excluded from the entire Salt Creek drainage.

**Resident Salmonids**

Native resident salmonids that evolved in streams of the western Cascades and were present in the Salt Creek watershed include: Char (*Salvelinus spp*); bull trout (*S. confluentus*); Trout (*Oncorhynchus spp*): cutthroat (*O. clarki*) and rainbow (*O. mykiss*); Whitefish (*Prosopium spp*): mountain whitefish (*P. williamsoni*); and sculpin (*Cottus spp*); dace (*Rhinichthys spp*); large scale suckers (*Catostomus spp*); squawfish (*Ptychochellos spp*); and redsided shiners (*Richardsonus balteatus*).

Bull trout are presumed to have inhabited the Salt Creek watershed, though historical data available to verify this assumption is limited to a photo from the 1930's (Oakridge R.D.) of anglers holding a presumed bull trout or dolly varden. Bull trout were known to inhabit nearby Salmon Creek, a tributary to the Middle Fork of the Willamette River (Salmon Creek Watershed Analysis) as well as the mainstem Middle Fork of the Willamette River.

CURRENT CONDITION

**Anadromous Salmonids**

Currently there are no anadromous runs of salmon or steelhead in the Salt Creek drainage. A limited number of spring chinook juvenile fingerlings were released (by ODFW) at the confluence of Salt Creek and the Middle Fork Willamette River in June of 1996 and January of 1997 (ODFW, pers. comm). Numbers of fish released in 1996 were one stocking with 93,779 fish (966 lbs) and another with 97,480 fish (1026 lbs). The 1997 release totaled 101,890 juvenile fingerlings (ODFW, pers. comm). Currently, the Salt Creek watershed is managed for anadromous fish with the idea that in the future passage over the dams may be possible.

It is not known historically to what extent or volume Chinook salmon permeated the drainage. It is estimated that a total of 215 miles of stream historically accessible to salmon and steelhead were blocked by the construction of Dexter and Lookout Dams. This estimate includes Salmon Creek, the North Fork of the Middle Fork of the Willamette Rive Salt Creek, Hills Creek, and the Upper Middle Fork of the Willamette River (Willamette Basin Task Force, 1969). Approximately 25 miles of this habitat was available in the Salt Creek basin. The Lookout and Dexter Dams were erected on the Middle Fork Willamette River downstream from the confluence of Salt Creek in the 1950's by the Army Corps of Engineers to provide water supply and regulate flooding. Lacking passage facilities, both structures prevent upstream migration of salmon and steelhead.

**Resident Salmonids**

Currently, bull trout are thought to be extirpated from the Salt Creek drainage although anglers have reported catching bull trout in 1992 & 1996 in the lower. Data collected does not reveal the presence of bull trout in any of the streams surveyed from 1937 to the present in the Salt Creek watershed. Suitable habitat (low gradient, cold water streams) for bull trout still exists in the upper watershed and many of the tributaries (especially Eagle Creek and the upper reaches of South Fork Salt Creek).

Native resident salmonids currently present in the watershed include cutthroat trout (*O. clarki*) & rainbow trout (*O. mykiss*), and mountain whitefish (*Prosopium williamsoni*) (Figure 3.6-2). Brook trout (*Salvelinus fontinalis*), is the only known non-native resident fish species currently inhabiting the Salt Creek drainage.

Ranges of fish presence are varied throughout the watershed. Typically, rainbow trout populate lower reaches of Salt Creek and its tributaries though they are observed in the upper reaches above Salt Creek Falls. The lower part of Salt Creek and Gold Lake has been stocked with rainbow trout by ODFW. Cutthroat trout typically inhabit upper reaches of streams but as with the rainbows, can be found throughout stream sections.

Many lakes have been stocked with brook trout, rainbow trout and cutthroat trout. Some lakes contain naturally reproducing populations of trout while others are stocked regularly of ODFW. There are known populations of brook trout in the upper reaches of Salt Creek above the falls as well as in Fall Creek, Diamond Creek, and Deer Creek.

## SALMONID HABITAT CONDITIONS

### Salmonid Limiting Factor Analysis - Physical Habitat Requirements

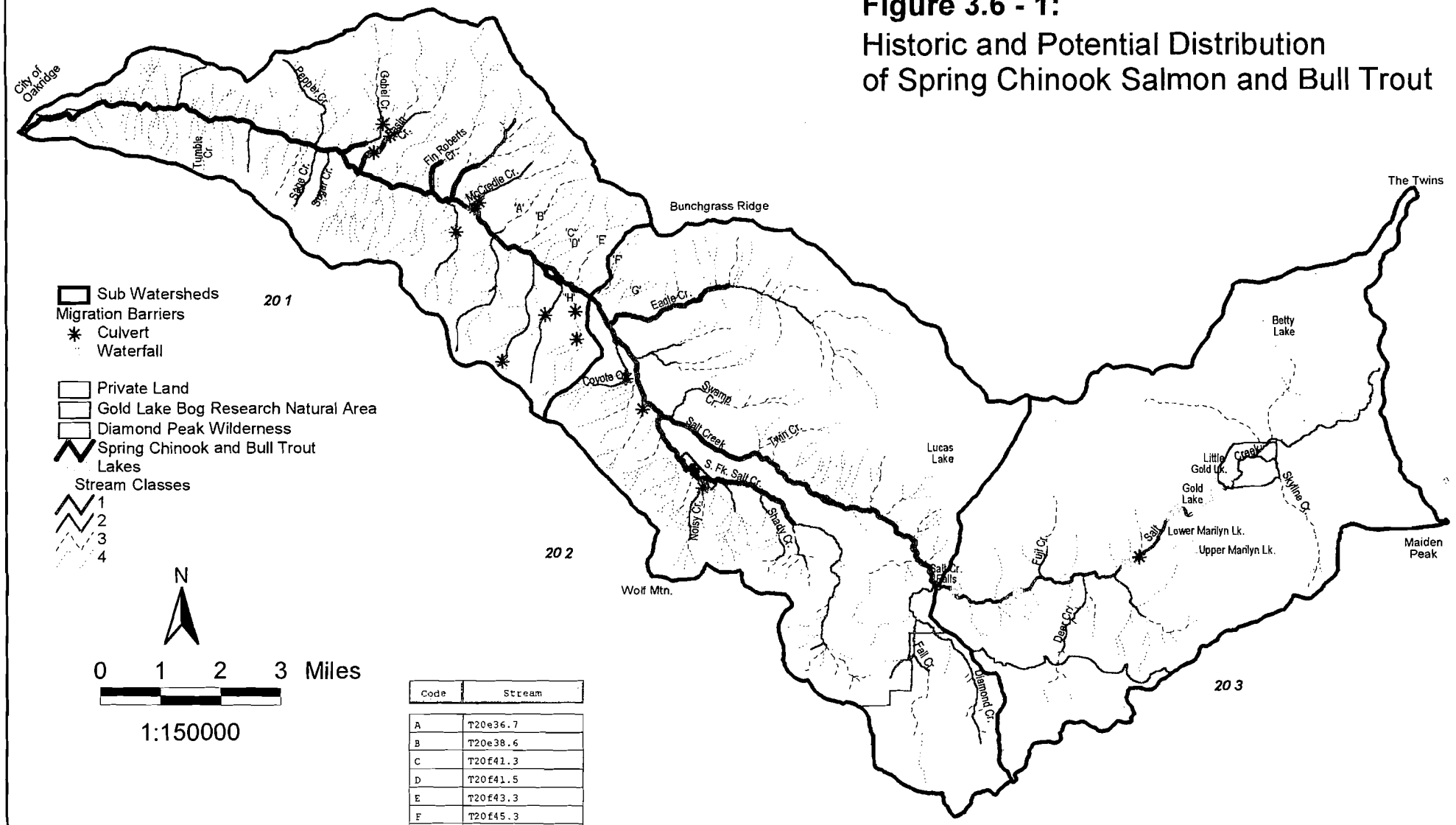
The Limiting Factor Analysis: an Overview

The purpose of a limiting factor analysis is to determine the physical habitat parameters that are thought to be currently limiting to resident salmonid populations. Restoration objectives can then be identified for the improvement of habitat conditions.

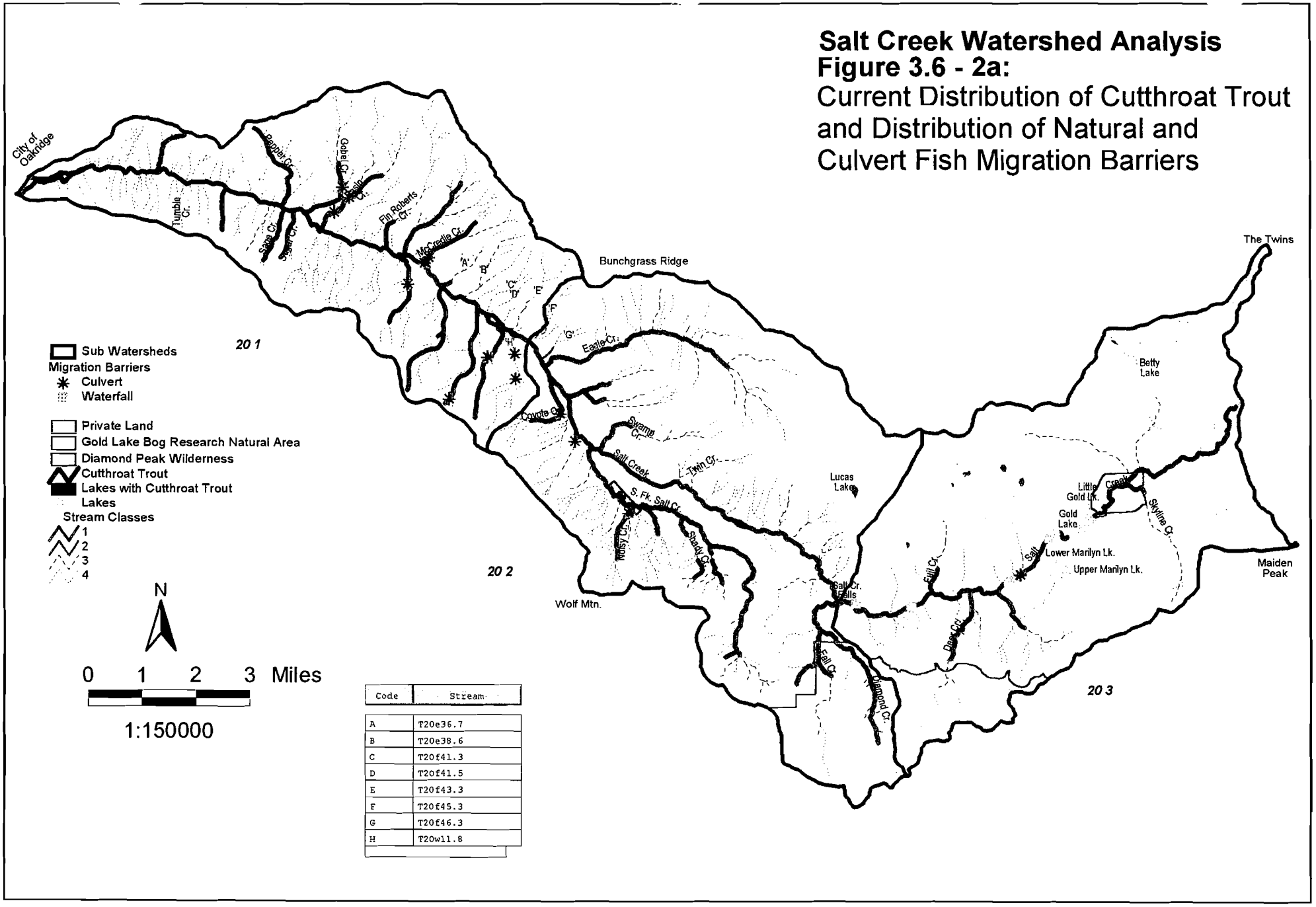
In general, salmonids require four kinds of habitat throughout their lifetime. These include adult, spawning, rearing and overwintering habitats (Behnke, 1992). All of these habitats are important, and a lack of any one of these may be sufficient to limit the potential size and overall health of the population. Temperature and large wood are also included in this analysis, as temperature may be a limiting factor for salmonids during various life stages. Large wood provides cover and is a major forming factor of many of the habitat types necessary for healthy salmonid populations. Parameters other than habitat, such as food, may also limit populations. However, it is thought that physical habitat is often more limiting than food (Behnke, 1992). It should be noted that limiting factors differ between species and life stages. Limiting factors are also temporal and spatial in nature and if the factor that is currently the most limiting is improved, the next most limiting factor will limit salmonid production (Bjornn and Reiser, 1991). Refer to Table 3.6-1 for current aquatic objectives in relation to large pools, large wood, width:depth ratios, and temperatures.

## Salt Creek Watershed Analysis

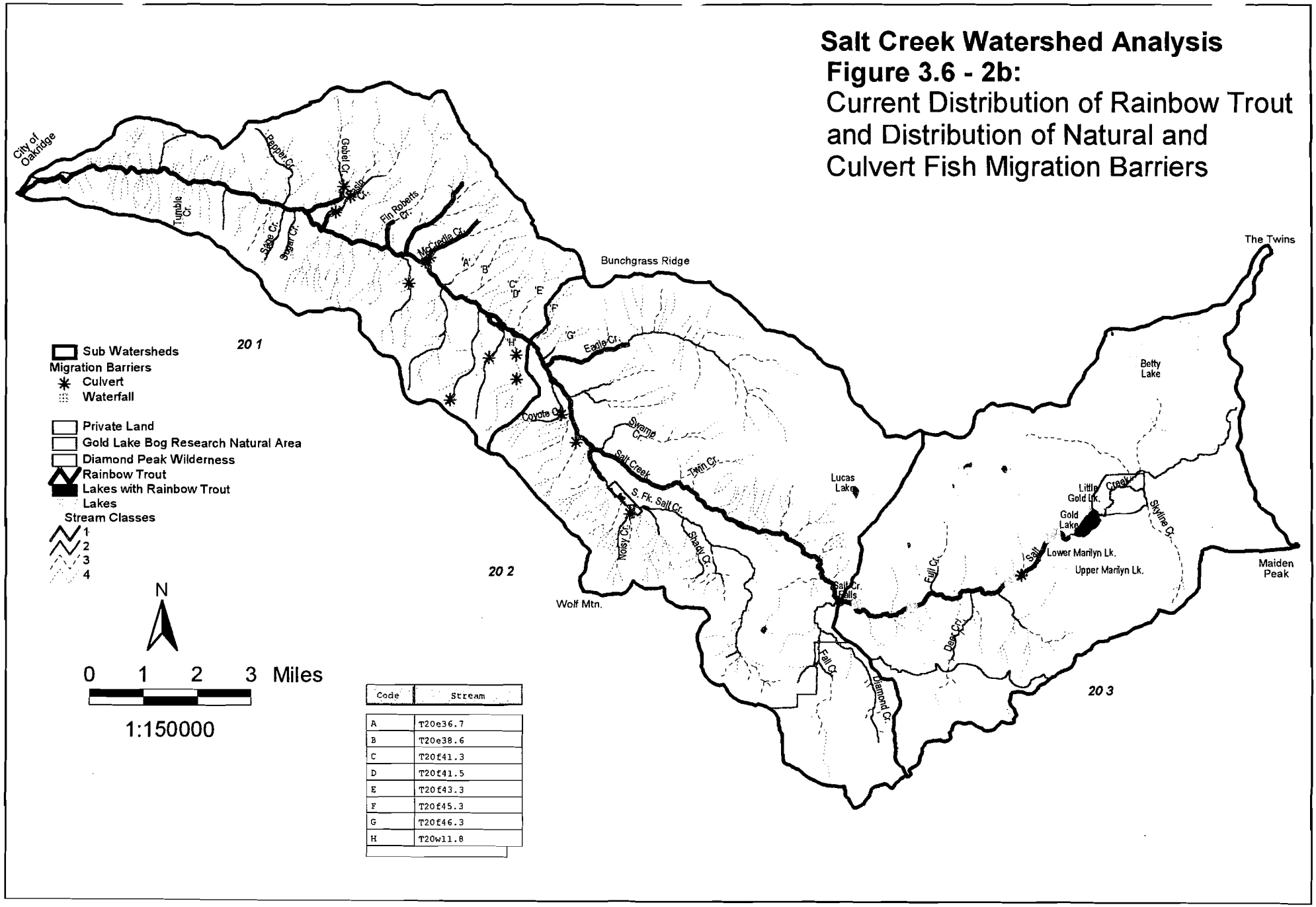
**Figure 3.6 - 1:**
Historic and Potential Distribution of Spring Chinook Salmon and Bull Trout



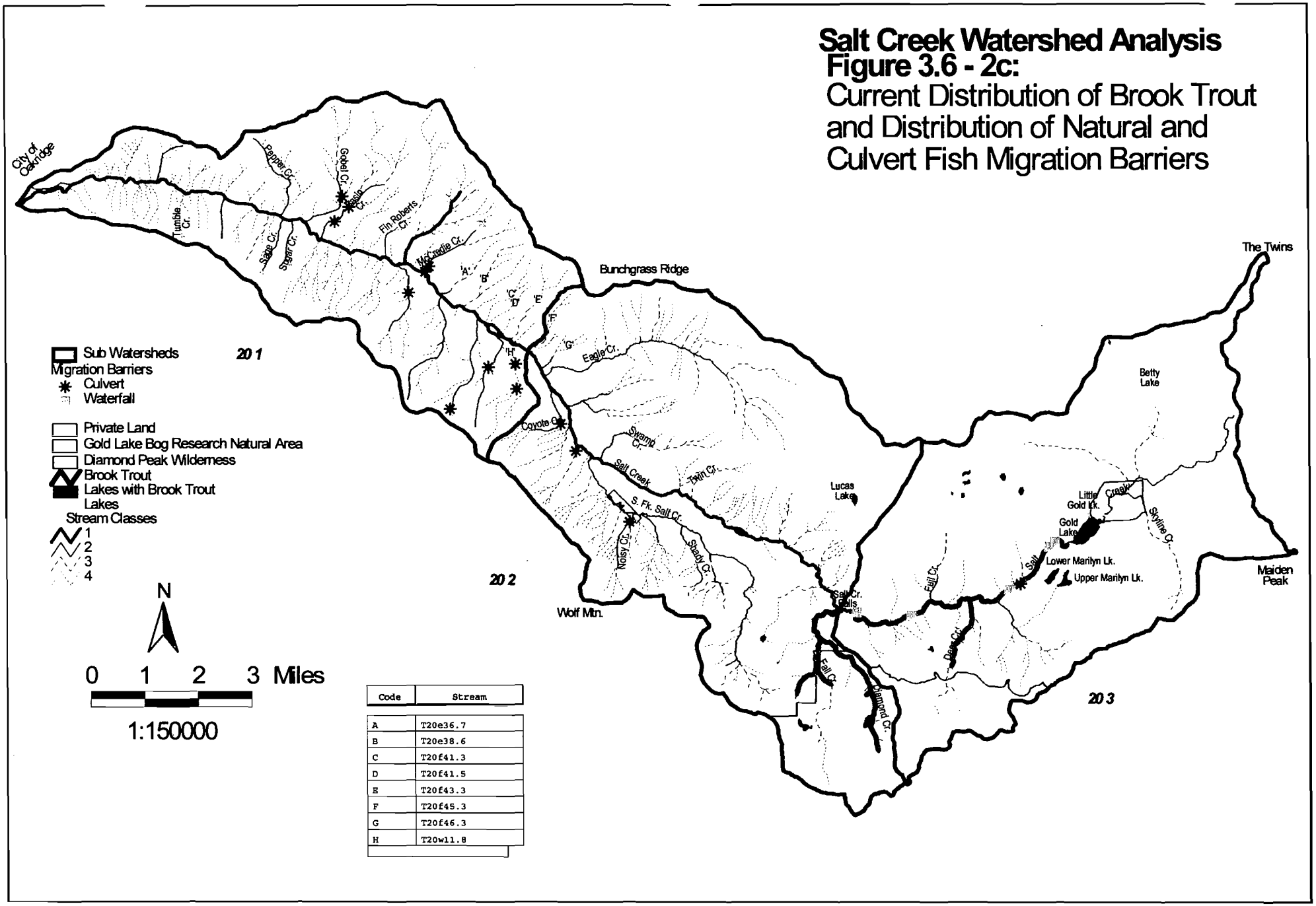

| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |



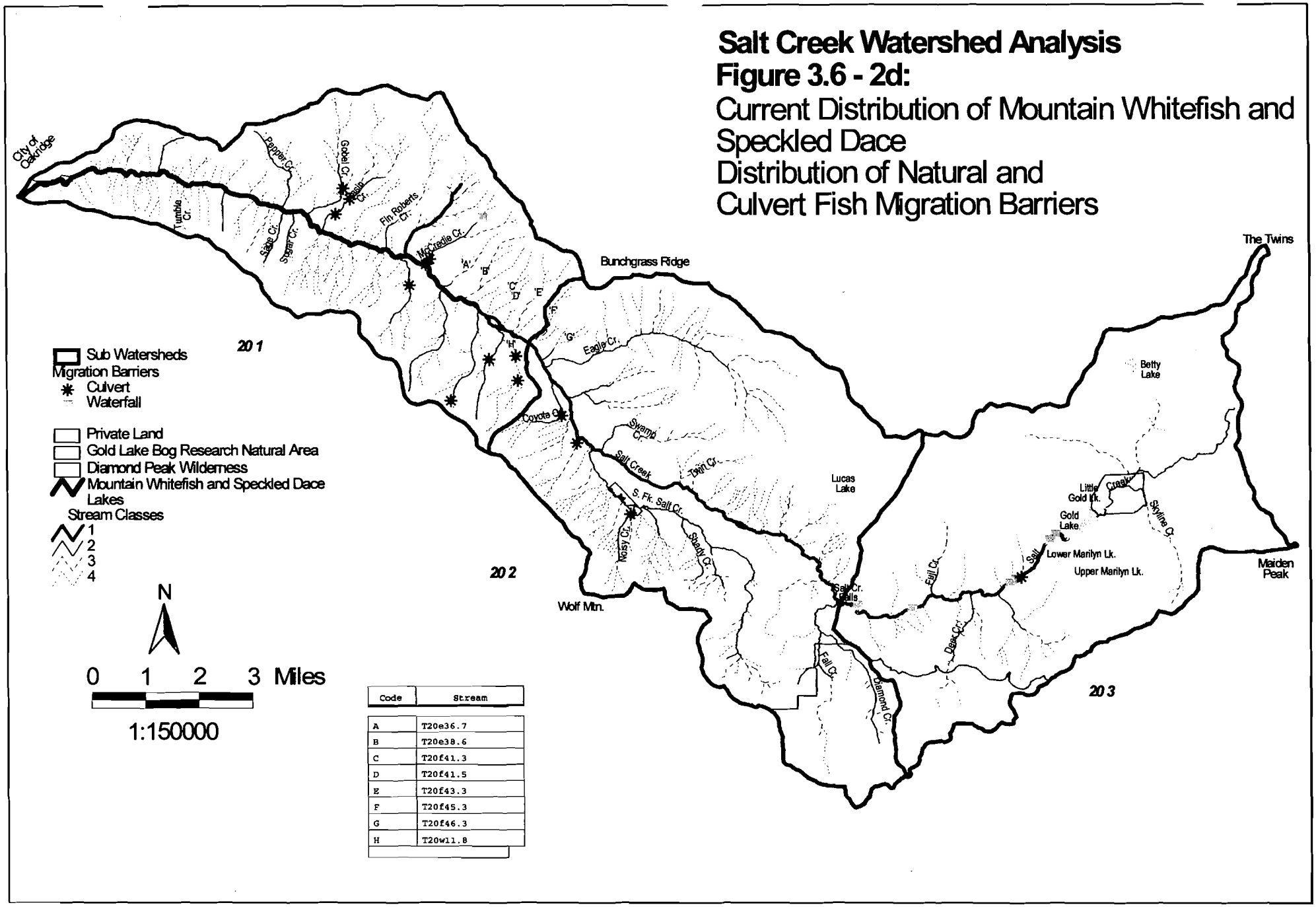

| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |


Salt Creek Watershed Analysis
Figure 3.6 - 2b:
Current Distribution of Rainbow Trout and Distribution of Natural and Culvert Fish Migration Barriers
City of Oakridge
Tumble Cr.
Sage Cr.
Sugar Cr.
Pepper Cr.
Gabel Cr.
Fin Roberts Cr.
McCredie Cr.
Bunchgrass Ridge
Eagle Cr.
Coyote Cr.
Swamp Cr.
Salt Creek
Twin Cr.
S. Fk. Salt Cr.
Noisy Cr.
Shady Cr.
Wolf Mtn.
Lucas Lake
Salt Cr. Falls
Full Cr.
Deer Cr.
Diamond Cr.
Betty Lake
The Twins
Little Gold Lk.
Gold Lake
Skyline Cr.
Lower Marilyn Lk.
Upper Marilyn Lk.
Maiden Peak
20 1
20 2
20 3
Sub Watersheds
Migration Barriers
Culvert
Waterfall
Private Land
Gold Lake Bog Research Natural Area
Diamond Peak Wilderness
Rainbow Trout
Lakes with Rainbow Trout
Lakes
Stream Classes
1
2
3
4
N
0 1 2 3 Miles
1:150000
Code
Stream
A T20e36.7
B T20e38.6
C T20f41.3
D T20f41.5
E T20f43.3
F T20f45.3
G T20f46.3
H T20w11.8

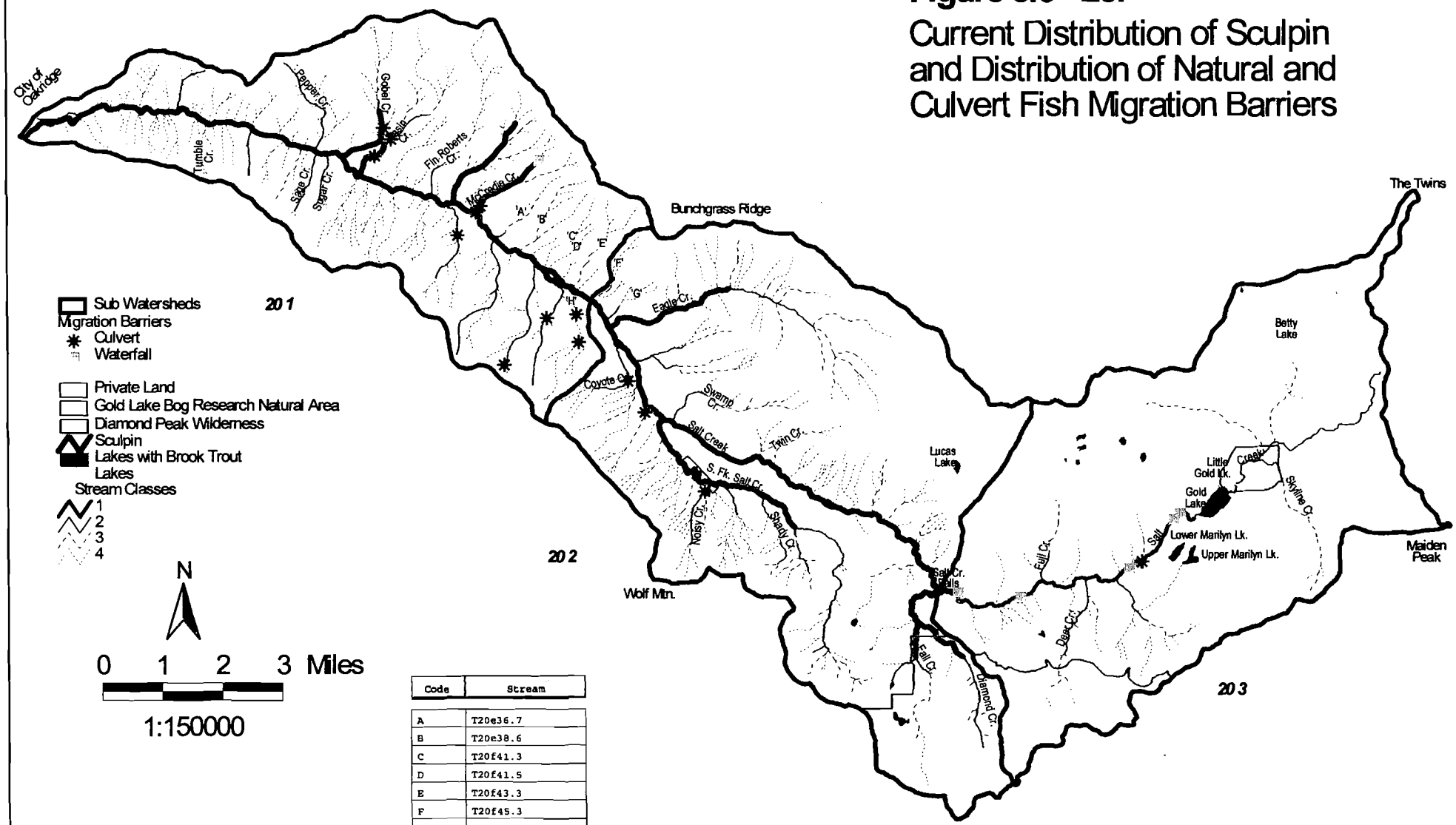
# Salt Creek Watershed Analysis
## Figure 3.6 - 2c:
Current Distribution of Brook Trout and Distribution of Natural and Culvert Fish Migration Barriers




| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |


Salt Creek Watershed Analysis
Figure 3.6 - 2d:
Current Distribution of Mountain Whitefish and Speckled Dace
Distribution of Natural and Culvert Fish Migration Barriers
City of Oakridge
Tumble Cr.
Pepper Cr.
Gobel Cr.
Sugar Cr.
Fin Roberts Cr.
McCredie Cr.
Bunchgrass Ridge
Eagle Cr.
Coyote Cr.
Swamp Cr.
Salt Creek
Twin Cr.
S. Fk. Salt Cr.
Noisy Cr.
Shady Cr.
Wolf Mtn.
Lucas Lake
Salt Cr. Falls
Fall Cr.
Diamond Cr.
Dace Cr.
Betty Lake
Little Gold Lk.
Gold Lake
Lower Marilyn Lk.
Upper Marilyn Lk.
Skyline Cr.
The Twins
Maiden Peak
20 1
20 2
20 3
Sub Watersheds
Migration Barriers
Culvert
Waterfall
Private Land
Gold Lake Bog Research Natural Area
Diamond Peak Wilderness
Mountain Whitefish and Speckled Dace Lakes
Stream Classes
1
2
3
4
N
0 1 2 3 Miles
1:150000
Code | Stream
A | T20e36.7
B | T20e38.6
C | T20f41.3
D | T20f41.5
E | T20f43.3
F | T20f45.3
G | T20f46.3
H | T20w11.8

# Salt Creek Watershed Analysis
## Figure 3.6 - 2e:
## Current Distribution of Sculpin and Distribution of Natural and Culvert Fish Migration Barriers




| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |

**Table 3.6-1.** Objectives for Aquatic Habitat Variables

| Habitat Variable | Definition or Range | Objective | Source |
|---|---|---|---|
| Large Pools | <2% Gradient | 1 pool/5-7 channel widths | Willamette NF Plan |
| | 2-8% Gradient | 1 pool/3-5 channel widths | Willamette NF Plan |
| | Channel Width | See below (*) | PACFISH* |
| Large Wood | Undefined | 80 pieces over 24" dbh & 50' length per mile | PACFISH* |
| | Low Gradient Streams | 105 pieces longer than stream width w/pieces >25' per mile | Willamette NF Plan |
| | High Gradient Streams | 50% of channel length should be influenced | Willamette NF Plan |
| Width:Depth Ratio | All Streams | <10 | PACFISH* |
| Water Temperature | Streams (salmonids) | Meet State standards ($58^0$ F) | State Standards |

(*) PACFISH Objective for Pools per Mile by Wetted Stream Width in feet (USDA, USDI, 1994c)

| Wetted Stream Width | 10 | 15 | 20 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pools/Mile | 96 | 70 | 56 | 47 | 26 | 23 | 18 | 14 | 12 | 10 | 9 |

**Instream Large Wood Material**

Large wood is an important component in stream channels, influencing them by affecting bed profiles, channel patterns, and channel geometry (Bisson et al. 1987). Instream large wood material is critical in the formation of large pools, which in turn is critical for adult and overwintering habitat. Large wood provides cover for both adult and juvenile salmonids during summer and winter. Additionally, large wood is important for the maintenance of suitable spawning areas and providing nutrient input and potential forage material for aquatic macroinvertebrates.

**Adult Habitat (Large Pools)**

Large pools provide thermal refuge for aquatic organisms dependent on cold stream temperatures and protective cover for rearing, and act as holding areas for LWM flowing through the system. The quality of pool habitat is based on several factors including: pool depth, stream width, amount of LWM in place, and the complexity of sub-habitats within the pool. The number of pools increases as the stream size decreases. Channel morphology influences where pools are formed and determines the hydraulic controls that create pools. Adult habitat is thought to limit trout populations in most high gradient western streams (Behnke 1992).

**Rearing Habitat**

Rearing habitat is another potentially limiting factor for salmonid populations. Suitable rearing areas typically have a low water velocity and large amounts of cover. Areas such as stream margins, spring seeps, side channels, and small tributaries generally make suitable rearing areas (Behnke, 1992). High gradient areas in the upper reaches may lack suitable rearing habitat due to high water velocities, especially in reaches lacking in large wood. In addition to the formation of areas with low water velocity and large wood also provides the cover necessary for juvenile salmonids.

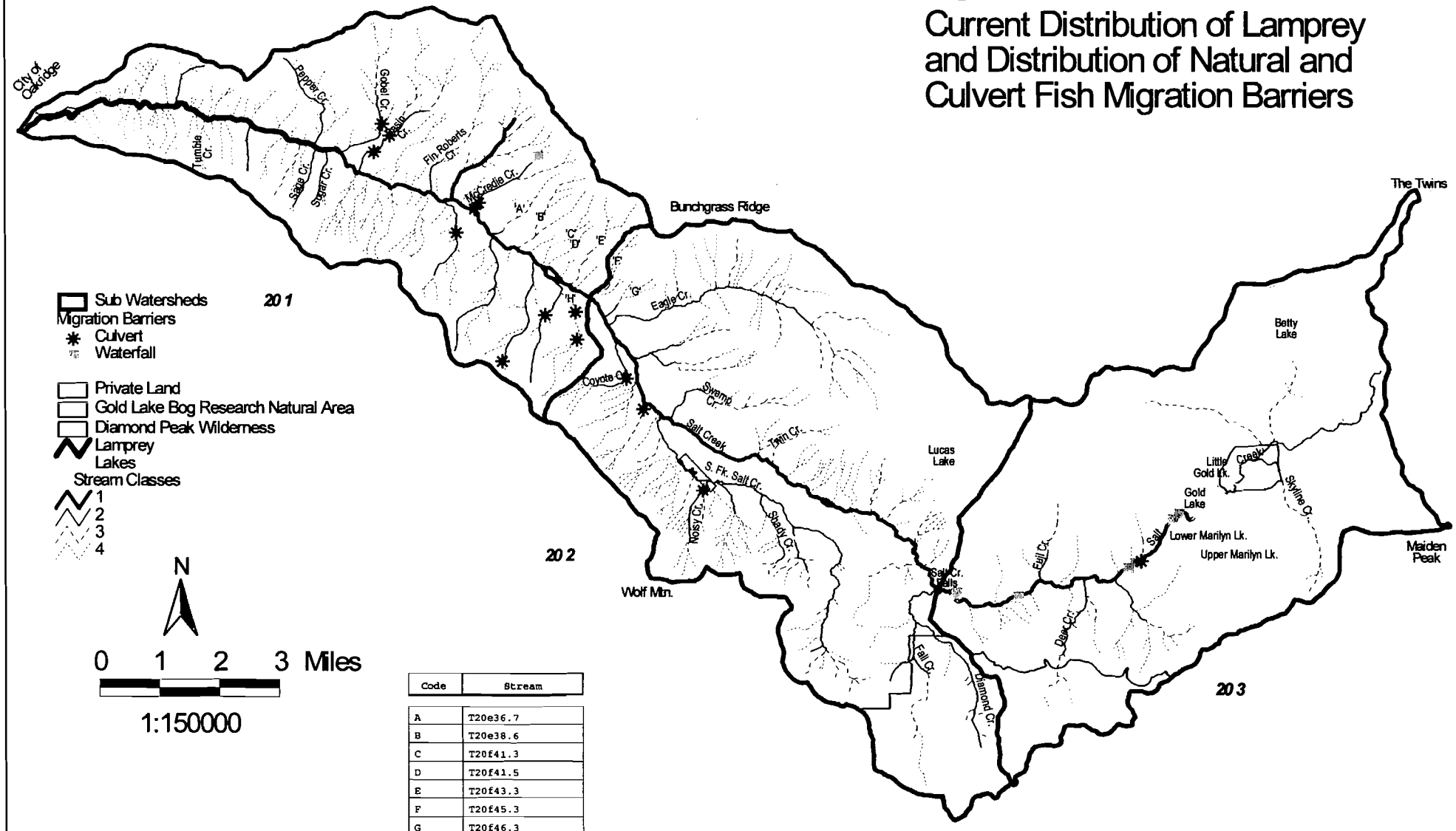
**Spawning Habitat**

Suitable spawning areas are also important for maintaining healthy salmonid populations. Spawning success may be poor if areas of silt-free gravel are not available (Behnke, 1992). Large wood is also an important component of maintaining suitable spawning areas as it allows the sorting and storage of spawning gravels, especially in high gradient streams where the water velocities are sufficient to carry gravels downstream.

**Overwintering**

Overwintering habitat is also important for salmonids. Overwintering habitat for adult salmonids typically consist of deep water habitat with low velocities and high amounts of cover (Behnke, 1992). In addition to large pools, side channels and tributaries may also be used by overwintering salmonid populations, especially juveniles (Bjornn and Reiser, 1991). In small tributary streams with high winter water velocities, trout may migrate downstream to overwinter in larger deeper areas (Behnke 1992). Many of these small tributaries have impassable culverts, making migration back up in the spring impossible, and thus depleting already isolated populations of resident salmonids.

# Salt Creek Watershed Analysis
## Figure 3.6 - 2f:
## Current Distribution of Lamprey and Distribution of Natural and Culvert Fish Migration Barriers




| Code | Stream |
|---|---|
| A | T20e36.7 |
| B | T20e38.6 |
| C | T20f41.3 |
| D | T20f41.5 |
| E | T20f43.3 |
| F | T20f45.3 |
| G | T20f46.3 |
| H | T20w11.8 |

**Water Temperature**

Water temperature is a major factor influencing the composition and productivity of aquatic ecosystems. Fish, aquatic macroinvertebrates, and other aquatic organisms are affected directly and indirectly by changes in water temperatures. Specifically stream temperature influences the timing of salmonid migration, spawning, incubation rates, growth, distribution, resistance to parasites, food supply and quality, and tolerances to diseases and pollutants (Bjornn and Reiser 1991).

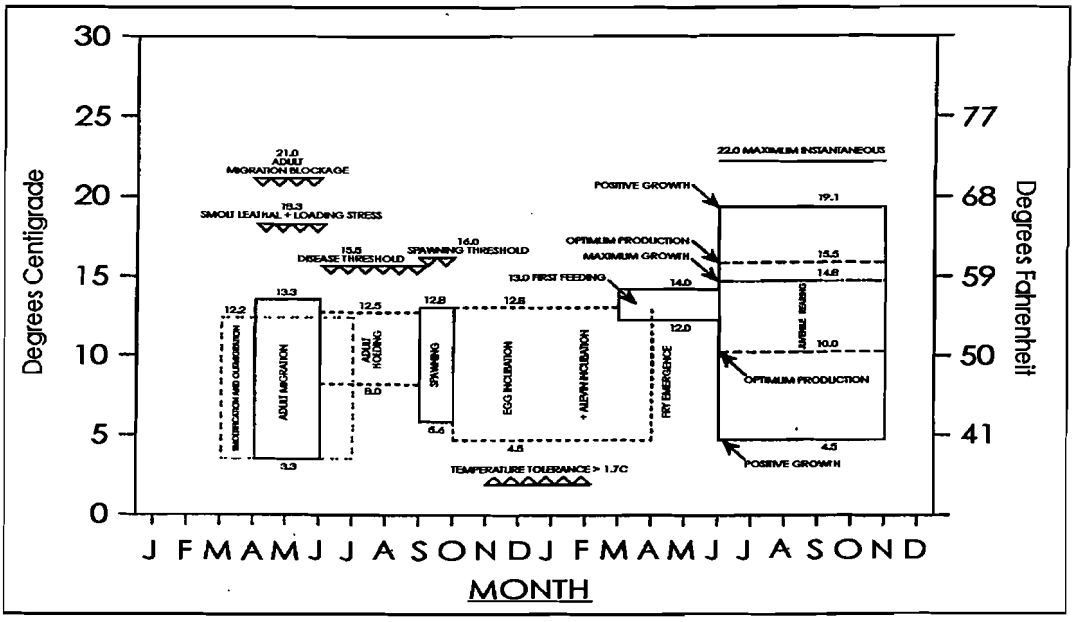
Water temperature can also be a limiting factor for salmonids especially during the critical times of egg incubation, fry emergence, and juvenile rearing. Table 3.6-2 shows the lethal temperatures of salmonid species historically and presently found in the Salt Creek watershed.

**Table 3.6-2.** Upper lethal and preferred temperatures (F) for selected species of salmon and trout (After Bjornn and Reiser 1991).

| Species | Upper lethal temp (deg F) | Preferred temp (deg F) |
|---|---|---|
| Chinook salmon | 79 | 53.6 - 57.2 |
| Steelhead | 75 | 50.0 - 55.4 |
| Rainbow trout | 77 | N/A |
| Bull trout | -- | 40-55 |
| Brook trout | 78 | 53.6 - 60.8 |
| Cutthroat trout | 73 | N/A |

Figures 3.6-3 and 3.6-4 show the critical temperatures, by life stage, for spring chinook salmon and bull trout.

**Figure 3.6-3.** Spring Chinook Temperature Requirements by Life History Stage



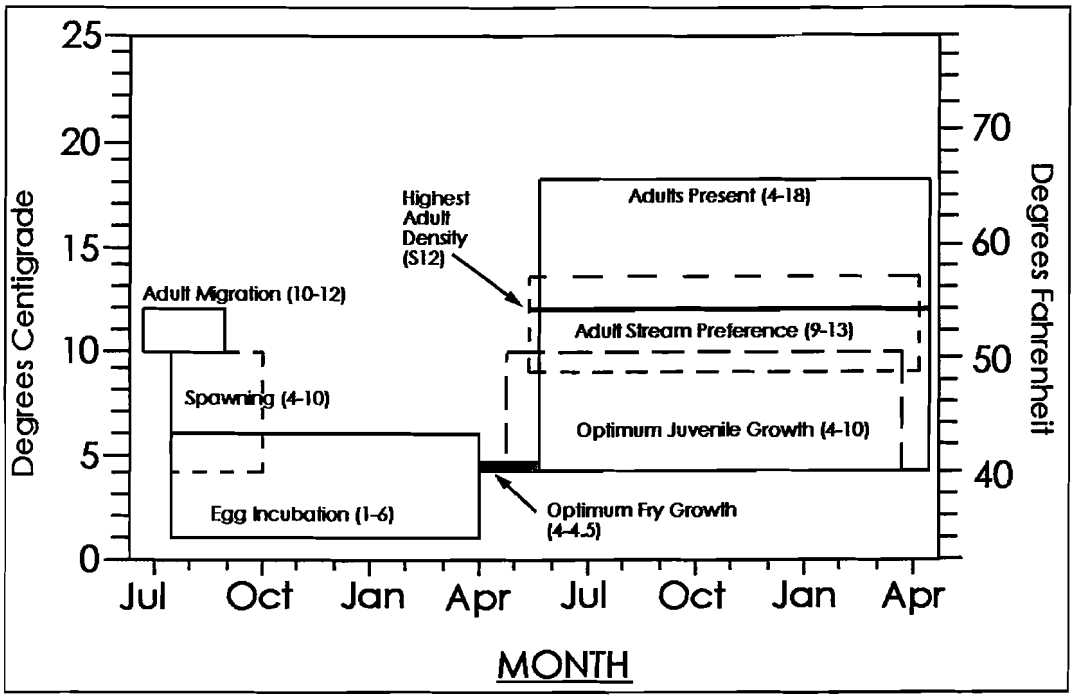


**Figure 3.6-4.** Bull Trout Temperature Requirements by Life History Stage