# BEAVER AND PALMER CREEK WATERSHEDS

**Rogue River National Forest**
**Applegate Ranger District**

# PREFACE

Watershed analysis is an important aspect of implementing ecosystem management on a watershed basis and will be vital to adaptive management over a broad scale. This watershed analysis which was conducted for the most part using existing data and information, is to be considered a baseline document initiating a study of the processes, funtions, conditions and trends within the Beaver and Palmer watersheds. Watershed analysis is an ongoing, iterative process that will evolve as experience and knowledge of new techniques for completing this process grow.

This report is a dynamic document, that will be revised and updated as new information (both process related and resource based) becomes available. Updates of this document may include the following types of information: resource data collected at the project level, monitoring data, and questions and answers clarifying findings and recommendations presented in this document. Revisions of this document are warranted when new data and information, collected from both project level and monitoring efforts, indicates important changes in watershed conditions and trends.

**1994 WATERSHED ANALYSIS**

**BEAVER AND PALMER CREEK WATERSHEDS**

Applegate Ranger District
Rogue River National Forest

**TABLE OF CONTENTS**

*EXECUTIVE SUMMARY*


I. INTRODUCTION

A. ANALYSIS STRATEGY

1. Why do Watershed Analysis I-1
2. What is Watershed Analysis I-1
3. How was this Analysis Conducted I-1

B. AREA OVERVIEW

1. Basin Overview I-2
2. Rogue River Basin Characterization I-3
3. Southwest Oregon Province I-4
4. Climate of Interior Southwest Oregon; Eastern Siskiyous I-8
5. Analysis Area Management Direction I-9

II. HISTORIC AND CURRENT WATERSHED CONDITIONS, PROCESSES, FUNCTIONS AND TRENDS

1. HUMAN PROCESSES

A. HUMAN PROCESSES INFLUENCING CURRENT WATERSHED CONDITIONS

1. Prehistory II-1
2. Early Euro-American Exploration II-2
3. Mining and Initial Settlement II-2
4. Livestock Ranching II-2
5. The Depression, World War II, and After II-3
6. "Postscript" II-4

B. PRESENT DAY SOCIO-ECONOMICS

1. Timber II-4
2. Livestock/Grazing Uses II-4
3. Recreation II-5
4. Neighborhood II-5

## 2. PHYSICAL AND BIOLOGICAL CONDITIONS, PROCESSES, FUNCTIONS, AND TRENDS

### A. GEOMORPHOLOGY


1. Paleozoic and Mesozoic Eras II-6
2. Cenozoic Era II-6
3. Pleistocene Epoch II-8
4. Holocene Epoch II-8


### B. GEOLOGY & SOILS


1. Bedrock Distribution II-9
2. Soil Resource Inventory II-10
3. Natural Processes Influencing Slope and Soil Stability II-10
4. The Effects of Human Activities on Slope and Soil Stability II-11
5. Landslide Hazard and Zonation Mapping II-16
6. Sediment Produced From Landslides II-16
7. Erosion II-19


### C. HYDROLOGY & FISHERIES


1. Stream Classification and Characteristics II-20
2. Beaver and Palmer Stream Types II-20
3. Stream Flow Regime; Character, Timing and Distribution of Major Storm Events and Low Flow in the Watersheds. II-24
4. The Effects of Vegetation on Stream Flow II-25
5. The Effects of Climate and Weather Patterns on Stream Flow II-25
6. Human Processes Affecting Stream Flow II-25
7. The Effects of Low Flow, Bankful or Flood Events on Stream Characterization and Aquatic Habitat II-27
8. Water Chemistry II-29
9. The Effects of Sediment on Channel Morphology and Aquatic Habitat II-30
10. Riparian Zones II-35
11. Other Watersheds II-35


### D. VIABILITY OF FISH POPULATIONS


1. Diversity of Fish Species II-38
2. Contributions of Beaver and Palmer Watersheds to Downstream Fisheries II-38
3. Habitat Connectivity and the Effects on Viable Populations of Fish II-38
4. Macroinvertebrates II-41


### E. TERRESTRIAL VEGETATION


1. Vegetation Zones and Vegetative Composition II-43
2. Timber Stand Health Issues II-48
3. Site Potential II-49

F. SOIL PRODUCTIVITY

1. The Effects of Management Activities on Soil Productivity II-50
2. Other Processes Affecting Soil Productivity II-51

G. BOTANICAL RESOURCES

1. Area Surveyed; Palmer Creek, Billy's, Flumet, and China Gulches Watersheds II-52
2. Area Surveyed; Beaver Creek Watershed II-52
3. Rare Plant Habitat II-52
4. Appendix J Species (Plant Species from Table C-3) II-54
5. Non-native Populations of Local Plant Species II-54
6. Non-native species II-54

H. FIRE REGIME

1. Historic Fire Environment - Before Organized Fire Suppression II-55
2. Historic Fire Environment - After Organized Fire Suppression II-56
3. Vegetation Zones; Influence to the Fire Environment II-56
4. Developing Fire Hazard and Fire Risk Maps II-56

I. TERRESTRIAL WILDLIFE

1. Wildlife Habitats II-63
2. Connecting Habitats within Beaver Creek and With Adjacent Watersheds II-73
3. The Effects of Roads on Wildlife Habitat II-74
4. Wildlife Species II-75

III. DESIRED FUTURE CONDITIONS (DFC); MANAGEMENT RECOMMENDATIONS III-1

IV. MONITORING AND RESEARCH IV-1

V. LITERATURE CITED V-1

GLOSSARY

APPENDICES
Appendix A: Issues and Key Questions
Appendix B: Heritage Resources
Appendix C: Geology and Geomorphology of Beaver and Palmer Creeks
Appendix D: Soils
Appendix E: Hydrology & Fisheries
Appendix F: Vegetation
Appendix G: Botany
Appendix H: Fire Management
Appendix I: Terrestrial Wildlife

LIST OF FIGURES


Figure 1: Vicinity Map I-5
Figure 2: Beaver/Palmer Watershed Analysis Area I-6
Figure 3: Beaver/Palmer Watershed Sub-basins I-7
Figure 4: Distribution of Terranes in Southwest Oregon II-7
Figure 5: Road Density Table (system roads) II-14
Figure 6: Road Density Table (system roads) II-15
Figure 7: Landslide Activity Level Descriptions II-17
Figure 8: Landslide Hazard Level Descriptions II-18
Figure 9: Broad Level I Delineation of Major Stream Types II-21
Figure 10: Delineative Criteria of Major Stream Types II-22
Figure 11: Flood Frequency Analysis - Star Gulch II-23
Figure 12: Beaver/Palmer Transient Snow Zones II-26
Figure 13: Watershed Risk Rating; Beaver Creek II-33
Figure 14: Watershed Risk Rating; Palmer Creek II-34
Figure 15: Large Wood Material Analysis; Beaver Creek II-36
Figure 16: Large Wood Material Analysis; Palmer Creek II-37
Figure 17: Profile of Stream Channel; Beaver Creek II-39
Figure 18: Profile of Stream Channel; Palmer Creek II-40
Figure 19: Beaver/Palmer Vegetation Zones II-44
Figure 20: Summary Vegetative Composition II-45
Figure 21: Summary of Vegetative Composition for Riparian Zones II-46
Figure 22: Summary of Riparian Zone Vegetaion By Reach II-47
Figure 23: Beaver/Palmer Fire Hazard II-60
Figure 24: Beaver/Palmer Fire Occurrence/Risk II-61
Figure 25: Beaver/Palmer Fire Risk/Hazard Intersect II-62
Figure 26: Wildlife Habitat Amounts by Watershed II-70
Figure 27: Wildlife Habitat Amount for Beaver Creek Sub-basins II-71
Figure 28: Wildlife Habitat Amount for Palmer Creek Sub-basins II-72
Figure 29: Beaver/Palmer Spotted Owl Pairs; Reproductive History II-77
Figure 30: Adjacent Spotted Owl Pairs; Reproductive History II-77
Figure 31: Beaver Creek Quarter-townships; 50-11-40 II-78
Figure 32: Palmer Creek Quarter-townships; 50-11-40 II-78
Figure 33: Bat Species Table II-82
Figure 34: Geologic Rock Types by Sub-basin II-9A
Figure 34: Beaver/Palmer Soil Resource Inventory II-9B

1994 WATERSHED ANALYSIS

BEAVER AND PALMER CREEKS

# EXECUTIVE SUMMARY
## "The Short Story"

### Analysis Strategy

The Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, incorporates the Aquatic Conservation Strategy; developed for restoring and maintaining the health of watersheds, and the aquatic ecosystems contained within them, on all public lands. The Aquatic Conservation Strategy, is a basis for Standards and Guidelines (contained within the ROD) which focus on the attainment of this strategy.

A system of Key Watersheds are identified in this strategy to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous fish species. Both Beaver and Palmer Creek Watersheds are designated by the ROD as Key Watersheds; identified for their potential through restoration, to become high quality habitat in the future for anadromous and other fish species.

Watershed Analysis is an assessment of the health of an ecosystem at the watershed scale, and plays an important role in providing for the protection of aquatic and riparian habitat. It identifies processes and functions occurring within a watershed that are key to maintaining healthy terrestrial and aquatic ecosystems, and assesses the effects of human activities on these processes and functions. Through watershed analysis, opportunities will be identified for the restoration of aquatic habitat and ecosystem health.

An Interdisciplinary Team (IDT) of resource specialists was assembled to complete the watershed analysis for Beaver and Palmer Creek Watersheds. The team following the eight steps outlined in A Federal Agency Guide for Pilot Watershed Analysis, identified processes, functions, and issues that are key to this Watershed Analysis Area (WAA), and developed key questions that were used to guide the analysis. Team members, as well as other resource specialists, presented a report to the team addressing key questions specific to their field of expertise. These reports are summarized here and have been integrated by the IDT in this Watershed Analysis Report.

### Area Overview

The Beaver and Palmer Creek Watersheds, tributaries of the Applegate River, are located in the Klamath Mountains Physiographic Province in Southwestern Oregon. The Applegate River Watershed encompasses 491,520 acres and drains approximately 15 percent of the Rogue River Basin. The Applegate River meets the Rogue River in the central valley segment of the Rogue River. The lower Rogue River (from the confluence of the Applegate River to the ocean) serves as a highway for all the anadromous fish species to reach interior Rogue River streams for spawning and rearing.

The Beaver Creek Watershed occupies 14,018 acres; the Palmer Creek Watershed is west of Beaver Creek and is 10,077 acres in size. The Analysis Area also includes several other small watersheds immediately adjacent to Beaver and Palmer Creeks. Billy's Gulch (south of Palmer Creek), China and Flumet Gulch (north of Palmer Creek) are included into the Palmer Creek Watershed acreages; Mckee (north of Beaver Creek) is included into Beaver Creek Watershed acreages. Of the 24,095 acres within the Analysis Area, 73 percent is Forest Service, 13 percent is Bureau of Land Management, and 14 percent is private ownership.

**Climate of Interior Southwest Oregon; Eastern Siskiyous**

Interior southwest Oregon, eastern Siskiyous, has the lowest annual precipitation and the highest annual summer temperatures for the west side of the Cascade Mountain range. The influence of temperature and moisture is important for a site's vegetative potential. The rain shadow from the Oregon coast to the Analysis Area is very pronounced. Within the Analysis Area about 40 inches of annual precipitation occurs; similar elevations on the coast receive about 100 inches of annual precipitation.

**Historic Human Processes Influencing Current Watershed Conditions**

Based on archaeological evidence from other areas in the Applegate Valley and the wider southwestern Oregon area, people have probably been inhabiting the Beaver and Palmer Watershed Analysis Area for the past 10,000 years. It is likely that the burning of vegetation, by human inhabitants, began as far back as 8000 years ago. The Middle Archaic period (about 4,000 years ago) may have seen increased use of fire as a tool for maintaining the food-rich oak savannah/woodlands.

With the discovery of gold in the Rogue River Valley in 1851-52, Palmer Creek and adjacent stretches of the Applegate River saw intensive placer mining with rocker and sluice box systems. During the 1870s, hydraulic mining came to the Siskiyou Mountains and continued on a large scale through the 1880s. Palmer Creek, Flumet Gulch, China Gulch, and the Applegate River all experienced extensive mining during the 1880s. Beaver Creek, except for a few medium-sized mining ditches was largely unaffected.

Beginning with the mining era agricultural settlers began farming terraces of the Applegate River. During the period between 1890 and 1930, the main human impact to the area came from the activities of local farmers. These activities included heavy livestock grazing and water diversions for irrigation.

Forest cover would have changed due to the miners' and settlers' intensive cutting of easily accessible, mature sugar and ponderosa pine for shakes, flume boards, and so on. In addition, nineteenth-century prospectors regularly set extensive fires in order to enhance the visibility of bedrock and colluvial deposits. Ranchers carried on the regional tradition of seasonal burning to maintain and promote grass on the lower southwest aspect slopes, and to clear brush and small trees.

During the period following 1950, Forest Service and Bureau of Land Management became the major suppliers for new, large capacity lumber and plywood mills in Jackson and Josephine Counties. This period of intensive timber harvesting and road construction was a major factor in changing the overall appearance of the Watershed Analysis Area.

Today timber sales, recreation developments, some mining activity, and livestock grazing play an important role in "shaping" the present day economic uses and extractions of the federally managed watersheds. The importance of these uses are constantly changing as social values change, and demands for resources evolve as the government applies an ecosystem approach to forest management.

**Geomorphology**

Plate tectonics have played a major role in shaping the ancient geological conditions, and evolving it over time, to the present landforms and geologic setting. Subduction, accretion, faulting, folding, mountain building, tilting, landsliding, and erosion have all shaped the topography to produce the present geomorphic and geologic conditions. Four granitic bodies (Squaw Peak Pluton being the largest) have intruded into the metavolcanic and metasedimentary rocks. The upper elevations of the Analysis Area are highly dissected. The steep mountains were produced by uplift and millions of years of surface erosion and landslides.

## Slope and Soil Stability

The slope stability of Beaver and Palmer Creek Watersheds are influenced both by natural processes and human activities. Natural processes influencing slope and soil stability include: bedrock distribution and characteristics, steepness of slope, aspect, wildfire, vegetation, weather, peak flow, and flood events. Human activities which have affected slope and soil stability include: mining, the exclusion of fire, clear-cut timber harvesting, logging systems (especially tractor logging on steep slopes), and roads.

Slope stability of the Palmer Creek Watershed is relatively stable with the exception of the granitic terrane. Some active debris landslides and areas of surface erosion are found in China Gulch and at Palmer Peak. Minor slumps are found in most of the metavolcanic terrane.

Mining activities are the greatest source of sediment in Palmer Creek, China and Flumet Gulches, and along the mainstem of the Applegate River. Hydraulic mining occurring in Palmer Creek washed large volumes of sediment and rock from the stream banks and adjacent slopes into the stream channel. This has created bare and eroding slopes up to 30 feet high adjacent to the stream. These high slopes are susceptible to failure when the creek levels get to bankfull widths and flood levels. Hydraulic mining has affected Palmer Creek mainly from the mouth to the confluence of Dark Canyon. Steep, poorly drained mining roads have also contributed to erosion and landslide problems in the Palmer Creek Watershed.

Beaver Creek Watershed slope stability varies from unstable to moderately stable. Beaver Creek has had more timber and road building activities which have produced an increase in the frequency of landslides and erosion related problems. Clear-cut timber harvesting in the granitics of the Squaw Peak Pluton has produced a large volume of sediment to streams. Numerous areas of active landslides and severe gully erosion were located in clear-cut units during field verification for this analysis.

Road construction is identified as another major producer of sediment in the Beaver Creek Watershed. Steep road grades, poor drainage, logging landings in drainages, and concentrated water flow, all contribute to surface problems associated with roads. Landslides, sheet, rill, and gully erosion have all been accelerated (especially in the granitic terrane).

## Hydrology & Fisheries

Adjustments to the Beaver and Palmer stream systems occur as a result of change in stream-flow magnitude and/or timing, sediment supply and/or size, direct disturbance, and vegetative changes.

The upper reaches of Beaver and Palmer Creeks are characterized by a highly dissected stream pattern. Short duration, high intensity summer storms and rain-on-snow events result in high peak flows capable of transporting large amounts of sediment. Much of the sediment produced by roads, landings and skid trails is presently being stored within intermittent stream channels because of the current eight year drought.

These roads, skid trails, and landings in their current condition will continue to produce sediment, prevent lateral stream migration, divert and concentrate flow, inhibit the growth of vegetation for stream canopy cover and coarse woody debris recruitment, as well as potentially increasing water temperatures and suspended sediment.

Other contributing factors of concern are:
- irrigation canals which de-water the stream having catastrophic effects on aquatic populations.
- damaging impacts from livestock grazing have occurred in certain portions of the Beaver Creek watershed.
- the vegetative composition in the riparian zone is low in conifers providing inadequate future coarse woody debris recruitment. The high amount of hardwoods provides good canopy cover.

- mining activities which are the greatest sediment source to Palmer Creek and its tributaries, leaving the stream in a highly aggraded condition with little pool habitat for aquatic species.
- past timber management practices
- fish structures luring fish into staying in pools while the system has become disconnected as water flows subsurface.

Stream channel adjustments from the above factors have imparted a detrimental effect on the quality of fish habitat. These effects include a reduction in; the quality and quantity of pools, spawning gravel, and the nutrient and food supply. Ultimately there will be a further decline in aquatic species diversity and population size.

**Terrestrial Vegetation**

Field validation of vegetative composition relative to vegetation zone locations took place by Bill Warner, Applegate Ranger District, Silviculturist. Within the Beaver and Palmer Analysis area, 74 percent is estimated to be within the Interior Valley Vegetation Zone, while 26 percent of the analysis area falls within the Mixed Conifer Vegetation Zone.

The southern exposures in the **Interior Valley Vegetation Zone/Douglas-fir series** (below 3,600 feet) support scattered ponderosa pine, black and white oak, poison oak, live oak, madrone, ceanothus, and manzanita. Douglas-fir is present in the draws and on the more favorable sites. Some small grass savannahs are also present in the lower elevations. The more northern and eastern aspects of this watershed are primarily occupied with Douglas-fir and scattered ponderosa pine, sugar pine, madrone, and black oak.

On the southern exposures in the **Mixed Conifer Vegetation Zone/white fir series** (above 3,600 feet), Douglas-fir becomes more predominate and white fir can be found intermixed with the other species. The vegetation is still very dense in spots with the live oak forming heavy thickets along with the madrone. Two exceptions to this are the presence of white fir in the bottom of Beaver Creek at an elevation of 2,200 feet, and the apparent absence of white fir on Baldy Peak, an elevation of close to 4,800 feet. The close proximity to the low valley conditions along the Applegate River and accompanying heat may account for the apparent lack of white fir on Baldy.

**Timber Stand Health Issues**

With the exclusion of fire in the ecosystem since the early 1900's, high vegetation densities are causing extreme competition for moisture, nutrients, and growing space. The result has been an increase in mortality rates, especially in the large tree component. In addition, an 8 to 9 year drought in southwest Oregon has contributed to the increased mortality.

Ponderosa pine which are less tolerant of high stand densities than other conifer species, are experiencing the highest mortality rates. The bark beetles are responding to the weakened condition of the larger pine and making successful attacks. A vigorously growing tree can usually survive beetle attacks by literally pitching out the insects. The smaller pine can successfully compete at this time as their water distribution systems (given their smaller size) is much more efficient. However, they may never reach the size and age of the pine now dying while the current vegetation density levels remain.

Dwarf mistletoe is a major problem in the Douglas-fir in both the Interior Valley and the Mixed Conifer Vegetation Zones. White fir also is heavily infected with dwarf mistletoe in various locations. The dwarf mistletoe seems to be much more of a problem on the northerly aspects in the Interior Valley Vegetation Zone and the Mixed Conifer Vegetation Zone. The reason is probably related to the fire frequency intervals. If stands remain untreated, mortality will be accelerated in those trees infected with the disease, the younger healthy trees that are growing close to the currently infected trees will become infected. Growth and yields from infected trees will be reduced

up to 80%. The impacts will be much more pronounced on the Douglas-fir than on the white fir. The end result will be a decreased ability to produce large trees and quality old-growth habitat.

**Soil Productivity**

Soil biology, chemistry, and physics act both independently and collectively to create soil characteristics that determine "Soil Productivity". Productivity is the ability of the soil to produce vegetation. Historic land uses and management acitivities have potentially impacted soil productivity through soil compaction, topsoil loss and displacement, and loss of organic material (duff and litter layers).

In general, compaction effets the soil biology by reducing the macropore space changing the air and water relationships within the soil, thus changing the soil chemistry. Soil displacement and removal effects the soil biology by removing the source for food, altering the air and water relationships, and changing the structure.

**Botanical Resources**

Fourteen rare plant species have been found within and/or adjacent to the Beaver and Palmer Watershed Analysis Area. Seven of these species are currently listed as sensitive, three on the the review list, and four on the watch list.

Vascular plants from Table C-3 (ROD for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl) have been reviewed for this Analysis Area. Of the species listed, Cypripedium fasciculatum and Cypripedium montanum have been located here. Not much is known about the other plant species from Table C-3 within the Beaver and Palmer Watershed Analysis Area, and they have not been surveyed for.

**Fire Regime**

Before aggressive organized fire suppression began in 1902, fires within ponderosa pine vegetation communities were described as frequent, low-intensity, ground/surface fires, which may spread over periods of weeks or months in the Siskiyou Mountain forests (James K. Agee; 1993). Fire return intervals for the Siskiyou Mountain, Interior Valley Vegetation Zone is estimated to be 8-10 years on a landscape basis (Atzet; May/June, 1994). Given this frequent fire return interval, heavy accumulations of down coarse woody debris did not occur. Live woody fuels (trees and shrubs) were also at lower densities.

A very different set of vegetative conditions exist today within southwest Oregon. Fuels (live and dead) have built up to an un-natural state due to aggressive fire suppression efforts. With this increase in dead standing and down coarse woody debris and live woody fuels, there is an increase in fire intensity and the chance of crown and stand replacement fires, especially when fires occur during hot dry weather conditions.

The wildfire potential was characterized across the landscape using tested and universally used methods for the calculation of fire occurrence density rating, fire risk, and fire hazard. The fire hazard and fire risk assessment can provide insight from a landscape perspective as to potential areas of concern to focus attention on fuels management, fire prevention, and forest health issues. This can be of value when prioritizing areas for further review and possible prescriptions to improve forest and watershed health. However, this process only provides a course filter, refinement is needed at the project level for site specific planning.

Fire hazard is defined as vegetation by the kind, arrangement, volume, condition, and location that forms a special threat of ignition, spread, and difficulty of control. Thick, continuous, multi-layered stands with heavy accumulations of dead and down woody deris, on steep southerly or west facing slopes, is an example of high fire hazard vegetation that has a high probability of a stand replacing event. Using this definition, there are 7,872

acres assigned with a high fire hazard rating for the Beaver and Palmer Watershed Analysis Area. Another 16,224 acres are assigned to a medium fire hazard rating. There are no acres assigned to a low fire hazard rating.

Fire risk is defined as the chance of various ignition sources causing a fire, threatening valuable resources, property and life. Using a fire occurrence map for the Beaver and Palmer Watershed Analysis Area, and values associated with the land, a fire risk map was developed. As values associated with the land increase, and the probability of ignition increases; fire risk increases. High fire probabilities without high values associated with the land, result in low fire risk. Values used to develop the various risk rating zones, primarily reflect the traditional values associated with the concentration of human habitation and traditional values associated with forested land.

**Terrestrial Wildlife**

Vegetated lands within the Beaver and Palmer Watershed Analysis Area have been grouped into the following categories of wildlife habitats: late-successional forests, mature closed-canopy forests, young closed-canopy forests, early seral/open-canopy forests, hardwood forests, hardwood/conifer forests, brushfields, and grasslands. Special habitats found within the watersheds are riparian zones, caves, rock out-crops, talus, bridges, buildings, snags, and down logs. The analysis of habitat types was conducted for the entire watershed without consideration for ownership boundaries.

Late-successional forests, often referred to as old-growth forests, can be characterized as multi-storied (scattered large conifers with an understory of smaller trees), canopy closure usually greater than 70 percent (with occasional small openings), and a component of snags and down logs. Late-successional forests are uncommon throughout the entire Watershed Analysis Area. The average by sub-basin ranges from 5 percent in China Gulch to 11 percent in Billy's Gulch. An analysis of vegetative conditions classes indicates that the potential for late-successional habitat in the Beaver and Palmer Watershed Analysis Area may be up to 30 percent of the Analysis Area. This assumption is based on the percentage of land in early seral stages, and knowledge of past timber harvest activities.

The Lack of late-successional forest habitats within the watershed analysis area likely has had a negative effect on presence, abundance, and distribution of wildlife species that are dependent on old-growth forests. For example, spotted owl nest sites are restricted to only several locations within each of these watersheds. Prior to the removal of large tracts of late-successional forests, spotted owl nest sites were probably more plentiful. Each spotted owl pair within Beaver and Palmer Creek Watersheds are presently within an incidental take situation because of lack of adequate amounts of suitable habitat.

Other habitat types are more common within the Watershed Analysis Area and provide habitat for a diversity of wildlife species. This Watershed Analysis Area is a year-round home for some species, and for other species it is a migratory stopover. A species list compiled for the Applegate Adaptive Management Area (AAMA) (BLM, 1993) indicates the AAMA may be home to 12 amphibian species, 19 reptile species, more than 100 birds species, and greater than 60 mammal species. This list also applies for this Analysis Area. These watersheds are also home to uncommon species (i.e., the northern goshawk), endemic species (i.e., Siskiyou Mountains salamander), and Federally listed species (i.e. northern spotted owl).

An analysis of connecting habitat within Beaver Creek Watershed and to adjacent watersheds shows connecting habitats to be heavily impacted by timber sales in areas that are important connecting points to other areas. Squaw Creek Gap is an important area that links three watersheds; Beaver Creek, Yale Creek, and Squaw Creek. In addition, this area leads to Dutchman Peak, Silver Fork Basin, Jackson Gap; all important points of connection with Mount Ashland, and sub-basins of the Klamath River Watershed. Other important connecting points impacted by timber harvest are; the crest between Beaver Creek and Yale Creek Watersheds, and the ridge between Beaver Creek (Hanley, Haskins, Petes, Beaver Head sub-basins) and Squaw Creek Watersheds.

**Desire Future Conditions (DFCs) and Recommendations**

Based on the analysis conducted, the Desired Future Conditions (DFC) and Trends were identified that would indicate a more stable and resilient watershed ecosystem. recommendations are included that would move this watershed towards this stable condition.

**PROCESS: Human Access and Travel (Roads)**

**DFC:** Forest Access and Travel Management (A&TM) plan amends the LRMP, to facilitate closing and decommissioning of FS roads based upon long-term transportation planning needs.

**RECOMMENDATION:**

1. In planning long-term transportation needs the following is considered:

   a. Road densities are reduced in areas where road densities are high especially in riparian areas, sensitive granitic and unstable soils, and in black tailed deer winter range;
   b. Adequate fire suppression response times are maintained;
   c. Interim steps are taken on a watershed basis to facilitate the closure and restoration of roads not currently being used until long-term forest wide plans are completed and implemented. Utilize the Rogue River National Forest Access and Travel Management Process Guide to facilitate both interim and long-term transportation planning.

**PROCESS: Stream Flow Regime**

**DFC:** Channel maintenance flows provide for the orderly conveyance or uninterrupted transport of water and imposed sediment supply produced from the watershed through the stream channel network such that over time, channel dimensions and patterns are self-maintained. B-type channels are created and/or maintained in both Palmer (mouth to 1/2 mile above Dark Canyon) and Beaver watershed (mouth to Pete's Camp)

**RECOMMENDATIONS:**

1. Recreate a B type channel in the lower Reaches of Beaver Creek.
2. Reestablish the floodplain and the meander pattern to the lower Reaches of Palmer Creek.
3. Work toward the establishment of a Memorandum of Understanding (MOU) with the private irrigation users (as well as other water users), to ensure adequate flow for aquatic species and stream channel maintenance in Beaver and Palmer Creeks.

**PROCESS: Water Chemistry**

**DFC:** Water quality is restored and/or maintained to protect beneficial uses and support healthy riparian, aquatic, and wetland ecosystems.

**RECOMMENDATIONS:**

1. Improve water temperature and increase dissolved oxygen by reducing width/depth ratios by recreating a B channel in the lower Reaches of Beaver Creek.
2. Test water and talus for potential toxic metals in mine sites. Obtain any existing test results from mine claimants.

**PROCESS: Sediment Regime**

**DFC:** The sediment regime is more consistent with the historic range of variability.

- Road prisms, landings, human-caused slides and other sources are no longer sources of erosion. The most important areas are riparian zones of steep tributaries and sensitive (granitic) uplands with slopes greater than 30 percent.

- Road densities are reduced, especially within the riparian zones and on sensitive (granitic) uplands, and unstable slopes.
- Soils exist in a noncompacted condition.
- Streambanks are stable and contribute to a high quality habitat for anadromous and resident fisheries.

**RECOMMENDATIONS:**

1. Reduce road density in the following sub-basins: Baldy, Beaverhead, Charley Buck Gulch, Boaz, Hanley Gulch, Haskin's Gulch and Pete's Camp in the Beaver Creek watershed and West Palmer and Sourdough Gulch in Palmer Creek.
2. On roads that will be closed, remove culverts, pull back sidecast fill material, outslope to restore natural drainage, deep rip where appropriate, and plant with native species. Priority roads are midslope, cross live creeks, or are actively contributing sediment.
3. On roads that will be left open but infrequently maintained, evaluate drainage for functioning during storms. Perform work such as outsloping, removing outside berms, waterbarring above culverts, surfacing roads and armoring drainage structures (draindips, diverterdips, waterbars, and culvert cut and fill slopes) on sensitive soils and/or unstable lands (see geology report for specific restoration proposals).
4. Inventory all nonsystem roads and evaluate need for restoration.
5. Stabilize eroding streambanks.
6. Update range allotment management plant (AMP) to control livestock movement through riparian areas.
7. Readjust fish structures as needed to decrease accelerated streambank erosion and to decrease embeddedness upstream.
8. Timber management strategies (especially ground-based systems) meet desired condition for restoring sediment regime to historic range of variability.
9. Complete slope stability mapping and updates to Soil Resource Inventory prior to any ground disturbing land management activities.
10. Restore unstable lands especially in or near riparian zones.

**PROCESS: Riparian Zones**

**DFC:** The riparian zone is in proper functioning ecological condition. It supports a diversity of native plants, supports bank stability, provides shade to maintain water temperature adequate for aquatic species, provides connecting habitat, and supports a healthy population of native and desired nonnative birds, animals, and plant species.
- Mature age classes are maintained within the riparian zone. Microclimate and ecological conditions found in unmanaged systems are maintained. Desired conditions will require between 50 and 150 years to attain.
- A diversity of vegetation age classes are well distributed and maintained within the watersheds, ultimately allowing no more than 25 percent of the basin in age classes less than 30 years of age.
- Streambanks are stabilized to a condition contributing to a high quality habitat for anadromous and resident fish.

**RECOMMENDATIONS:**

1. Create and maintain a diversity of seral stages, species, and vegetation structure. Ultimately allowing no more than 25 percent of the basin in age classes less than 30 years of age.
2. Restore riparian habitat to increase the average age class of riparian forests to improve connectivity.

**PROCESS: Viability of Fish Populations**

**DFC:** Viable populations of individuals of all life stages throughout the watershed for all anadromous and resident fish are maintained. Aquatic habitat is restored and protected for all anadromous and resident fish. Spatial and temporal connectivity is restored and protected within and between watersheds.
- 25 pools per mile of stream channel are created and/or maintained and a pool/riffle ratio or step/pool ratio approaching approximately 40/60 ratio is also maintained (determined by channel morphology).

- Riparian zones are in proper functioning ecological condition (discussed in more detail under PROCESS: Riparian Zones).
- Lower stream temperatures, in the short term - attain a summer seven day average of the maximum daily stream temperatures less than 68 degrees F throughout the basin. In the long term - maximum daily temperatures are reduced to historic levels which pre-date European settlement.
- Average between 25-80 pieces of large and small coarse woody debris (CWD) exist per mile of stream channel. This will vary by channel morphology and will not be achieved for 100 years unless artificial wood structures are placed. These artificial wood structures may not be appropriate until the sediment regime has been corrected in the upland portion of the watersheds.
- Channels with gradients of less than 2 percent will have less than 35 percent embeddedness.
- Natural gravel/cobble/small boulder substrate mixture is recreated and maintained, eliminating embeddedness.
- Culverts are replaced and maintained to allow for 100-year events and facilitate fish passage.
- Viable populations of anadromous coho salmon and summer and winter steelhead are maintained, as well as resident rainbow and cutthroat trout.
- Instream flows are restored and maintained at a level which improves water quality in the lower main stems, and which support a viable anadromous and resident fishery.
- Irrigation canals will be regulated at a level which prevents sediment from entering nearby streams.

**RECOMMENDATIONS:**

1. Reinstate the aquatic ecosystem that existed prior to the 1950's. (See recommendations for PROCESS: Stream Flow Regime)
    a. After channel morphology is reestablished, add spawning gravel.
2. To increase short term supply of coarse woody debris, strategically place large-sized CWD throughout both basins in the main stems.
3. To reduce embeddedness and to recreate pool habitat see recommendations for PROCESS: Sediment Regime.
4. Replace culverts identified as not designed to carry 100 year flow events.
5. In addition to, or separate from, recommendations in PROCESS: Flow regime, work with private irrigation users, in preventing fish movement through canals.

**PROCESS: Natural Disturbance (Fire, Insects & Disease)**

**DFC:** Landscapes are in a stable condition in relation to their response to disturbances such as fire, insects, and disease.

***FIRE***

**DFC:** Landscapes are relatively resistant (within range of natural variation) to large scale stand replacing fires.

**RECOMMENDATIONS:**

1. Take aggressive action, to protect, restore, or stabilize these landscapes. Manage vegetation in high risk, high hazard areas to lower the risk of large stand replacing fires.
    a. Mimic natural disturbance to meet landscape objectives. Tools to be considered include: density management, prescribed fire, and manual manipulation of live/dead vegetation. Work toward developing new techniques for meeting landscape objectives that consider economically feasibility.
    b. Construct strategically located shaded fuel breaks to lower the risk of large stand replacing fires.
    c. Integrate the analysis of habitat requirements, site productivity and other ecological considerations with site specific fire hazard and fire risk analysis. Relative risk and fire hazard rating should be considered when deciding what actions to be taken.

2. Analyze and provide for adequate presuppression and preattack facilities such as helispots, access and safety zones.
3. Strong prevention programs should be developed with local communities emphasizing defensible space and hazard reduction around private property. Encourage private commercial forestry, to practice adequate live and dead fuels treatment, particularly at lower elevations.
4. The following table, using the best existing information, recommends the amount of coarse woody debris within vegetation zones based on aspect, as influenced by the pre-fire suppression fire return interval. The recommended amounts would be primarily justified for planning the amount of coarse woody debris **for projects emphasizing fire hazard reduction to reduce stand replacement fires precluding LSR, AMA and Matrix land objectives.** The recommendation provides reasonable amounts (within the range of natural variation) of coarse woody debris with the objective of meeting the intent of the ROD standards and guidelines while being consistent with that which would be expected for specific fire return intervals as influenced by the specific fire environment. Integration must take place when making final decisions as to the amount of coarse woody debris within the range of natural variation that should be planned for.

| Vegetation Zones (a) | Primary Successional Phase | Fire Return Interval (b) | Recommended Amounts of Coarse Woody Debris by Vegetation Zone and Aspect |
|---|---|---|---|
| Interior Valley (ponderosa pine & driest Douglas-fir series) | Seral | 8-10 years | 0 to 3 pieces/acre on south aspect; 2 to 5 pieces/acre on north aspects. |
| Mixed Conifer (Douglas-fir and driest white fir series) | mostly seral | 15-20 years | 3 to 7 pieces/acre on south aspects; 5 to 10 pieces on north aspects. |
| Riparian Areas | | | 16 inch diameter, 120 lineal feet/ acre minimum; Mattrix S&Gs, ROD, pp C-40. |

(a) taken from Jerry F. Franklin and C. T. Dryness. Vegetation Of Oregon & Washington. - U.S.D.A. Forest Service Research Paper PNW-80. 1969. (b) Fire return intervals are on a landscape basis. Intervals determined from personal discussion with Tom Atzet, Area Ecologist, 1994, concerning fire return interval for the forest/urban interface above Ashland, Oregon and the upper Applegate Valley eastern Siskiyous.

## INSECTS AND DISEASE

**DFC:** Landscapes are relatively resistant to large scale insect and disease infestations. Site productivity is restored and maintained at levels conducive to healthy vegetative growth and survival. Vigorously growing vegetation is less susceptible to insect and disease attacks than poorly growing stagnated vegetation.

**RECOMMENDATIONS:**
1. Manage vegetation according to recommendations of the *Applegate Adaptive Management Area Ecosystem Health Assessment*, Landscape and Stand Level Goals.
2. Analyze existing soil conditions when designing vegetation management projects. Design new projects to restore or maintain soil productivity characteristics.

## TERRESTRIAL SPECIES VIABILITY

**DFC:** Habitats support diverse and viable populations of terrestrial native wildlife species, and exist in locations that are important in providing for connectivity with adjacent watersheds.
- Late-Successional habitat exists at ranges closer to historic levels which takes into account growing site capabilities and pre-suppression era fire return intervals.
- Black tailed deer winter range, summer range and fawning habitat has been identified and used to update the LRMP Big Game Winter Range Land Allocation mapping.
- Habitats for other species of concern for this area have identified.

**RECOMMENDATIONS:**

1. Identify black-tail deer winter range , summer range, and fawning habitat within each of these watersheds. This activity will update the winter and summer ranges identified within the Forest Plan, which is inaccurate for much of this area.
2. Identify areas within the watershed analysis area that are important for providing connecting habitats with adjacent watersheds, e.g., Squaw Gap which leads from Beaver Creek watershed into the Yale Creek and Squaw Creek watersheds. Also, identify areas that are presently serving as connecting habitat and should be maintained for this purpose. For areas where connecting habitat is important but is not available because of past timber harvest, identify and implement appropriate silvicultural projects that would speed up the growth of forests in order to provide suitable connecting habitats.
3. Implement prescribed fires within brushfield habitats to increase the amounts of brushfields in early seral stages and to increase the distribution of age-classes.
4. Improve band-tail pigeon habitat by planting and encouraging blue-elderberry plants and Pacific madrone trees within high elevation areas, particularly in conifer plantations. One area to consider is along Beaver ridge between Beaver Creek and Squaw Creek watersheds.
5. Remove from future mineral exploration, areas within Palmer Creek watershed that are known to be used by Townsends big-eared bat. This will provide long-term protection for this sensitive bat species within the Palmer Creek watershed.
6. Close-off to human activities caves (mine adits) within Palmer Creek watershed that are known sites for Townsends big-eared bat and other bat species. Human activities are a major disturbance to Townsends big-eared bat.
7. Complete data collection for information lacking or not included within this report, such as spotted owl habitat amounts on private and Federal lands, connecting habitats within and adjacent to the watershed analysis area
8. Review the status of ponderosa pine and oak savannahs within the watershed analysis area and design projects to re-establish, or to maintain existing savannah communities.
9. Implement prescribed fire where (compatible with other resources) to restore TE&S plant communities.
10. See monitoring for recommended surveys needed to identify current populations of species of concern for these watersheds.
11. Field verify PMR data used in this report.

## IV. MONITORING AND RESEARCH

The Rogue River National Forest (RRNF) Monitoring Vista Group has evaluated the RRNF current monitoring plan and developed a new methodology to assess the health of ecosystems through indicators of biological diversity. This new strategy " An Integrated Ecosystem Monitoring Framework" establishes a scientific approach for observing and recording the forest ecosystem.

Monitoring and research opportunities abound with the analysis area, particularly since this area is within the Applegate Adaptive Management Area. The following list highlights several areas of monitoring or research that are presently on-going or proposed, or in areas where information is totally lacking but may be important to conduct forest management activities.

### BIOLOGICAL

*Siskiyou Mountain salamander*: Research concerning habitat parameters is presently on-going. Additional survey work has been conducted which has increased the known range of this salamander. Additional research is needed to learn more about this species natural history and the extent of their range. The natural history of this species is a long-term research endeavor, but the identification of the range of this species can be learned through intensive, short-term surveys. Research into the effects on the species from timber management activities should also be considered.

Field verify all potential Siskiyou Mountain salamander habitat to determine if the species is present. Considerable portions of these watersheds have been identified as potential habitat, but they have not all been surveyed for presence of Siskiyou Mt. salamander. Survey for Siskiyou Mountain salamanders. Several areas within theses watersheds are known to be occupied by this salamander species. The ROD provides specific management guidelines for this species and their habitat.

*Furbearers*: Conduct camera station monitoring along the major drainages within the watershed analysis area in order to determine presence/absence of furbearers (fisher, pinemarten).

*Bats*: Continue with telemetry studies of bat species to learn about maternity roosts, day roosts, feeding areas, and migration patterns. Conduct surveys to determine the locations of important roosts for Townsends big-eared bat, fringed myotis, and other cave dwelling bat species.

*Spotted Owl*: Implement the Applegate Districts proposed telemetry study to gain a better understanding of habitat use. Of particular interest is use of hardwood and hardwood/conifer forests, and of young forests.

Conduct surveys for spotted owls within and adjacent to habitat areas that are not known to be presently occupied, but may be occupied.

Surveys meeting established protocol are required prior to implementing projects that could impact spotted owls.

Monitor all known spotted owl nest sites to determine nesting status.

*Neotropical Migratory Birds*: Continue participation with the Monitoring Avian Productivity and Survivorship (MAPS) program. This national research program is studying dynamics of neotropical migrant bird populations.

*Snag/Down-Log Habitat*: These habitat types directly or indirectly support a great diversity of wildlife species. Past management practices by Federal and private forest managers in general have had a negative impact on

these habitats. Salvage logging has recently been an important forest management system, but salvage has the potential to be detrimental to the maintenance of snag/down-log habitat. State safety concerns also impact the ability to maintain snag/down-log habitat. Design monitoring to better evaluate existing levels of snag/down-log habitat and what remains after implementation of forest management activities.

*Great Gray Owl:* Conduct surveys for great gray owls as required in the ROD (beginning in January, 1995). The potential is high for this species to be found on the Beaver Creek watershed.

*Goshawk:* Conduct surveys for northern goshawk, a species of concern throughout their range. A nest site is known in Palmer Creek watershed and nest site(s) are suspected on the Beaver Creek watershed. No information is available for the other four watersheds.

Begin survey work for wildlife species identified in Appendix J2, that must be surveyed for prior to implementation of projects.

*Fish survey*: Continue monitoring fish distribution and age classes in the main stems. Monitor redd counts. Determine existence of fish in the China Gulch, Flumet, Billy's Gulch and McKee watersheds and the tributaries on the north side of Palmer Creek.

*Macroinvertebrates*: Most sites appeared to have hit bottom as far as habitat and biotic integrity and to be recovering. Trend monitoring will document this process. These streams will have differing potential for recovery, depending on; how rapidly sediment inputs can be brought under control, and the degree of damage to the overall habitat structure. Monitor Palmer Creek for baseline data.

**PHYSICAL/CHEMICAL**

*Channel Morphology*: Aggradation and degradation processes should be monitored by repeating cross-sectional surveys at fixed transect sites. These transects have been set perpendicular to the channel and have been permanently located with lag bolts set in cement at a distance set far enough away from the bank to prevent loss during flood events.

Continue monitoring other key morphological indicators including sinuosity, sediment size, channel slope and entrenchment.

*Water Quality*: Long-term monitoring of stream temperature, dissolved oxygen, pH, conductivity, suspended sediment and bedload.

*Soil Conditions:* Monitor the degree and spatial distribution of soil compaction. Use this data to assess the effects of past management activities, identifying restoration needs, and for designing new projects that will maintain or restore productive soil characteristics.

Monitor duff and litter thickness to assess the effects of past management activities, identifying restoration needs, and for designing new projects that will maintain or restore productive soil characteristics.

# 1994 WATERSHED ANALYSIS

# BEAVER AND PALMER CREEK WATERSHEDS

Applegate Ranger District
Rogue River National Forest

## I. INTRODUCTION

### A. ANALYSIS STRATEGY

#### 1. Why do Watershed Analysis?

The Record of Decision (ROD) for Amendments fo Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, incorporates the Aquatic Conservation Strategy; developed for restoring and maintaining the health of watersheds, and the aquatic ecosystems contained within them, on all public lands. The Aquatic Conservation Strategy, is a basis for Standards and Guidelines (contained within the ROD) which focus on the attainment of this strategy.

A system of Key Watersheds are identified in this strategy to serve as a refugia for maintaining and recovering habitat for at-risk stocks of anadromous fish species. Both Beaver Creek and Palmer Creek are designated by the ROD as Key Watersheds; identified for their potential, through restoration, to become high quality habitat in the future for anadromous and other fish species. Watershed Analysis is a key component for implementing the Aquatic Conservation Strategy. Through watershed analysis, opportunities will be identified for the restoration of aquatic habitat and ecosystem health.

#### 2. What is Watershed Analysis?

Watershed analysis plays an important role in providing for the protection of aquatic and riparian habitat. Watershed analysis is an assessment of the health of an ecosystem at the watershed scale. It identifies processes and functions occurring within a watershed that are key to maintaining healthy terrestrial and aquatic ecosystems, and assesses the effects of human activities on these processes and functions. This analysis focused on the compilation and analysis of data identifying processes and functions occurring within the Beaver and Palmer Watersheds, and displays the effects of human activities. This Watershed Report will document the analysis completed by an Interdisciplinary Team. It will also identify gaps in data and information needed to make sound decisions and recommendations on future management activities in these watersheds.

#### 3. How this Analysis Was Conducted

A core team was assembled to complete the Watershed Analysis for the Beaver and Palmer Creek Watersheds. The original core team was represented by Deb Whitall (Hydrologist), Su Maiyo (Fisheries Biologist), Dan Sitton (Geologist), Mario Mamone (Wildlife Biologist), Bill Warner (Silviculturist), Brent Hasty (Geographical Information System Support), Tom Lavagnino (Analyst), and Kristi Mastrofini (Facilitator). Early in the analysis process, the need for fire management input was recognized; the core team was joined by Bill Rose (Fire Management Specialist).

In addition to this core team, support was provided to the team by Dave Green, Dave O'hara, Ron Brady, Jim Doty, Mel Beaty, (Engineering); Tom Atzet (Ecology); Ed Reilly (ARC-Info, GIS/Analyst); George Badura (Soils); Barb Mumblo (Botany); Jeff Lalande (Heritage Resources); Dave Rosgen (Hydrologist); Bill Thomas, Scott

Thompson, and volunteer Kevin Ritter (hydrology/fisheries crew); volunteer Richard Hart (water chemistry); Katy Marshall, Elaine Plaisance, Robin Thomas (support services), and Tod Harrison (cover illustration). Other agencies contacted for information and technical support were Oregon Department of Fish and Wildlife (ODF&W), Pacific Southwest Research Station (PSW), University of California at Berkley, and United States Geological Survey (USGS).

The direction for completing Watershed Analysis for fiscal year 1994, was, to the extent possible, to use existing data for completing the Analysis Process. For the most part, this direction was achievable. However, some time was spent on field reconnaissance and collecting stream data the team felt important to completing this analysis.

The original time frame for completing this Analysis was set at 2 months. Most team members concurrently worked on other priority Forest projects (fire assignments, watershed restoration, "the journey", Special Uses Process Team, etc.) at the same time as this Watershed Analysis was being conducted. As a result, this process evolved into a 6 month project. Even if team members could dedicate 100% of their time to this process, 2 months may likely be an unrealistic time frame. There are many variables that may influence this time frame such as: the time of year conducted, number of acres, interagency coordination, availability of existing data, Forest priorities, downsizing organization and workload scheduling, start-up time for new teams, and fire. In other words, every analysis area will be different.

The team following the eight steps outlined in A Federal Agency Guide for Pilot Watershed Analysis, identified the processes, functions, and issues that are key to this Watershed Analysis Area (WAA), and developed key questions that were used to guide the analysis. These key questions are available for review in Appendix A.

Core Team members, as well as some supporting resource specialists, presented a report to the team that addressed key questions specific to their field of expertise. These reports are summarized here and have been integrated in this Watershed Analysis Report by the Team. Individual specialists reports are available for review as Appendix B-I of this Watershed Analysis Report.

Geographic Information System (GIS) was used as a tool for completing this Watershed Analysis. Map Overlay Statistical System (MOSS), R6 Maps, and ARC-Info GIS software systems were used. Since each system manipulates the data slightly different, small differences in acreage results may be detected from one software system to the next. For the purpose of this type of analysis these acreage differences are insignificant to the overall findings. Acreages were resolved throughout this report, however, slight conflicts from one specialist report to the next may be found.

## B. AREA OVERVIEW

### 1. Basin Overview

The Beaver and Palmer Watersheds, tributaries of the Applegate River, are located in the Klamath Mountains Physiographic Province in Southwestern Oregon. The Applegate River Watershed encompasses 491,520 acres and drains approximately 15 percent of the Rogue River Basin. The Beaver Creek Watershed occupies 14,018 acres. The Palmer Creek Watershed is west of Beaver Creek and is 10,077 acres in size. The analysis area also includes several other small watersheds; Billy's Gulch, to the south of Palmer Creek and China and Flumet Gulch, to the north of Palmer Creek. These sub-basin acreages are included into the Palmer Creek Watershed acreage above. Mckee sub-basin is located just north of Beaver Creek and is included in the Beaver Creek Watershed acreages. Of the 24,095 acres within the Watershed Analysis Area; 73 percent is Forest Service, 13 percent is Bureau of Land Management (BLM), and 14 percent is privately owned.

For the purpose of this analysis, the Beaver and Palmer Watersheds were further divided into sub-basins. These sub-basins are referred to throughout this Watershed Analysis Report (see Figure 3 for a map of sub-basins)

*Sub-basins of Beaver and Palmer Creeks (Map 1) are:*

| ***Beaver Creek*** | | ***Palmer Creek*** | |
|---|---|---|---|
| Armstrong Gulch | 963 acres | Babbit | 321 acres |
| Baldy | 761 acres | Bailey | 1,786 acres |
| Beaver (Head) | 1,570 acres | Dark Canyon | 470 acres |
| Beaver (Middle) | 187 acres | East Palmer | 232 acres |
| Boaz | 1,171 acres | Lime Gulch | 1,083 acres |
| Charley Buck | 638 acres | Nine Dollar Gulch | 1,170 acres |
| Hanley Gulch | 2,112 acres | Section One | 369 acres |
| Haskins Gulch | 1,098 acres | Sourdough Gulch | 379 acres |
| Jackson | 232 acres | Upper Palmer | 510 acres |
| Medite | 383 acres | West Palmer | 619 acres |
| Pete's Camp | 2,172 acres | | |
| Texter | 2,165 acres | | |

***Other Watersheds***

| | |
|---|---|
| Billy's Gulch | 581 acres |
| China Gulch | 997 acres |
| Flumet Gulch | 1,558 acres |
| McKee | 564 acres |

**2. Rogue River Basin Characterization**

The Applegate Watershed is one of seven sub-basins within the 3,300,000 acre Rogue River Basin which flows into the Pacific Ocean. The Rogue River is located in the Klamath Mountain physiographic area and the Cascade Mountain area which includes the Western and High Cascade sub-provinces. The basin is approximately 110 miles from east to west, roughly rectangular, with the main river about 210 miles in length from Crater Lake National Park to Gold Beach. The upper section of the river originates primarily in the steep topography of the Rogue-Umpqua Divide, west slope of the Cascade Mountains and upper elevations of the Siskiyou Mountains.

The Applegate River meets the Rogue River in the central valley segment of the Rogue River which is characterized by alluvial and alluvial fan-influenced valleys. These central segments contain two major towns, Medford and Grants Pass, and include much of the farm land in the basin. The streams in this valley are flat in gradient, have streambeds composed of sand and gravel with some cobble, tend to bordered by wide terraces, are capable of meandering across flood terraces in the valley to interact with adjacent hillslopes, and are depositional with regard to sediment and large wood material.

If these central valley segments were not maintained by humans, large wood and flood deposited material would cause major stream channel shifts during flooding. Prior to European settlement these valley segments in the mainstem Rogue River, Applegate River, Illinois River and larger tributaries contained more wetland and marsh habitat than today. Agricultural development to capitalize the rich alluvial soils and irrigation water has simplified this aquatic and riparian habitat that was once more pervasive across these valleys.

The lower Rogue River below the confluence of the Applegate River is characterized as a gorge, primarily bedrock canyon valley, with a profusion of sharp ridges and steep tributary canyons. This river segment is of

steeper gradient than the central valley segments of the river system and tends to transport sediment and large wood to the estuary and ocean.

This portion of the river serves as a highway for all the anadromous fish species to reach interior Rogue River streams for spawning and rearing. Key fish species that inhabit the lower river are sturgeon, juvenile salmon and trout and migrating salmonids. Much of the freshwater lifecycle of fall chinook, spring chinook and summer steelhead is spent in the mainstem of the Rogue River. Coho salmon and winter steelhead are generally more dependant on tributary stream habitat and tend to stay in these habitats for one full year or more (Frick, 1994).

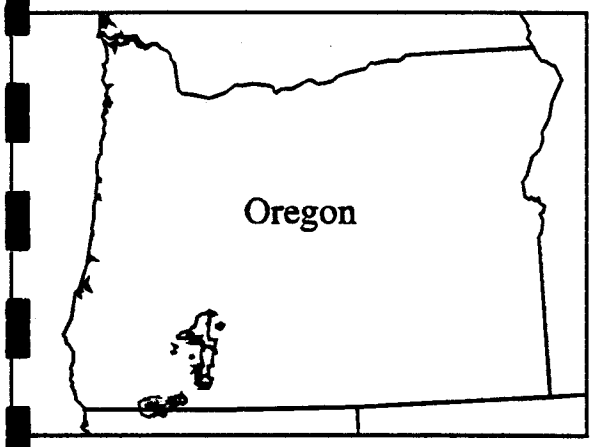
**3. Southwest Oregon Province**

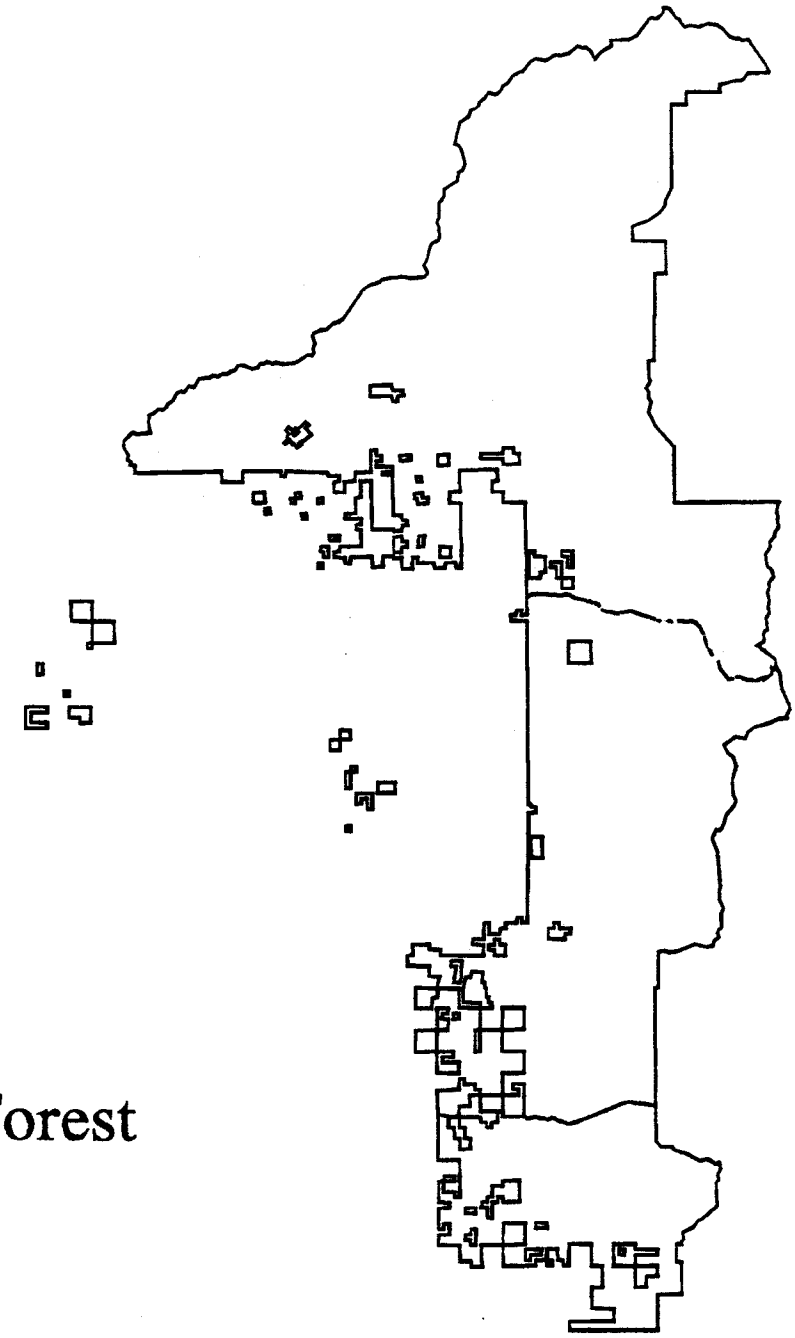
The Southwest Oregon Province overlays three geological areas that have considerable implications for the diversity and migration of flora and fauna. These geological areas include the High Cascades, the Western Cascades, and the Klamath Geological Provinces. The Klamath Geologic Province links the Sierra Nevada of California to the south, Cascade Mountains to the east and the Oregon Coast Range to the West and North. This connectivity has contributed to the Klamath Province in being the most floristically diverse in the United States.

The Klamath Geologic Province includes the Siskiyou Mountains of Oregon, and extends roughly from Redding, California to near Roseburg, Oregon, and west almost to the Pacific Ocean. The Klamath province lies within the Mediterranean systems more characteristic of California.

Province level processes include species dispersal (short-term movement and interaction), migration (long-term movement of populations and species ranges), and adaptive processes (evolution in the long-term). Health and viability of populations depend on their ability to reproduce, survive, and grow. Movement is critical for these processes.

# Vicinity Map



Rogue River National Forest

Beaver/Palmer Watersheds

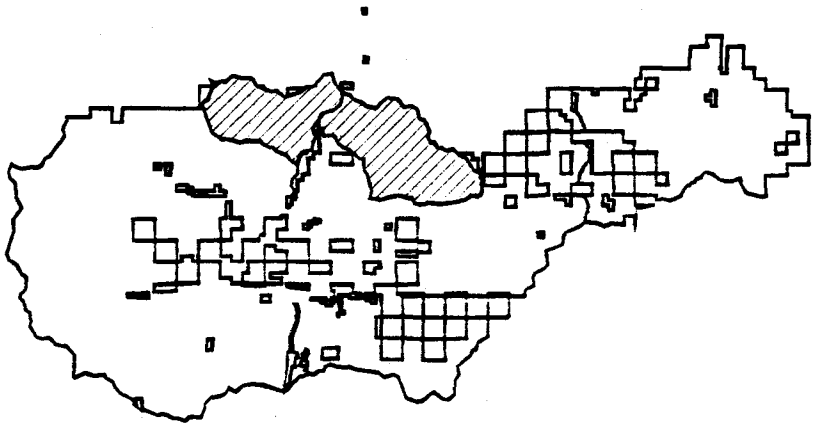
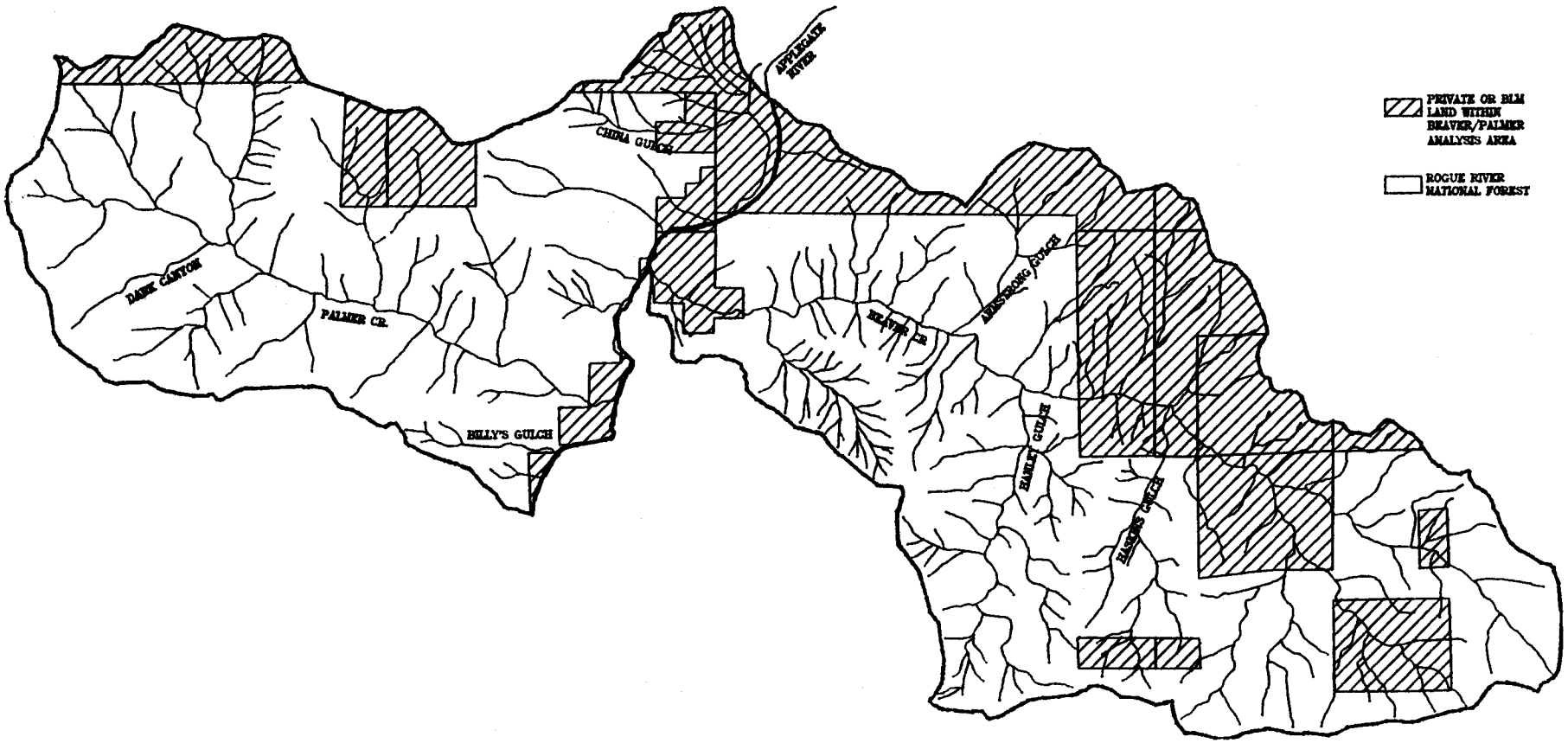


Figure 1

# BEAVER AND PALMER WATERSHED ANALYSIS AREAS




SCALE 1: 66000.

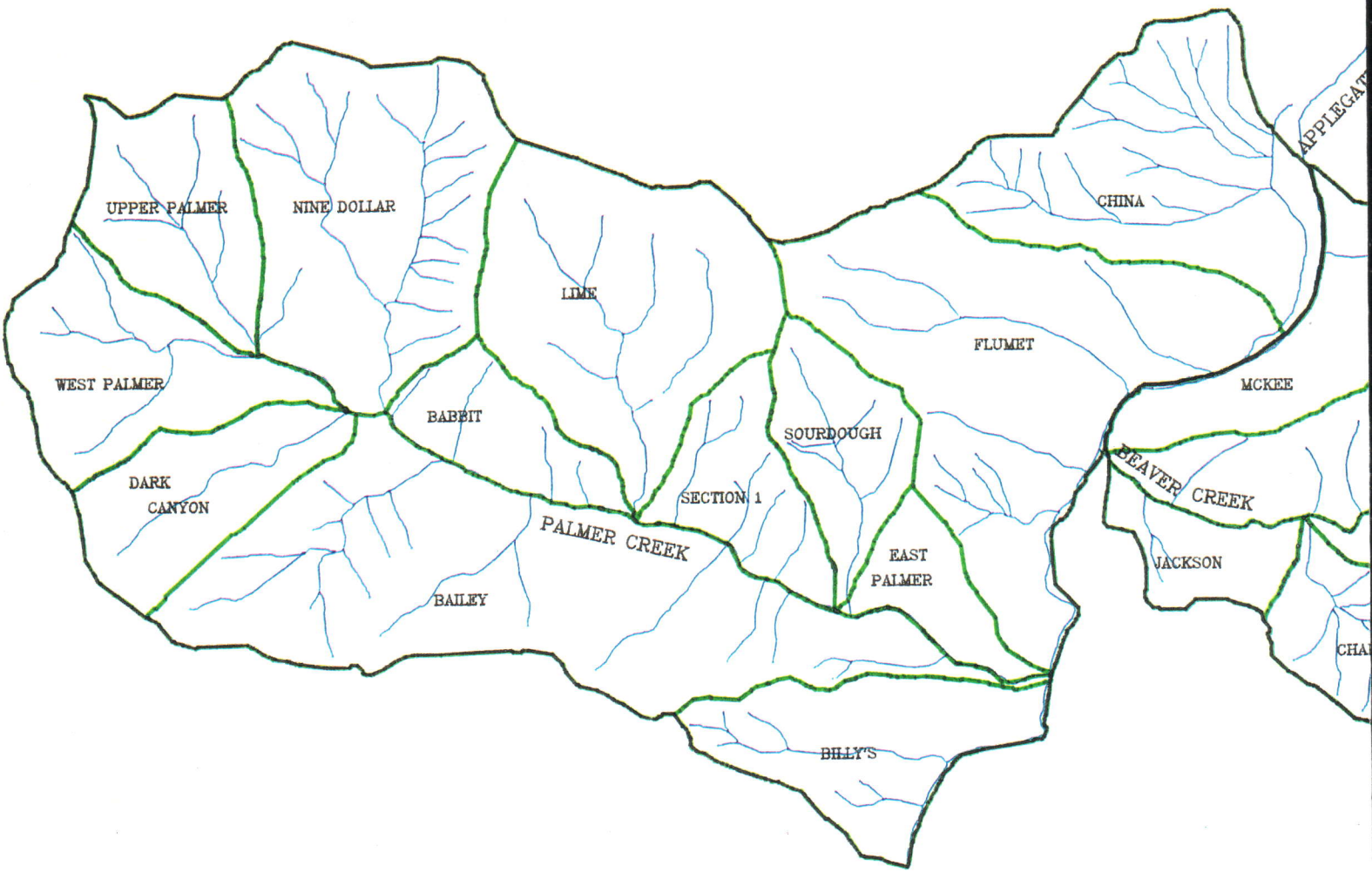
N

Figure 2

AUTOGIS

11/15/94 15:45:55

# BEAVER/PALMER W




SCALE 1:

N

# ATERSHED SUBBASINS

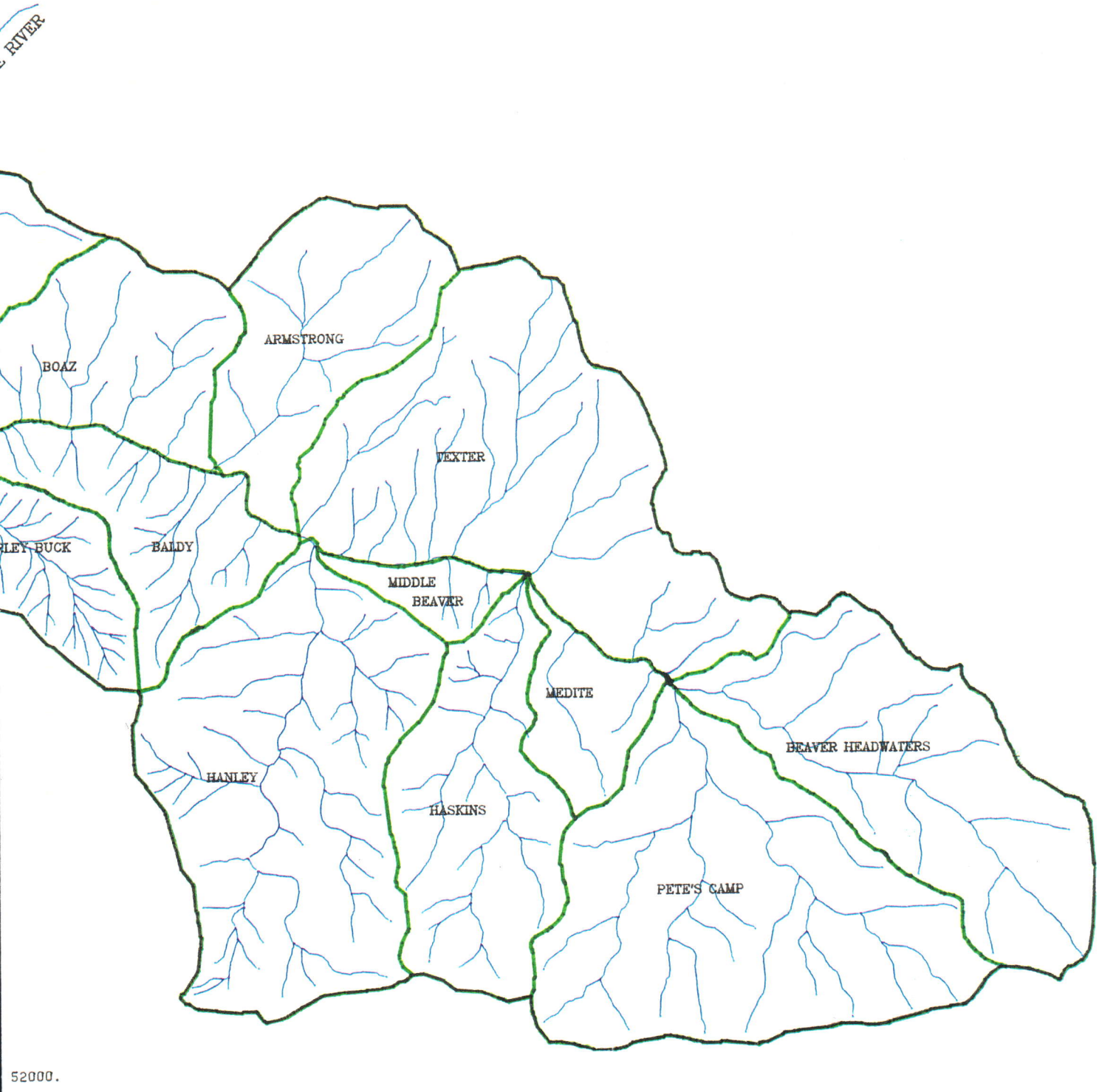



**Figure 3**

8/29/94 8:13:56

## 4. Climate of Interior Southwest Oregon; Eastern Siskiyous

The summertime weather pattern is dominated by the Pacific high pressure cell which moves from its southern wintertime position and migrates into the northern Pacific during the summer months. Moisture and cold air mass movement and location are influenced by the position of the high pressure cell. During the summer months many storms with moisture are diverted to the north of interior southwest Oregon due to the influence of the Pacific high pressure.

The global position of interior southwest Oregon results in exposure from cold storms of the north and warm tropical storms from the south. These cold air masses influence snow and rainfall potential during the cooler months. The upper air tropical moisture influxes, bring lightning activity during the summer months.

As referenced in Atzet and Wheeler's document concerning the fire history of the Klamath Province (Atzet and Wheeler 1982) the unique topographic orientation of the Klamath Mountain Range (including the Siskiyou Mountain Range) influences the manner in which storms are received across the landscape. Incoming storms are not uniformly received across the landscape. There is no recognizable pattern to the major drainages of the Siskiyou Mountains. Therefore, some drainages preferentially intercept the cold storms while others the warmer storms.

Interior southwest Oregon, eastern Siskiyous has the lowest annual precipitation and the highest annual summer temperatures for the west side of the Cascade Mountain range. Waring (1969) recognized climatic differences between the eastern and western Siskiyous and used the absence of Sadler oak to indicate the drier eastern climatic zone.

The influence of temperature and moisture is important for a site's vegetative potential. The rain shadow from the Oregon coast to the analysis area is very pronounced. From similar elevations on the coast about 100 inches of annual precipitation occurs. At the analysis area about 40 inches of annual precipitation occurs.

From the Squaw Peak remote automatic weather station (elevation 4,964) and the Star Ranger Station weather station (elevation 1,676), summer time temperatures can be closely estimated for the Beaver/Palmer.

| Squaw Peak | *Average High Temp* | *Maximum High Temp* |
|---|---|---|
| June | 65 | 89 |
| July | 72 | 90 |
| August | 72 | 89 |
| September | 68 | 92 |

| Star RS | *Average High Temp* | *Maximum High Temp* |
|---|---|---|
| June | 80 | 107 |
| July | 87 | 107 |
| August | 90 | 107 |
| September | 86 | 108 |

Relative humidities are often in the single digit during the latter part of the summer months. Particularly during September. Generally low-elevation, south aspects are hot and dry. On north aspects relative conditions are cool and moist. Elevation and aspect conditions influence micro-climate and vegetative response.

The Beaver Creek Watershed ranges in elevation from 1,600 feet to over 5,200 feet; the Palmer Creek Watershed ranges in elevation from 1,600 to 4,800 feet. In the winter, snow often occurs on slopes above 3,000 feet in

elevation. During the winter storms usually move in from the north. Rain-on-snow events frequently occur in the late winter and spring months from 3,500 to 5,000 feet in elevation.

**5. Analysis Area Management Direction**

An estimated 277,500 acres of federal lands, located within the Applegate Watershed, are designated as an Adaptive Management Area in the Final Environmental Impact Statement for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, and April 13, 1994 Record of Decision (ROD). The overall objective for Adaptive Management Areas as stated in the ROD: " to learn how to manage on an ecosystem basis in terms of both technical and social challenges, and in a manner consistant with applicable laws." A specific emphasis for the Applegate AMA is " Development and testing of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest (eg, aerial systems) that provide for a broad range of forest values including late-successional forest and high quality riparian habitat."

The Rogue River National Forest, Land and Resource Management Plan (RRNF, LRMP) specifies overall direction to manage the Forest. The LRMP divides the Forest into Management Areas (MA) each with an accompanying management strategy and activity standards and guidelines. The RRNF, LRMP was amended by the April 13, 1994, ROD for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Where the ROD land allocations are more restrictive, they mask RRNF, LRMP Management Areas. Where RRNF, LRMP Management Areas are more restrictive, they will mask ROD land allocations.



Whenever it began, the natives' practice of setting regular fires in the spring and late summer had undoubtedly

# II. HISTORIC AND CURRENT WATERSHED CONDITIONS, PROCESSES, FUNCTIONS, AND TRENDS

## 1. HUMAN PROCESSES

### A. HISTORIC HUMAN PROCESSES INFLUENCING CURRENT WATERSHED CONDITIONS

#### 1. Prehistory (ca. 10,000 B.P.-AD 1775)

Based on archaeological evidence from other areas in the Applegate Valley and the wider southwestern Oregon area, people have probably been inhabiting or otherwise using the Beaver and Palmer Watershed Analysis Area (WAA) for the past 10,000 years. Almost nothing is known about human occupation of the wider area for the period prior to 8,000 years ago, but it seems likely that the Beaver and Palmer WAA would have served as hunting, gathering, and fishing territory for semi-nomadic groups. Projectile points that probably are much older than 2,000 years have been found in the WAA, particularly at ridge-crest locations. Several archaeological sites (i.e., apparent base-camps/villages) that date from the period between 8,000 and 2,000 years ago (the Early Archaic and Middle Archaic periods) are situated a short distance to the south, along the upper Applegate River.

Human populations occupying the Beaver and Palmer Watersheds during the Early and Middle Archaic periods may have remained quite small. It is likely that regular burning of the vegetation began as far back as the Early Archaic. The Middle Archaic (beginning about 4,000 years ago) may have seen increased anthropogenic fire in the general area, perhaps due to attempts to maintain the food-rich oak savanna/woodland vegetation component.

Whenever it began, the natives' practice of setting regular fires in the spring and late summer had undoubtedly become an important environmental factor by the Late Archaic (beginning about 2,000 years ago). The transition forest and mixed-conifer communities of the Beaver and Palmer WAA would have been significantly more open and pine-dominated than the vegetative conditions seen today. Oak-dotted grasslands likely would have covered extensive portions of the south and west aspect slopes.

Three major native groups that inhabited the general area during the Late Archaic period would have been ancestral Takelma, Dakubetede, and Shasta peoples. These populations aggregated at winter villages along the Rogue, Applegate, and Klamath Rivers, as well as Bear Creek. The Beaver and Palmer WAA is not known to have included any major winter encampments, but this simply may be due to the lack of intensive archaeological survey on privately owned land. The Applegate River; McKee Bridge, mouth of Beaver Creek, and the mouth of Palmer Creek areas would be high candidates for the location of such sites. If such villages were at one time located in the area, the nearby brushy or lightly forested slopes may have been used as tobacco-growing patches. These small, individually tended horticultural plots involved the burning of vegetation and the use of digging sticks for occasional cultivation of the *Nicotiana* plants.

The major legacy of environmental change left by native people would have been the extensive fire created and maintained vegetation communities, particularly those situated at the lowest and highest elevations of the WAA.

#### 2. Early Euro-American Exploration (ca. 1775-1850)

Early Euro-American visitors to the interior of southwestern Oregon were concerned primarily with trapping beaver. The policy of the Hudson's Bay Company during the 1820s-40s was to "trap out" the streams of southwestern Oregon and other areas on the fringe of the Company's territory. Semi-annual trapping forays by

the Company and by American fur men during this period may well have resulted in a significant decrease in, if not near extermination of, beaver in much of the Applegate River drainage.

**3. Mining and Initial Settlement (ca.1850-1890)**

With the 1851-52 discovery of gold in the Rogue River Valley, prospectors flocked to the Siskiyou Mountains. Gold strikes soon followed at a various places along the Applegate River and its tributaries. Palmer Creek and adjacent stretches of the main Applegate saw intensive placer mining with rocker and sluice box systems during the 1850s-60s. Apparently very little gold mining of any kind (other than small-scale prospecting) occurred in the Beaver Creek drainage.

During the 1870s, hydraulic mining technology came to the Siskiyou Mountains. Hydraulic mining, conducted by Chinese and Euro-American companies, continued on a large scale through the 1880s. As with the smaller placer operations of the 1850s-60s, this activity was confined to the Applegate river and to the tributaries entering from the west; Beaver Creek (aside from the construction of several medium-sized mining ditches) was largely unaffected. Palmer Creek, Flumet Gulch, and China Gulch all experienced extensive mining during the 1880s.

During the 1850-60s, a few agricultural settlers arrived to farm the terraces of the main river. Within the Beaver and Palmer Creek drainages during this period, it is likely that such people included less than half a dozen families at any one time.

Forest cover would have changed due to the miners' and settlers' intensive cutting of easily accessible, mature ponderosa and sugar pine for shakes, flume boards, and so on. In addition, there is ample documentation that late nineteenth-century prospectors regularly set extensive fires in order to enhance the visibility of bedrock and colluvial deposits. This practice probably continued, and perhaps even enlarged upon, the aboriginal pattern of burning in the WAA.

**4. Livestock Ranching and the Early Forest Service Period (ca.1890-1930)**

The forty years after 1890 saw a lessening of gold mining production and very likely a decrease in both permanent and seasonal populations within the Beaver and Palmer WAA. Mining continued, but on a substantially smaller scale. A handful of prospectors/miners settled on "flats" at the mouths of major gulches in Palmer Creek drainage.

The main human impact during this period came from the activities of local farmers, most of whose bottomland was planted to hay and other feed for livestock, primarily cattle. During summer and early fall, cattle and some sheep ranged into the higher elevations of the WAA, particularly upper Beaver Creek and adjacent drainages to the east and south. A few "home ranches" strung along the Applegate River accounted for these animals. Irrigated pastures used water diverted from the Applegate River and Beaver Creek. One of the earliest irrigation ditches was the Comstock Ditch, with water rights to the Applegate River dating to 1876. Perhaps the highest elevation ditch in Beaver Creek was the Beaver Ditch (1896 water right), which watered the Cameron family's so-called Beaver Ranch, a summer pasture in Sec. 17, T40S, R2W. Flood irrigation was the standard method, and diversions were not screened until well into the twentieth century; annually, large quantities of stranded salmon and trout likely became fertilizer for the fields. By 1920, approximately 2.0 second feet of water from Beaver Creek was allocated for irrigating an approximate total of 100 acres of farmland within the WAA.

Heavy grazing, especially during the world-wide high beef and wool prices of 1910-1919, contributed to degradation of meadow vegetation in the highest elevations of the WAA and adjacent drainages along the Siskiyou Crest. Forest Service grazing reports for the period attest to the "over-grazed" character of the local range. With the sharp drop in market prices following World War I, one might expect that livestock numbers

declined, and in many cases this did occur. However, some local ranchers faced burdensome mortgage payments (dating from the war-time boom) and consequently ran even more animals on their allotments during the early 1920s in an attempt to survive economically. Bankruptcy and foreclosure affected several area ranchers during this stressful period.

Logging had begun in the area during the early mining era, and it continued on a small scale into the 1920s. The Beaver and Palmer WAA, and immediately surrounding vicinity, probably contained only a very few and extremely small capacity sawmills between 1890 and 1930. These would have been family operations that cut seasonally and sold to a limited local market. Shake-makers, culling the woods for high grade sugar pine, evidently had the most noticeable effect during the period; they typically cut down any pine they found, leaving the lesser grade timber to rot on the ground.

Ranchers carried on the regional tradition of seasonal burning, especially so as to maintain or promote grass on the lower, southwest aspect slopes. Late summer and fall burning was the norm, and the main goal was to eliminate brush and small trees. A particular area might be burned at least once and perhaps twice a decade. The ranchers' blazes, combined with the effects of other human and lightning caused fires, contributed to the dense smoke that typically filled the Applegate and Bear Creek valleys nearly every summer during this period. Accounts in the Jacksonville paper in the late 1800's talk of summer days with extensive smoke hiding the sun. The actual acreage burned during this time, and the actual severity of the burns is uncertain. Based on newspaper accounts, large crown fires do not seem to have been the norm. Rather, slow moving and long burning fires of relatively low intensity probably typified both human and natural caused fires. Forest survey records from 1900 indicate that, although extensive areas of timber in the eastern Siskiyou Mountains showed the marks of past fire (e.g., cat faces and scorched trunks), severely burned tracts were less than ten percent of the timberland.

After Forest Service rangers arrived in 1906 to administer much of the Beaver and Palmer WAA, human-caused fire remained their major social-environmental challenge for twenty years. The Applegate Ranger District became notorious among agency personnel as a "hotbed of incendiarism." The regionally catastrophic fire season of 1910 notwithstanding, the almost-as-severe 1915 season saw numerous arson-set fires in and near the WAA. This included a 1,000 acre blaze in the Palmer Creek drainage that grew from several purposely-set fires. Local ranchers objected strenuously to the agency's desire to suppress fires in the brushy lowlands, and years of controversy ended only in the 1920s, when the Forest Service generally succeeded in establishing an effective fire detection and fire suppression system in the area. By 1930 at the latest, most fires in the area were contained as quickly as possible by means of aggressive attack. Brushfields of buckbrush and manzanita encroached on grass savannas. High elevation meadow vegetation retreated before expanding forest; within the forest, cover became more dense.

**5. The Depression, World War II, and After (1930-1950):**

The Great Depression had seemingly contradictory effects on the Beaver and Palmer WAA. One would expect overall human environmental effects to lessen, given the smaller livestock herds and reduced lumber demand of the era. However, these trends were counterbalanced by an increase in mining due to the government-set price of gold. Much of the so-called "Depression mining" activity in the area consisted of single individuals or very small groups hand working placer claims along the Applegate River and Palmer Creek. These winter time operations probably had a negligible impact beyond the actual mine locations. However, two relatively large scale steam operated dragline operations (the "McKee/Crescent-Pacific" and the "Rippey Ranch" placer mines) were active in the gravel bars along the river between McKee Bridge and Palmer Creek during the late 1930s. Settling ponds were likely required by the state (the Rogue River recreational fishery had acquired major economic significance by this time), but some turbidity probably occurred. In addition, some hydraulic mining continued at a location on Palmer Creek. Hard-rock mining, for gold and for mercury, took place in upper Palmer

Creek, along Bailey Gulch (the "Gold Pan" or "Ray Mine") and Dark Canyon (the "Golden Star Mine") during the mid-to-late 1930s.

Another factor influencing human/environmental interaction during the Depression was the arrival of the Civilian Conservation Corps, one of the New Deal's major government employment programs. Crews of CCC enrollees constructed a major recreational facility at McKee Bridge; more importantly, they built the "Beaver Creek Road" from the river to the headwaters of Beaver Creek and beyond. This road served administrative needs and recreational purposes during the 1930s, and with the World War II and post-War boom in lumber prices it became one of the major timber haul roads of the Applegate District. The first Forest Service commercial timber sale in the Beaver Creek drainage was logged by Timber Products Company in 1943-46. During the 1950s-70s, timber haul roads proliferated (e.g. along upper Palmer Creek and in the Hanley Gulch area of Beaver Creek).

**6. "Postscript"**

With America's post-War housing boom in full bore by 1950, and with many of southwestern Oregon's private timber holdings cut over by that time, Forest Service and Bureau of Land Management timberlands became the major supplier for the new, large capacity lumber and plywood mills in Jackson and Josephine Counties during the post-War decades. The period of intensive timber harvest and road construction following 1950 was a major factor in changing the overall appearance of the WAA.

## B. PRESENT DAY SOCIO-ECONOMICS

Timber sales, recreation developments, mining, grazing and their associated activities have played a major role in "shaping" the present economic uses and economic extractions of the federally managed watersheds. The importance of these uses are constantly changing as social values change, and demands for resources evolve as the government applies an ecosystem approach to forest management.

**1. Timber**

The next commercial offering from the watershed is expected to be from the Partnership One Timber Sale and associated projects. The timber sale portion of this project is scheduled to sell this winter and could provide some local employment opportunities. Other projects approved by the Partnership One Environmental Analysis, could also provide local employment.

**2. Livestock/Grazing Uses**

The Beaver Creek Watershed is mostly within the Beaver-Silver Cattle and Horse Grazing Allotment. The Palmer Creek Watershed is mostly within the Upper Applegate Cattle and Horse Grazing Allotment.

Historically cattle grazing and their impacts have influenced the landscapes of the Beaver and Palmer watersheds. Some of the grazing associated impacts have been within the riparian vegetation zones of most of the watercourses. Steps have been taken to mitigate and eliminate these impacts. Currently both Allotment Management Plans (AMPs) are being updated through the National Environmental Policy Act (NEPA) process. The purpose of this is to bring the management of the allotments in compliance with the Standards and Guidelines contained in both the Rogue River National Forest Land and Resource Management Plan (1990) reconciled by the President's Forest Plan (1994). This process involves an Interdisciplinary Team of agency specialists and includes extensive involvement with the public, landowners, and allotment permittees.

Much of the Beaver and Palmer Creek watersheds are at relatively low elevations and do not contain any significant primary grazing opportunities on federal lands. When cattle are released every year on the allotments they tend to concentrate in the best forage areas and do not fully utilize the lower elevation areas. The most

significant range resources are found within the fenced pastures of private land generally along or near riparian areas. Beaver meadow (along Beaver Creek) is a good example of how some of the natural and human improved/expanded meadow systems are being managed primarily for cattle grazing.

**3. Recreation**

Developed recreation sites include: Beaver-Sulfur (6 camping and day-use sites), Jackson Campground (8 camping and 4 day-use sites), Placer (5 picnic sites), McKee Bridge (45 Picnic Sites) and Flumet Campground (4 camping sites). The Flumet, and Jackson Campgrounds are managed by an independent concessionaire under contract to the USDA Forest Service. Numerous dispersed recreation sites exist mainly along the riparian zones of the main stem of Beaver and Palmer Creeks. These sites have been in use for many years and receive the most amount of use during deer season. Since most of the watersheds are at low elevations and there are no major recreation destination sites present, the trail systems are not that numerous. Most of the trails have been developed from either early mining or cattle grazing related activities. Existing road systems are also being used by motorcycle riders and organized groups. Recently there has been increased interest in the trail systems across the Forest for off-road motorcycle uses.

Many of the watershed's residents either commute to the Medford area for employment, work at home (telecommunications), manage cattle, assume misc. local odd jobs, or are retired and enjoy the rural attributes of the Upper Applegate Valley.

An Economical Assessment is scheduled to be accomplished for the Applegate Watershed in the fall of 1994. This will be a comprehensive report outlining the entire Applegate Watershed conducted (contracted) to Southern Oregon State College (SOSC). The Beaver and Palmer watersheds are within this study area and discussions for the Applegate Watershed should fully address all watershed economical issues. This proposed document will be available for review when it is completed.

**4. Neighborhood**

The Beaver and Palmer watersheds has been discussed in the recent publication *WORDS INTO ACTION: A Community Assessment of the Applegate Valley*, published by the Rogue Institute for Ecology and Economy, May 1994. In that document, the Beaver Palmer Watersheds are described as being within the **Upper Applegate Neighborhood.** This assessment is available for review at the Applegate Ranger District Office.

## 2. PHYSICAL AND BIOLOGICAL PROCESSES, TRENDS, AND CONDITIONS

### A. GEOMORPHOLOGY

Plate tectonics have played a major role in shaping the ancient geologic conditions, and evolving it over time, to the present landforms and geologic setting. Subduction, accretion, faulting, folding, mountain building, tilting, landsliding and erosion have all shaped the topography to produce the present geomorphic and geologic conditions.

**1. Paleozoic and Mesozoic Eras (350 to 150 million years ago)**

The Beaver and Palmer Creek Watershed areas were slowly beginning to form under the Pacific Ocean during its early geologic history (approximately 350 to 400 million years ago). Sediments such as mud, sand, silt, and cryptocrystalline quartz, were deposited and were consolidated into rocks on the seafloor. Volcanic eruptions occurred periodically during this time and produced interlayering lavas with the sediments in this submarine environment.

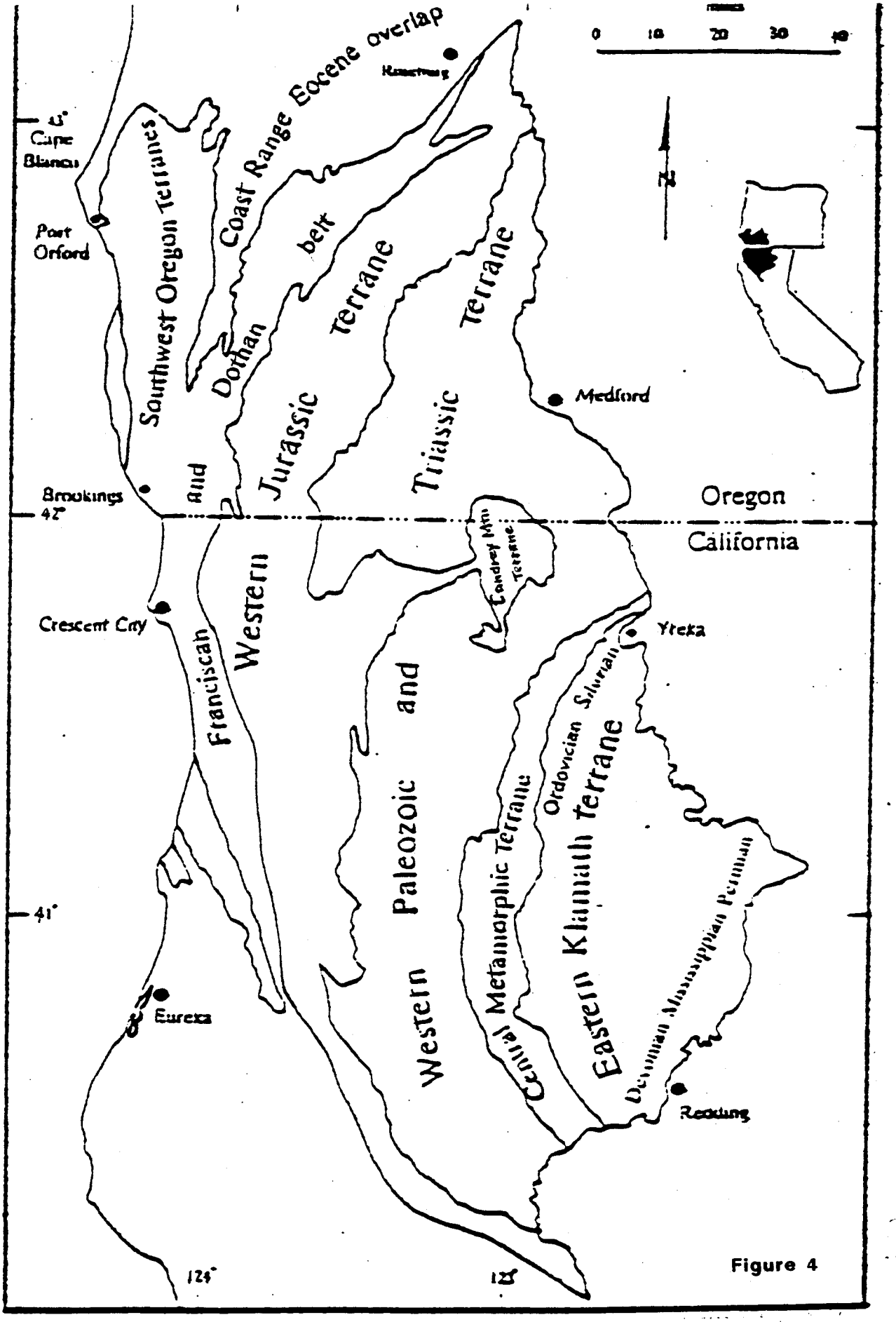
Since the Klamath Mountains are made up of composite belts of rocks formerly part of an ocean environment, the concept of displaced accreted terranes is fundamental to understanding the geology. "Terranes are separate groups of rocks formed in an open oceanic environment, each group with its own layered sequence of distinctive rocks and fossils by which it is recognized" (Geology of Oregon, Orr, Orr and Baldwin 1992). In all, four belts of tectonic terranes (only one of which is found in the Beaver/Palmer Watersheds) were formed during this time of early subduction of the oceanic plate beneath the continental plate. The four belts bounded by thrust faults are progressively younger to the west (see figure 4). As the oceanic plate was being subducted beneath the North American continent, it pushed the four belts eastward. Rocks were metamorphosed by high pressures and temperatures created by the plate movements and burial associated with subduction. By this process, the Klamath Terranes became joined/accreted to the western edge of the North American continent during the early Cretaceous Period (144 to 97.5 million years ago).

When the oceanic plate was being subducted beneath the continental plate, older oceanic sediments of the western Paleozoic and Triassic Belt slid over the younger oceanic crust of the Western Jurassic Belt. This subduction process caused descending rocks to melt, forming large granitic bodies at depth. Eventually, these granitic rocks intruded through the volcanic rocks (lavas and tuffs) and through both levels of oceanic (sedimentary) rocks during the late Jurassic Period. These same geologic processes allowed hot fluids to create small dikes and sills in the upper rock layers, which often carried gold and other precious metals. As mountain building and erosion continued, the granitic rock was exposed to the surface.

Due to the high pressures and temperatures created during subduction of the oceanic plate, this altered the sedimentary and volcanic rocks into metamorphic rocks. Peridotite in the lowest portion of the upper plate was altered to serpentine and now often forms the highest peaks in the Klamath Mountains. Toward the end of the Mesazoic Era, the major rock types were formed, but were in very different positions than the geology that is exposed today.

**2. Cenozoic Era**

During Cenozoic Era (the last 70 million years) the Klamath Mountains were uplifted. The uplift was centered around the the Condrey Mountain Dome located on the southern portion of the Applegate Ranger District. As this area was uplifted to around 23,000 feet in elevation, the surrounding area of the Beaver and Palmer




Distribution of terranes in southwest Oregon and northern California (after Irwin, 1985)

Watersheds was also uplifted. The uplift formed steep, rugged slopes during a time when the climate was cool and moist. Large landslides, glaciation, and bigger streams caused the steep mountainous landscape to erode to a more subdued topography. Following this long period of rapid erosion the climate changed to warmer and more humid conditions. This more humid climate resulted in increased weathering of the bedrock and soils in the Klamath Mountains.

**3. Pleistocene Epoch**

Beginning approximately 2 million years ago, during the Pleistocene Epoch, the landscape was rather subdued. The land was also uplifted 2,000 to 3,000 feet during this time frame and the modern mountains of the area were formed. While the mountains continued to uplift, rivers and creeks cut down into the softer sedimentary materials. The volcanic terrain would have began to appear slowly, during the pleistocene, as several thousand feet of metamorphosed sedimentary and volcanic materials continued to erode. Most of the eroded sediments were eventually transported to the Pacific Ocean via large streams. As a result of the rapid uplifting and erosion of upper sedimentary layers, modern landforms such as the Squaw Peak Pluton, and the China Gulch and Palmer Peak granitic bodies began to be exposed to the surface. Initially, these landforms would have been steeper, more dissected and smaller in size. These fresh granitic bodies would have contained more bluffs and outcrops than the present day topography.

Large landslides (mainly slumps and earthflows) began to occur and developed the eastern and southern portions of the Beaver Creek Watershed and the large majority of the Palmer Creek Watershed. These large landslides occurred during a time when the climate was much moister. Landslides occurred in steep sedimentary and volcanic rocks that were deeply weathered. Some of the evidence such as steep headwall areas and large deposits of several of these landslides are still seen on aerial photography today. Earthquakes would have also been common from subduction of the tectonic plates and would have produced even more mass-wasting during this time.

In the granitic terrain, debris landslides and avalanches would have carried material long distances from where they originally developed. More of the smaller tributaries that run north and south of Beaver Creek were more fully developed via large debris landslides/avalanches and erosion during the pleistocene epoch. Other landforms that resulted from this landsliding were steep mountainous terrain, benchy land, and large debris basins.

Evidence of glaciation is not found in the Beaver or Palmer Creek Watersheds, but glaciation did occur three miles to the south of Squaw Peak centered around Dutchman's Peak. This glacial evidence includes cirques, horns, glacial moraines and arets, resulting from glacial erosion during a colder climate. Squaw Mountain was not high enough in elevation at this time to collect large amounts of glacial ice, but would probably have had some minor ice along the upper peaks during the glacial episodes of the Pleistocene time.

**4. Holocene Epoch**

A warmer and drier climate began during the Holocene Epoch. The climate of the last 10,000 years was very similar to today's climate. These climatic conditions continued to erode the steep mountainous terrain of Beaver and Palmer Creek Watersheds. Only periodic flood events have changed the landforms to any large degree. Continued erosion and landsliding during these large flood events have altered the topography such that it is more dissected and has produced deeper stream channels which continue to widen.

In more recent years, major flood events, like the 1974 storm, have been a major force in shaping the conditions of the streams and river in the Beaver and Palmer Watersheds. Major flood activity was recorded in 1852, 1853, 1864, two in 1880's, and in 1890. The 1890 storm event (100 year storm event) had a very large impact on the Applegate District; triggering massive erosion and massive-wasting. There were newspaper articles of people and horses drowning while trying to cross the Applegate River during the storm. Floods during the 1900's

include: 1901, 1927, 1955, 1964, and 1974. The last four events of the 1900's were very big flood events which caused channel widening, vegetation removal, large landslides, and severe sheet and gully erosion. According to newspaper acticles in the Mail Tribune the 1927 storm event was the largest of the 1900's and caused a large amount of damage in the entire Rogue River Valley. There is also evidence visible on aerial photographs of a major disruption of vegetation in the riparian zone along large portions of Beaver Creek and some of its tributaries. The granitics were especially hit hard which triggered numerous debris flows. But the 1974 storm event was probably the largest ever recorded in the Applegate River Basin this century. The 1974 storm caused adverse impacts to the streams, mainly in Beaver Creek. Several homes, mining cabins, roads, bridges and drainage structures were either damaged or destroyed during these flood events. These 100 year storms caused severe down-cutting and widening within Beaver Creek which is an on-going problem today. The riparian vegetation was again taken out during the 1974 storm as the swollen stream moved large volumes of debris and sediment along with it. Since most of Palmer Creek is more stable than Beaver Creek, it withstood the 1974 flood much better than Beaver Creek.

## B. GEOLOGY & SOILS

### 1. Bedrock Distribution

Granitic rock occupies nearly 29 percent of the Beaver Creek Analysis Area, and 7 percent of the Palmer Creek Watershed. Squaw Peak Pluton is the largest exposure of granitic rock. Several smaller exposures of granitics exist; two located in the Palmer Watershed and a third located east of the Squaw Peak Pluton in the Beaver Creek Analysis Area. The distribution of granitic rock is very important to the modern erosion process, because deeply weathered granitic rock is susceptible to debris landslides and severe surface erosion.

Granitic soils in the area surrounding Beaver Creek (below 3000 foot elevations), are often found to be up to 10 to 15 feet thick. These thick soils have formed from landslide and erosion deposits that originated up slope. The sediment produced from granitic terrain contains mostly course sandy material with little gravel, cobbles and boulders. Deposited granitic sands are usually tightly packed and lack void space needed by many aquatic life forms. Since these course sediments are heavier, they are usually deposited on flatter slopes or behind debris in streams.

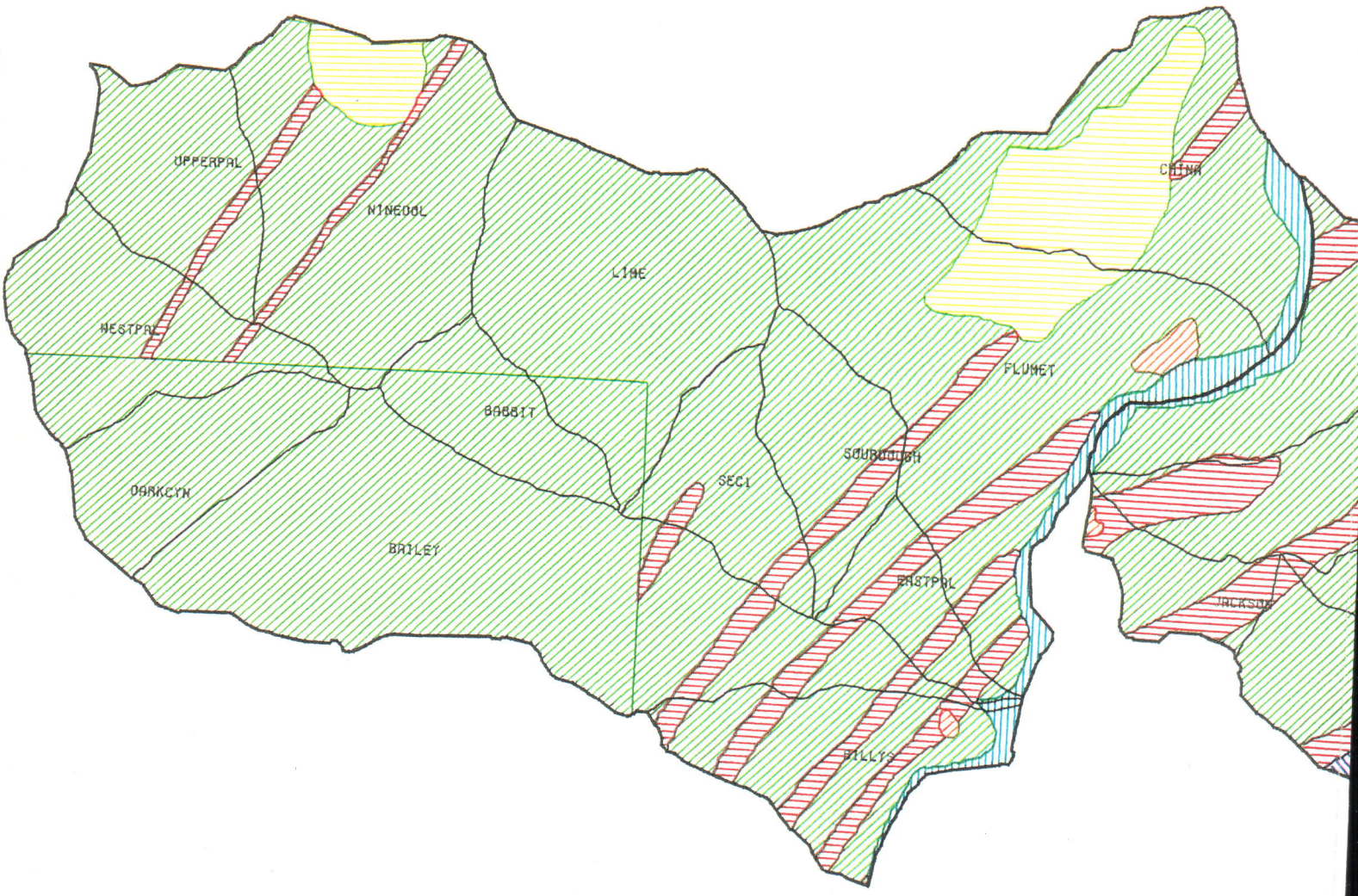
The granitics tend to be good growing sites on the north slopes, however, on the south side the soils are droughty and support less conifer trees. More drought tolerant species are usually found on the south facing slopes. Granitics in the Palmer Creek Watershed are mainly on drier south facing slopes, and tend to be somewhat less productive than the granitic soils in the Beaver Creek Watershed.

Phorphritic hornblende andesite lavas comprise around 18 percent of the Beaver Creek Analysis Area, and by far the largest portion of Palmer Creek Watershed at 83 percent. Slopes in this rock type are steep and moderately dissected. These andesitic lavas are interlayered with argillite rocks, forming silty clay soils that are generally more stable than the granitic, and argillite soils. However, these soils are more easily compacted by management activities. These soil types produce fine sediments often found suspended in streams.

Phorphritic hornblende-plagioclase andesite makes up 47 percent of the Beaver Creek Analysis Area. This rock type forms siltly clay soils similar to the one above, however contains equal amounts of plagioclase feldspar and hornblende which makes it less stable and more erosive.

Argillite comprises nearly 5 percent of the Beaver Creek Analysis Area, and is the second most abundant rock type in the Palmer Watershed at 8 percent. Argillite is made up of volcanic sandstones, mudstones, and bedded tuffs (layers of fragmented rock). Most of the outcrops of argillite are exposed in long narrow fingers that trend northeast. Steeply dipping bedding planes are sometimes nearly parallel with the side slopes which makes them

# GEOLOGIC ROCK T




SCALE 1: 52

N

# YPES BY SUBBASIN

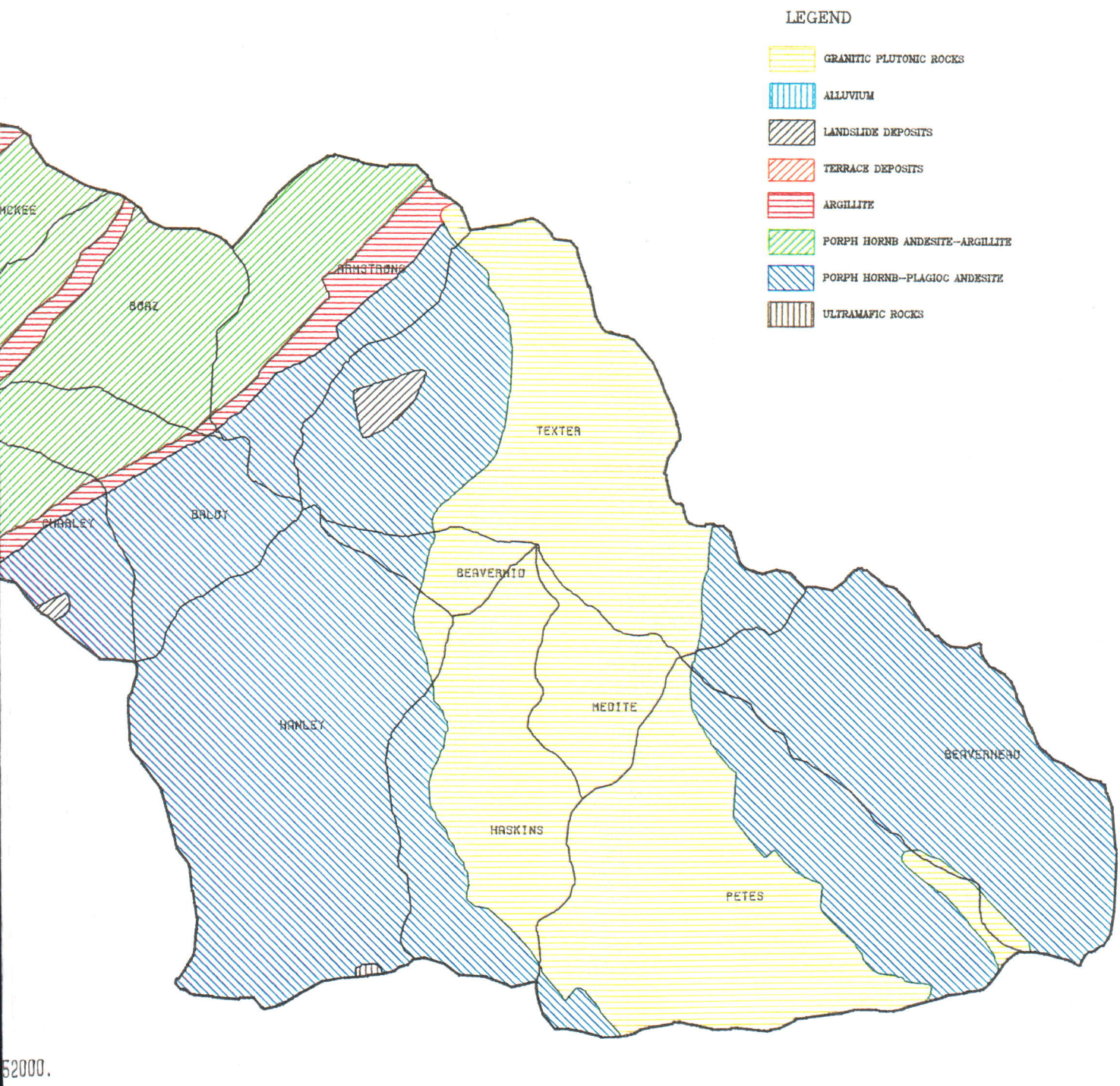
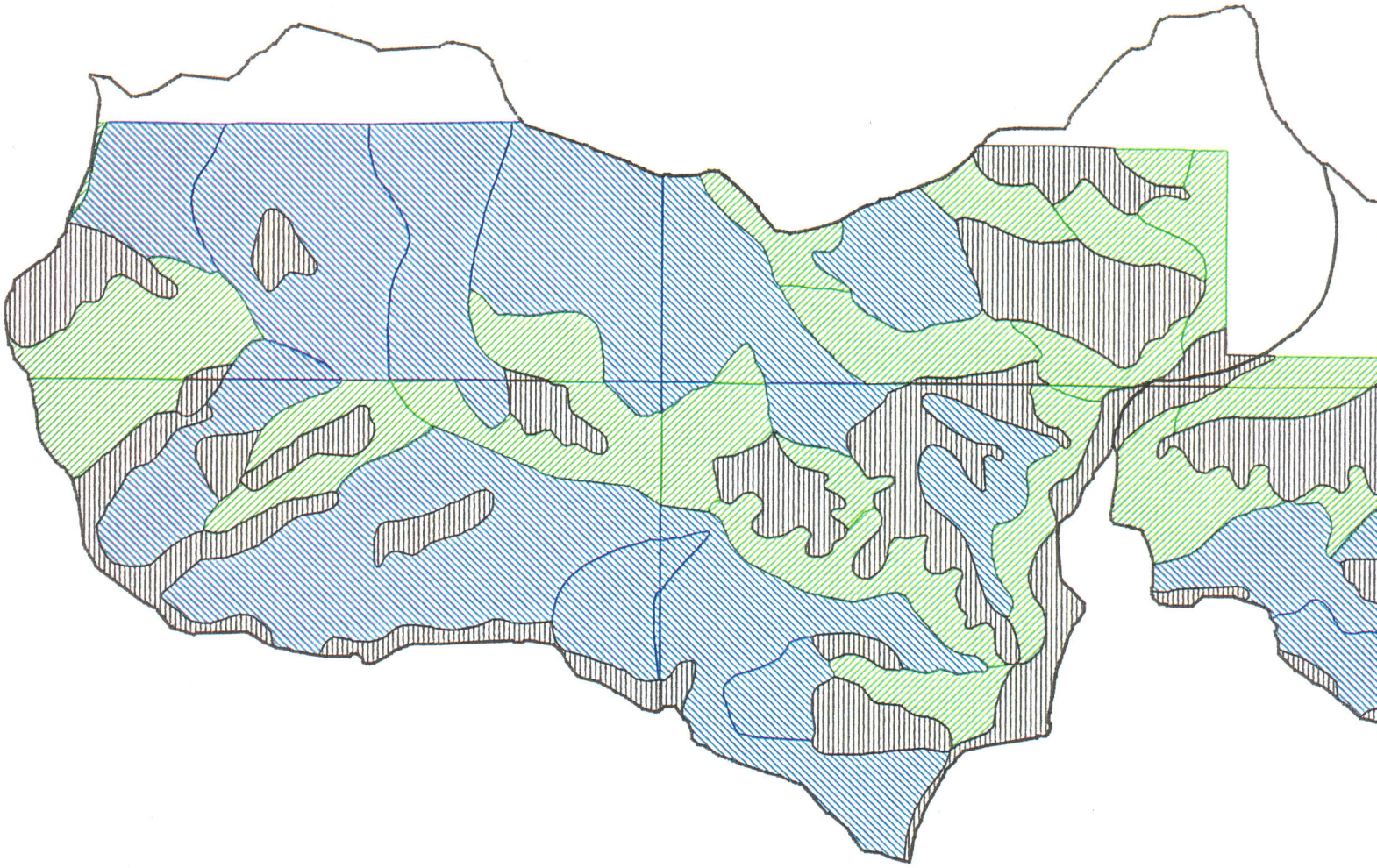



**Figure 34**

10/12/94 14:22:27

# BEAVER/PALMER SOI



SCALE 1:

N

# L RESOURCE INVENTORY

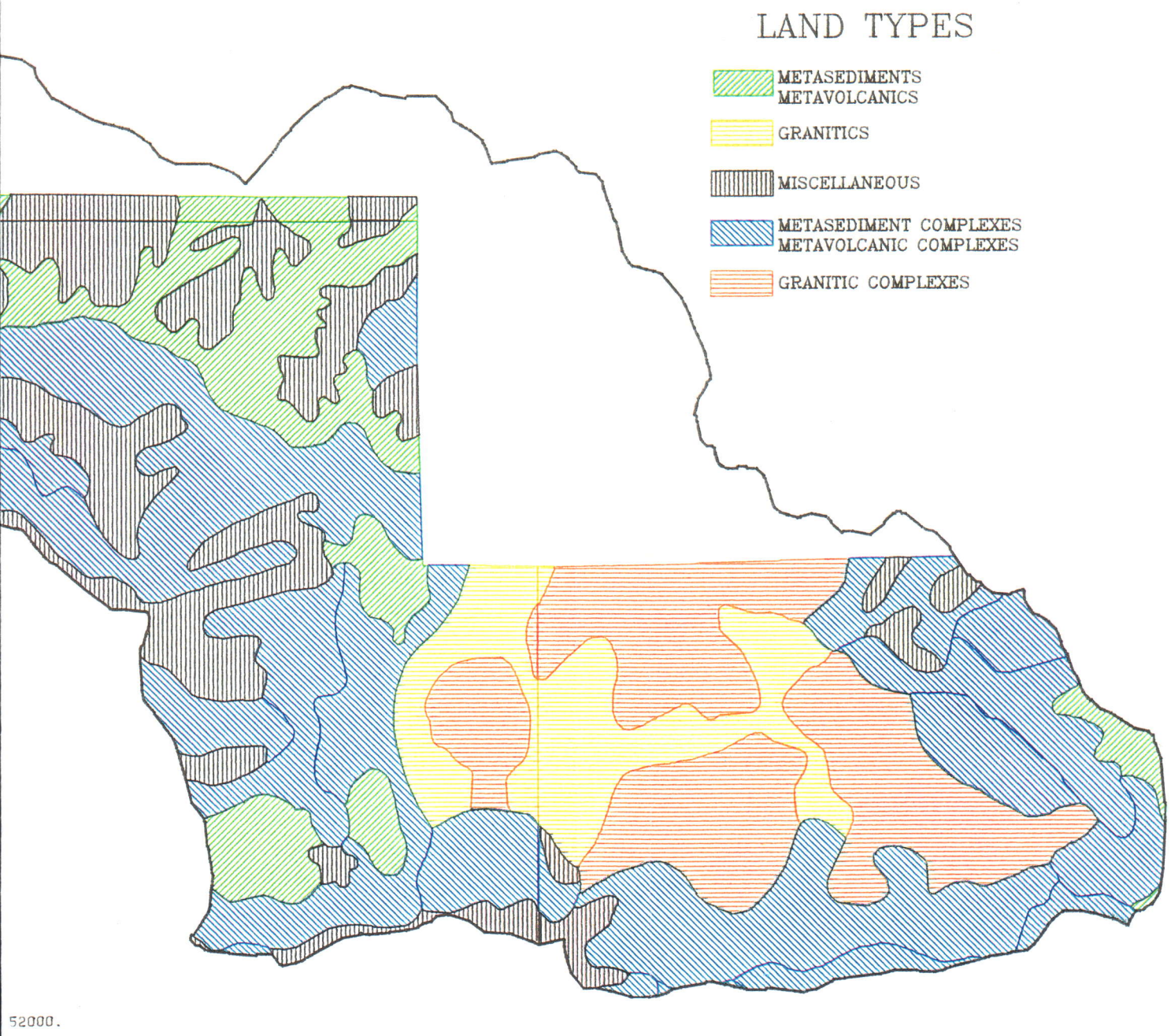



**Figure 35**

11/10/94 13:58:47

more prone to erosion and landsliding. These long stringers of argillite contain scattered occurrences of mineralized zones that sometimes contain rare heavy metals such as gold, mercury, and antimony. Argillite soils are often deep, especially in the lower elevations, and are easily compacted by management activities and are prone to slump-earthflow landslides. These soils tend to support good vegetative growth on north slopes, but, are droughty on south slopes. Two cinnabar (source for mercury) mines are found in the argillite slopes south of Palmer Creek in the SW 1/4 of section 3 in the Bailey sub-basin.

Alluvium and terrace deposits makes up less than 1 percent of the Beaver Watershed, and over 2 percent of the Palmer Creek Watershed. Large deposits of unconsolidated silts, sands, and gravels are found near the creek mouths and form terraces up to 15 feet thick along the Applegate River.

Landslide deposits makes up less than 1 percent of the Beaver Creek Analysis Area. These are ancient landslide deposits mapped by USGS. These older features are sometimes a greater mass movement risk, since they can be reactivated by management activities.

A very small portion of the Beaver Creek Analysis Area contains Ultramafic rocks. This rock is a type of peridotite which has been metamorphosed to serpentine. Serpentine are often deficient in calcium and high in magnesium which make them poor growing sites.

**2. Soil Resource Inventory**

The Soil Resource Inventory (SRI), for the Rogue River National Forest (RRNF), provides an extensive classification of land areas into individual units possessing similarities in soil, bedrock, climate, topography, and vegetation. These units are termed landtype units.

This Watershed Analysis Area occurs entirely in the mapped Environmental Zone I as explained in the RRNF, SRI. Characteristics of Environmental Zone I include: xeric (dry) soil moisture regime, and mesic (warm) soil temperature regime. This combination makes for an early growing season.

Landtypes 70 through 77 are derived from metamorphic parent material (metasediments and metavolcanics). Steeper slopes show colluvial movement and the parent material may be a mix of rock types. Landtypes 85, 86, and 87 are derived from granitic parent material. Miscellaneaous landtype units 90, 91, 93 and 99 include the alluvial soils, landslide deposits, and rock out-crops. Complex landtypes have been mapped within the Analysis Area, these complexes are comprised of the above landtypes in varying percentages. More detailed information on individual landtype characteristics is is available for review in the soils report contained in the appendix.

**3. Natural Processes Influencing Slope and Soil Stability**

**Slope:** The steepness of slopes plays a rather large role in whether a slope is stable or not. Granitic slopes are the most prone to fail when slopes are steep. When slopes exceed 65 percent and soils are thick, landslides usually occur more frequently. Steep drainages are the most likely natural areas to find debris flows, avalanches, and slides (see Geomorphology/Geology report for a detailed discussion of types of slope movements). Steep spring outlets and other riparian zones, located away from drainages, are often unstable. Obviously, the locations that tend to be the most stable are flat slopes and/or where unweathered bedrock is exposed.

**Aspect:** The northern aspects (N, NW, and NE) tend to be the locations of where most of the active landslides occur. This fact was documented in a report titled "Slope stability and Mass Wasting in the Ashland Creek Watershed", where numerous debris flows were studied in granitics similar to the Beaver and Palmer Creek Watersheds. Northern slopes are usually more dissected, hold more moisture than their southern counterparts, and are typically steeper also. However, one factor that sometimes aids in strengthening slope stability is that the north slopes grow large conifers. These large conifer trees take in abundant amounts of groundwater and

their roots provide more cohesive strength to the soil mantle. The southern aspects (S, SW, and SE) have smoother slopes and retain much less water because of the direct exposure to the sun for long periods of the day. Thus, these southern aspects grow less trees, more brush, and are more stable than their northern aspects.

**Fire:** In portions of both watersheds wildfires have caused duff layers to be destroyed which normally protect and hold soils in place during rain storms. Wildfire is a normal natural process that can affect soil erosion and landsliding in different ways depending on how intense the fire is.

**Weather:** Southern Oregon has been in a drought for eight of the last nine years which has helped the soils stabilize. However, when we return to times of prolonged heavy precipitation intensity, slopes will again become more unstable and the erosion process will be accelerated. These are the natural conditions that make soils the most susceptible to mass-movement, and cause severe sheet and gully erosion.

Rates of instability are much less during the drought conditions that we are currently experiencing in the Rogue River Valley. Overall, soils and slopes have stabilized somewhat over the last eight years as the drought has continued (except during 1993). When precipitation rates increase to normal, it is expected that slope instability features will increase again in the Beaver and Palmer Creek Watersheds. If a 100 year flood occurs in the next few years we can expect a major increase in the activity and frequency of landsliding. Also more sediment is stored in the stream tributaries which will increase the landslide size and amount of material involved.

**Peak Flow and Flood Events:** In the granitics peak flow events have caused severe erosion and landslide problems; aerial photos one year after the 1974 storm event illustrate this to be the case. Debris flows concentrated in the upper third of the Haskins' and Petes' sub-basins and sometimes widen down slope from where they originate. In clear cut harvest units the landslide frequency was even much higher. Numerous debris slides and gullies are observed on 1975 air photos from clear cut units in sections 13, 18, 19, 24, and 29. These failures sent large volumes of coarse sandy material (which contain little gravel or cobble) down slope and into stream channels.

Peak flows can reactivate old earthflow and slumps in the meta volcanic and sedimentary terranes. Old landslides and/or unstable ground along the flood banks of drainages are often reactivated during peak flow events, contributing large volumes of sediment directly to the streams. Debris and sediment from the large debris flows has caused Beaver Creek to widen. During these peak flow events, the debris moving down the stream removes many trees that are good cover/shade for fisheries habitat. Large storms such as the 1964 and 1974 storms produce the most slope failures and consequently produce the largest volume of material to streams. A majority of this sediment flows into the major streams and then is either deposited in the Applegate River or stays in suspension. Sediments staying in suspension contribute to the warming of water temperatures. Gravels, cobbles, and boulders are often produced and deposited in these terranes also.

**Vegetation:** Vegetation that covers the surface of the ground aids in stabilizing soils. Vegetation such as grass usually helps more for erosion control, because the roots do not penetrate deep enough to stabilize all of the soil thickness. Brush species root systems are deeper and tend to help stabilize surface erosion features if it grows thickly. Trees are the best type of vegetation for stabilization, because they take in large volumes of groundwater and have deep root systems that tie in the total thickness of the soils. Conifer trees in particular add cohesive strength to soils with their large deep root systems.

**4. The Effects of Human Activities on Slope and Soil Stability**

**Fire:** Fire exclusion has created conditions which has increased the potential for large, high intensity, stand replacing fires to occur. If a high intensity wildfire occurred, it would likely create very severe erosion and landslide potential throughout the watersheds, but especially in the granitics.

**Clear Cut Timber Harvesting:** A large amount of timber was harvested from the Beaver Watershed, especially during the last 30 to 40 years. A large percentage of units were harvested using clear-cut harvest methods. Clear-cut harvesting caused severe erosion, particularly in the granitics of the Squaw Peak Pluton. Several active debris landslides are found in large clear-cut units in Petes, Medite, Hanley, and Haskins sub-basins. Private and BLM lands north of Beaver Creek were also impacted, but usually the debris slides did not travel as far due to flatter slopes and terrain. Some of the metavolcanic and argillite terrane was affected from clear-cutting by initiating older and a few new earthflows to become active. Debris flows do occur, but not nearly as frequently as in the granitic terrane.

Numerous portions of the Palmer Creek Watershed have been clear-cut over the past thirty years also. The slopes have remained rather stable for the most part. The only areas that had any active stability problems were some small debris flows in granitic drainages below Palmer Peak, and in drainages in China Gulch and Flumet. However, clear-cut logging practices during the 1980's has not yet stood the test of time, because there has not been a large storm in the last 10 years to accelerate mass-wasting.

**Logging Systems:** Tractor logging skid trails increased the surface erosion and sometimes caused small landslides to occur. Past tractor logging operations were often done on steeper slopes than is allowed under our current RRNF, Land and Resource Management Plan, Standards and Guidelines. Tractor logging has occurred on slopes up to 60 percent in some cases. One area that was field verified this year in the granitics in the southern portion of Pete's sub-basin (SW 1/4 of section 19) found tractor skid trails on 45-50 percent slopes. Sheet, rill, and small gullies were found extending down some of the skid trails that climbed slopes nearly perpendicular to the contours. Some of the trails extended 150 to 200 feet upslope before they ended.

**Roads:** Road building intercepts streams and sometimes concentrates the water into areas that can saturate soils and weathered bedrock which makes conditions more likely for slope failures and surface erosion to occur. These roads traditionally have drain dips and culverts as drainage structures. However, many of the drain dips are not armored and/or do not have armoring on the fill slope side of the dips and culverts where water run-off creates rill, sheet, and gully erosion.

Numerous active to subactive roadcut and fill slope failures were located when verifying conditions in section 13 of the granitics in the Haskins sub-basin. Near the ends of roads 2000907 and 2000908, the cutslopes and fill failures occur one after another and in many cases merge into each other to form large areas of instability. The road has pit run surfacing and is not adequately drained. Road cut slopes are high, very steep, and continue to ravel and slide. Road fill slopes receive concentrated drainage, especially near headwalls or drainages. Road fill failures often merge together with raw erosion gullies which are up to 3 feet deep. The area has been clear-cut logged and has been very slow to recover in numerous areas in the southern portion of section 13. Road 2000908 has the most active slumps and debris flows in it. Slumps and debris slides are mostly concentrated near the drainages on road 2000907.

South of the above roads in the NW 1/4 of section 24, the 2000900 road has numerous areas of erosion rills and gullies in the road prism and fill slopes. Toward the end of the 2000910 road logging operations moved the stream channel and place a landing in the class 3 drainage. Slash and rotten timber are still piled where the stream channel used to be. The stream was pushed 50 feet from its banks to the west. A 3 foot berm still holds the stream in this western location. Farther down slope the road also enters the stream channel where surface erosion and a slump occur approximately 100 feet below the stream diversion. Several conifer trees fell down in this area and are laying across the road. The road is very wet where the trees have fallen down. This area is slowly starting to get some grass and brush established and probably should be left to restore itself.

Road drainage is inadequate on many low volume system and non-system roads. Not enough drain dips or water bars are one of the biggest problem areas in general. Steep grades are found on many of the non-system roads. Another problem is that many of the culverts are not large enough to pass a 100 year storm event on

both system and non-system roads. Many of the culverts have erosion gullies that begin immediately at the outlet end and need to have energy dissipators. Also the gullies below the culvert may need to be lined with geotextile fabric and rip rap placed in them.

Figures 5 and 6 show the area of the sub-basin (both in acres and square miles), road maintenance levels, road density, number of drainageways crossed, total density of roads, percent of acres, and the stream density within each sub-basin. Road densities shown in this table, especially for Hanley, Haskins', Beaver Head, Baldy, West Palmer, Sourdough, and Darkcanyon sub-basins are considered to be high. In addition to these roads are the numerous non-system roads used for either logging or mining activities or both.

Mining roads in Palmer Creek Watershed are steep and poorly drained, and, as a result contain numerous erosion rills and gullies. Some of these roads have triggered landslides; a few of these failures are in and above the mining roads in the SE 1/4 of section 3 in Bailey's sub-basin. Erosion gullies from 1 to 1 1/2 feet deep run down the 650 road for long distances and are up to 3 feet deep where they exit the 650 road. Some of the sediment from these gullies has reached the creek located in Bailey Gulch. Based on these observations, this area appears to have a high potential for restoration activities.

# Beaver Creek

## Road Density (System Roads)

| Sub-Basin | Area Sq.Miles | Area Acres | (Miles Rd/Sq Mi) (12' width) Level 1 | (Miles Rd/Sq Mi) (12' width) Level 2 | (Miles Rd/Sq Mi) (16' width) Level 3 | (Miles Rd/Sq Mi) (16' width) Level 4 | Position in Watershed Hi/Med/Lo Number of Drainage Ways Crossed | (All units) (Miles Rd/Sq Mi) Total | (Acres Rd/ Acres Sub-basin) Percent | (Miles/Sq Mi) Stream Density |
|---|---|---|---|---|---|---|---|---|---|---|
| Armstrong | 1 5 | 960 | 0.48 | 1.08 | 0.04 | 0 5 | 7/low | 2.10 | 0.51 | 3 66 |
| Baldy | 1 2 | 768 | | 3.43 | 0 01 | | 23/low disconnected class 4 | 3.44 | 0.78 | 6 90 |
| Beaver Head | 2 5 | 1,600 | 0.54 | 1.79 | 1.65 | | 20/low 4/hi | 3 98 | 1.03 | 3 82 |
| Beaver Mid | 0.3 | 192 | | 0.6 | | | 4/mid | 0.60 | 0.14 | 5 00 |
| Boaz | 1 8 | 1,152 | | 0.06 | 0.1 | 1.5 | 11/low | 1.66 | 0.50 | 4.53 |
| Charley Buck | 1 0 | 640 | | 3.3 | | | 10/low 9/hi | 3.30 | 0.75 | 8 52 |
| Hanley | 3 3 | 2,112 | 0.46 | 2.64 | 1 53 | 0.01 | 16/low 30/med/hi | 4 64 | 1.17 | 5 39 |
| Haskins | 1 7 | 1,088 | 1.06 | 3 12 | | | 6/low 6/hi | 4 18 | 0.95 | 4 88 |
| Jackson | 0 4 | 256 | | 1 62 | | | 3/hi | 1 62 | 0.37 | 2 67 |
| Medite | 0 6 | 384 | | 2.11 | | | 1/med | 2.11 | 0.48 | 3 61 |
| Pete's Camp | 3 4 | 2,176 | 0.34 | 1.32 | 0 6 | | 12/low 8/hi | 2.26 | 0.51 | 3 97 |
| Texter | 3 4 | 2,176 | 0 08 | 0 29 | 0.17 | 0.6 | 15/low | 1.14 | 0.35 | 4 69 |
| (Entire Watershed) Beaver | 21.9 | 14,018 | 0.31 | 1.61 | 0 55 | 0.25 | | 2.72 | 0.68 | |

# Palmer Creek

## Road Density (System Roads)

| Sub-Basin | Area Sq.Miles | Area Acres | (Miles Rd/Sq. Mi) (12' width) Level 1 | (Miles Rd/Sq. Mi) (12' width) Level 2 | (Miles Rd/Sq Mi) (16' width) Level 3 | (Miles Rd/Sq. Mi) (16' width) Level 4 | Position in Watershed: Hi/Med/Lo Number of Drainage Ways Crossed | (All units) (Miles Rd/Sq. Mi) Total | (Acres Rd/ Acres Sub basin) Percent | (Miles/Sq Mi) Stream Density |
|---|---|---|---|---|---|---|---|---|---|---|
| Babbit | 0 5 | 321 | | 0.04 | 2.78 | | 7/low | 2.82 | 0.85 | 4 86 |
| Bailey | 2 8 | 1,787 | 0 50 | 1.11 | | | 12/low | 1.61 | 0.37 | 3 23 |
| Dark Cyn. | 0 7 | 471 | 0.22 | 0.64 | 2.14 | | 7/low | 3.00 | 0.86 | 2.04 |
| East Palmer | 0 4 | 232 | | 0.22 | 2.52 | | 4/low | 2.74 | 0 92 | 2 57 |
| Lime | 1 7 | 1,083 | 0.48 | 1.55 | 0 01 | | 3/low | 2.04 | 0 47 | 2.45 |
| Nine Dollar | 1 8 | 1,170 | | 0.46 | 0.45 | | 1/low | 0.91 | 0 24 | 4 68 |
| Section 1 | 0 6 | 369 | | 1.11 | 1.83 | | 5/low 2/high | 2 94 | 0 81 | 5 76 |
| Sourdough | 0 6 | 379 | | 3.26 | 0 08 | | 3/low 1/high | 3.34 | 0.78 | 4 50 |
| Upper Palmer | 0 8 | 510 | | 0.28 | 1.03 | | 2/low 2/med | 1.31 | 0.40 | 3.42 |
| West Palmer | 0 9 | 619 | 0.81 | 2.62 | 1.16 | | 7/low | 4.59 | 1.13 | 3.04 |
| (Entire Watershed) Palmer | 15.7 | 10,077 | 0.45 | 0.90 | 0 58 | | | 1.95 | 0.49 | |

Figure 5

# Additional Watersheds

## Road Density (System Roads)

| Sub-Basin | Area Sq.Miles | Area Acres | (Miles Rd/Sq. Mi) (12' width) Level 1 | (Miles Rd/Sq. Mi) (12' width) Level 2 | (Miles Rd/Sq. Mi) (16' width) Level 3 | (Miles Rd/Sq. Mi) (16' width) Level 4 | Position in Watershed: Hi/Med/Lo Number of Drainage Ways Crossed | (All units) (Miles Rd/Sq. Mi) Total | (Acres Rd/ Acres Sub-basin) Percent | (Miles/Sq. Mi) Stream Density |
|---|---|---|---|---|---|---|---|---|---|---|
| China | 1.6 | 994 | 0.40 | | | | 10/low (to residents) | 0.40 | 0.10 | 5.65 |
| Billys | 0.9 | 581 | | 0.22 | 1.26 | | 2/low | 1.48 | 0.45 | 4.15 |
| Flumel | 2.4 | 1,560 | 1.39 | 0.93 | 0.13 | 0.18 | 5/low | 2.63 | 0.67 | 3.11 |
| McKee | 0.9 | 563 | | | | 0.12 | 1/low | 0.12 | 0.04 | 1.95 |

Figure 6

**Mining:** Hydraulic mining occurring in Palmer Creek in the 1870's and 1880's washed large volumes of sediment and rock from the stream banks and adjacent slopes, into Palmer Creek. This created bare and eroding slopes up to 30 feet high adjacent to the stream channel. These high slopes are susceptible to failure when the creek levels get to bankfull widths and flood levels. Hydraulic mining occurred from the mouth of Palmer Creek to Dark Canyon. Hydraulic and drag-line mining in the 1920's occurred along the mainstem of the Applegate River in the Billy's sub-basin.

Only a minor amount of placer mining was done in the Beaver Creek Watershed; mostly along the mainstem.

**6. Landslide Hazard and Zonation Mapping**

The Rogue River National Forest uses a process called Landslide Hazard Mapping and Landslide Hazard Zonation (LHZ). The geomorphologist uses contour, soil landtype, and geology maps, along with aerial photos, to identify and prioritize areas that are likely to contain unstable slopes in need of field examination. During field examinations for project level work, traverses are made across slope at every 100 to 200 foot contour. As the Geomorphologist traverses the slope landslide and erosion features are mapped according to activity level of the landslide (see Figure 7, which describes various activity levels).

Landslide Hazard Zonation Mapping is used to map the areas relative to the potential risk for activating landslides or erosion for a project area. Four hazard levels are used which incorporate the landslide activity level ratings discussed above when assigning hazard levels. Hazard zone 1 terrain includes active and potentially active landslides, wet areas, and areas of severe erosion (and is equivalent to activity level 1). Land mapped as Hazard Zone 1 is identified by the RRNF, Land and Resource Management Plan, as ***not*** suited for timber production. This is due to the high potential for irreversible resource damage. These areas are also included in riparian reserves designated under the April 13, 1994, Record of Decision for *Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (see Description - Riparian Reserve Widths; Seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas).

Hazard zone 2 areas are the second highest risk area. These areas are associated with and usually found near and/or upslope from hazard zone 1 areas. Lands mapped as hazard zone 2 are equivalent to lands allocated under the RRNF, LRMP as Management Strategy 21. These lands are considered sensitive, however, can usually be managed with a light touch and using the Standards and Guidelines outlined in the LRMP.

Hazard zones 3 and 4 are the most stable of the hazard risk zones. See Figure 8 for a description of the four landslide hazard level zones.

An estimated 20 percent of the Watershed Analysis Area has been mapped for slope stability and erosion hazard levels. Three project areas have been covered; Applegate Partnership I, Flying Apple, and Ranch Overstory timber sales. Several areas of active landsliding were mapped in these project areas.

The field work performed during this watershed analysis concentrated mainly in the granitic terranes of the two watersheds. The mapping was done with much less intensity than the project level work discussed above. Mapping traverses were made along 500 to 600 foot contour intervals and concentrated near logging and mining roads.

**7. Sediment Produced From Landslides**

Since the mappped areas of the two watersheds have not been monitored to quantitatively measure landslide volumes; sediment delivery from landslide and surface erosion cannot be addressed directly with this analysis.

## LANDSLIDE ACTIVITY LEVEL DESCRIPTIONS

| | |
|---|---|
| 1<br>ACTIVE | Currently active or active in the very recent past. May have fresh scarp or cracks. Leaning trees may indicate recent movement; i.e., straight, healthy conifer leaning from the base indicates recent movement. Broadly-bowed, living conifer indicates movement over a period of time. Hummocky terrain, terrace-like slopes not deeply weathered may indicate recent movement. |
| 2<br>SUB-ACTIVE | Movement occurring periodically, landslide features more weathered (e.g., flatter slope to scarp) than 1 . Leaning or bowed trees may indicate no very recent movement; i.e., temporarily dormant. |
| 3<br>DORMANT | No clear indications of recent movement. Landslide features not so heavily weathered as to indicate long-term stability. More subtle features often without obvious scarps or cracks. Possible low, constant creep rate; i.e., currently creeping at rate sufficiently slow that obvious cracks do not form. |
| 4<br>INACTIVE | No active movement within recent past. Landslide features moderately weathered. Only larger trees show indications of movement. Conditions (i.e., parameters of stability such as slope angle, shape and area of influence zone) make reactivation possible. |
| 5<br>ANCIENT | No indication of movement within recent past. Only oldest trees show indications of movement. Landslide features well weathered and revegetated. Interpretation (i.e., location and form) may be only from topographic map or aerial photographs. Field evidence for this type of landslide is difficult to interpret. |
| 6<br>PHOTO-INACTIVE | Ancient features, which are easily discernible only from topographic cap and aerial photographs. Field indications obscured by weathering, erosion and revegetation. Very low risk of reactivation. Creep rate, if present, is too slow to visibly affect tree growth. |

**Figure 7**

# TABLE 3

## LANDSLIDE HAZARD LEVEL DESCRIPTIONS

| | |
|---|---|
| 1 | Zone which includes landslides or actively gutting channel and/or includes the portion of the influence zones directly impacting the landslide or channel; i.e., the portion of the influence zone believed to require as much caution as the landslide or gutted channel due to instability and/or impact on the landslide or gutted channel. |
| 2 | Zone which is slightly less sensitive than the 1 zone. Often adjacent to or within the influence zone of an area of active landsliding. This hazard level used for type 2 or 3 landslides and portion of the influence zone directly impacting the landslide when other factors do not indicate greater instability. |
| 3 | This zone may be determined by proximity to active landslides or by potential for impacting active landslides. It is used for type 3 landslides and their immediate impact zones. Additional key parameters are percent slope and position of the zone on the slope (i.e., proximity to creeks or drainages). Some zones delineated by specific combinations of hazard parameters. |
| 4 | This zone usually does not impact active landsliding area except from considerable distance upslope. Applies to type 4 landslides and their immediate zones. |
| | Most stable zone. |

Figure 8

However, this report will estimate the sediment that is no longer at or directly below landslides and assume the majority has reached the next stream channel. The total volume from recent landsliding will not be estimated, but the percentages of those active landslides will be estimated in terms of percent of total volume delivered.

On the mid to lower 1/3 slopes of the granitics of Beaver and Palmer Creeks approximately 15 percent of the material from landslides has been delivered to a stream on lower and mid slopes. On the upper 1/3 slopes approximately 10 percent is delivered to a stream. These figures were based on landslide data sheets filled out from the granitics in the Little Applegate Watershed and are assumed to be generally applicable to granitics located here. Debris flows, debris slides and debris avalanches are the typical features(other than surface erosion) in the granitics. These landslides are very rapid events and tend to travel long distances down slope, thus more sediment is usually delivered than with other landslide types.

In the meta volcanic and meta sedimentary terranes approximately 5 percent of the upper slopes deposits and 10 percent of the lower slope deposits (nearest the streams) have reached a stream. Most of these slide were earthflows which typically don't travel as far as debris flows and debris avalanches. Obviously, earthflows near streams deliver more material than ones that are farther upslope from streams. However, there are many more earthflow landslides that are not near a class 3 stream channel. Debris landslides and flows are less frequently found in the meta andesite terrane, but some are found and tend to travel more rapidly with more sediment reaching the streams.

**8. Erosion**

Gully and rill erosion on exposed soils is an important process when water is concentrated. These types of surface erosion have had an adverse impact to large portions of the granitics, especially in the Beaver Creek Watershed. Sheet erosion is a problem in several of the intermittent draws and drainages in the NE 1/4 of section 13. This is in an area that was clear-cut harvested during the 1970's. Approximately 6 inches of soil loss is apparent on these slopes. Several 1 to 2 feet deep erosion gullies are also found in this area below the 900 road. It appears that the road drainage concentrated surface water on these slopes. Smaller rills are located near a class four stream that is just east of Haskins Gulch. South of this area on road 908 a series of fill failures continue to erode for at least 200 feet below the road.

As mention earlier in this report, there are numerous erosion rills and gullies associated with mining roads and non-system roads located in the Palmer Creek Watershed.

In sections 18 and 19 of the Beaver Creek granitics, several erosion rills and gullies are found in or associated with the 890 road. Landtypes in sections 18 and 19 are sandy and sandy clay loams which have a high potential for erosion. Most of the erosion in the 890 road is caused by poor or concentrated road drainage and steep grades. Several of the gullies run hundreds of feet down the road before they exit into the fill slopes. The road in section 18 (private land) can only be driven by using a four wheel drive vehicle due to the very large waterbars built up on the road. Small clear-cuts and partial cuts located in section 18 often have raveling slopes and some have rill erosion occurring. Soils are easily eroded when exposed when the litter layer is removed by burning. This is apparent both on the private and USFS lands.

Landtypes 71, 73, 74, 77 and 91 (composed of loams, clay loams and clays) are found in the metavolcanic and metasedimentary terrane. These landtypes are easily eroded if the litter layer is removed or slopes are exposed. These soils contain very fine materials and tend to "seal" if exposed to rainfall/raindrop impact. This sealing leads to additional runoff and erosion and retards the recharging of the soil reservoir, thus reducing growth potential and/or yield.

Dry ravel is common on all landtypes of Beaver and Palmer Watersheds. Dry ravel is a very important process on slopes greater than 60 percent. Bare soils are usually the sites where dry ravel occurs.

## C. HYDROLOGY & FISHERIES

Adjustments in the Beaver and Palmer watersheds occur as a result of change in stream-flow magnitude and/or timing, sediment supply and/or size, direct disturbance, and vegetation changes. These observed changes in channel morphology over time can be communicated in terms of stream type changes (Rosgen, 1994).

### 1. Stream Classification and Characteristics

The structure and form of the present day channel are governed by the laws of physics through observable stream channel features and related fluvial processes. A stream's structure and form are directly influenced by eight major variables including channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load, and sediment size (Leopold et al. 1964), (Glossary contains definition of the eight variables). A change in any one of these variables sets up a series of channel adjustments which leads to a change in the others, resulting in channel pattern alteration.

Because stream structure and form are the products of this integrative process, the variables that are measurable were used as stream classification criteria for this report. These variables were width/depth ratio, sinuosity, channel slope, channel entrenchment, and sediment size. These variables and their ranges make up the current morphological description of stream types as shown in Figure 9 (Rosgen, 1994). The classification can be applied to intermittent as well as perennial channels.

This classification scheme is delineated initially into the major stream categories of A-G as shown in Figure 9 (Rosgen, 1994). The stream types are then broken into discreet slope ranges and dominant channel-material particle sizes. The stream types are given numbers related to the median particle size diameter of channel materials such that 1 is bedrock, 2 is boulder, 3 is cobble, 4 is gravel, 5 is sand, and 6 is silt/clay. This initially produces 42 major stream types as shown in Figure 10. The values of these measured variables determined the unique stream type for each reach of the mainstem of Beaver and Palmer Creeks.

Data was obtained from field measurements in Star Gulch, a stream system in the vicinity of Beaver and Palmer Creeks, that contained a USGS gage station. The hydraulic geometry of the B3 stream type in Star Gulch can be extrapolated to other B3 reaches where detailed data are not readily available. The field determination of bankful measurements was calibrated against actual gauging station data as plotted on a flood frequency curve to assure accurate measurement of bankful widths in Beaver and Palmer Creeks (Figure 11).

### 2. Beaver and Palmer Stream Types

Data collected on the aforementioned variables were used to determine the stream types for Beaver and Palmer Creeks during the month of July. Beaver and Palmer Creeks had four different stream types; F3, B3, A3, G3

- The F type segments are wide and shallow, entrenched, highly channelized cutdown, abandoned floodplain.
- The B type segments are moderately entrenched, moderate gradient, riffle dominated, with infrequently spaced pools. Very stable plan and profile. Stable banks.

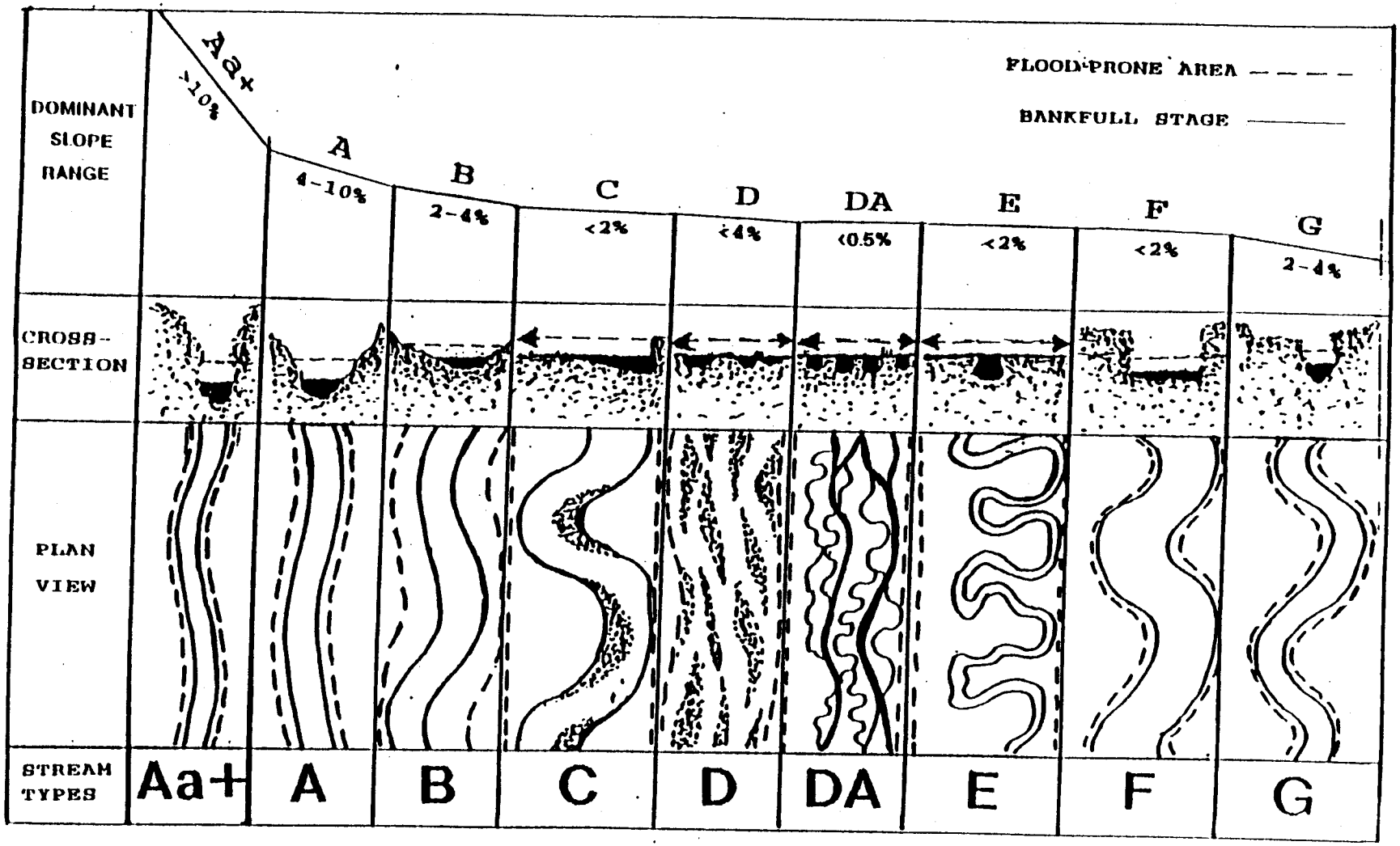
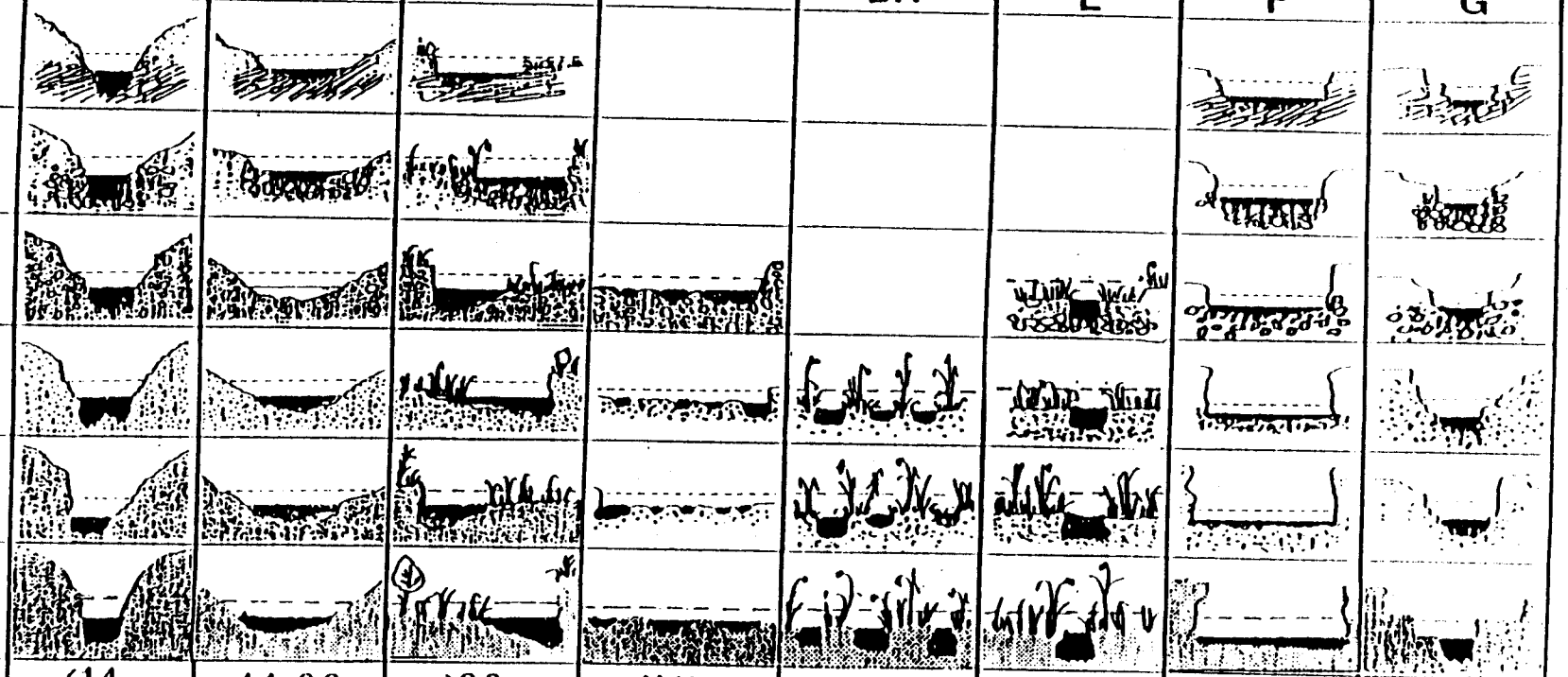



**Figure 9** Broad level I delineation of major stream types showing profile, cross-sectional and plan view morphology.



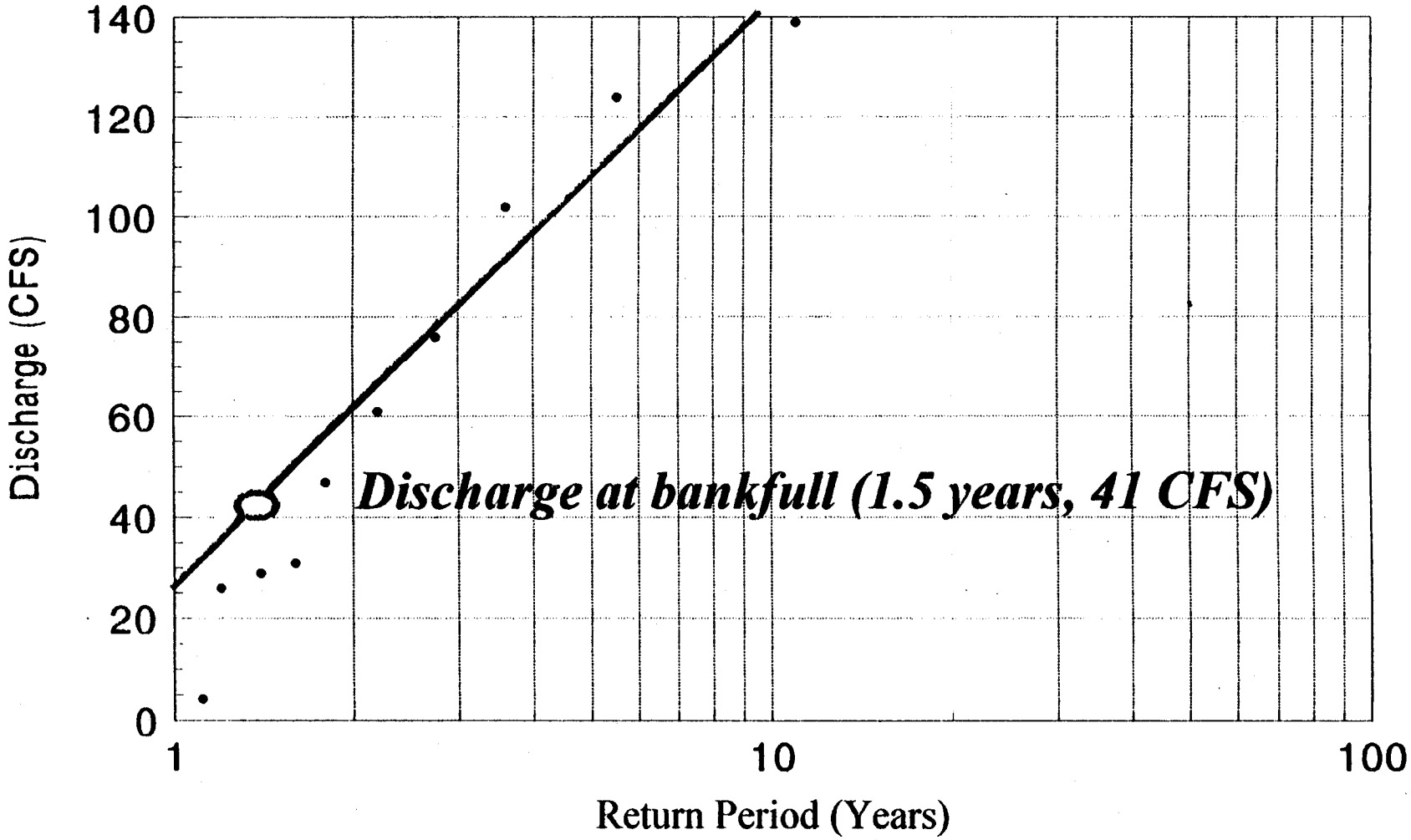

| | A | B | C | D | DA | E | F | G |
|---|---|---|---|---|---|---|---|---|
| ENTRIL. | <1.4 | 1.4–2.2 | >2.2 | N/A | >2.2 | >2.2 | <1.4 | <1.4 |
| SIN. | <1.2 | >1.2 | >1.4 | <1.1 | 1.1-1.6 | >1.5 | >1.4 | >1.2 |
| W/D | <12 | >12 | >12 | >40 | <40 | <12 | >12 | <12 |
| SLOPE | .04–.099 | .02–.039 | <.02 | <.02 | <.005 | <.02 | <.02 | .02–.039 |

**Figure 10** Illustrative guide showing cross-sectional configuration, composition and delineative criteria of major stream types.

Figure 11

# Flood Frequency Analysis - Star Gulch

## Data from 1983-93




Stargulc.prs

- The A type segments are steep, entrenched, narrow, deep, confined cascading step/pool streams.
- The G type segment is best described as an entrenched gully.

The range of data collected for each variable was often at or near the transition between stream types. Generally, both stream systems had cobble as the dominant substrate (3 - substrate size per Rosgen system, 1994). On Beaver Creek, bedrock was prevalent up to Haskin's Gulch.

The stream types at major tributary junctions on the main stem, sequential from the mouth to the headwaters are listed below.

**Beaver Creek**

- Site #1. Charley Buck - F3
- Site #2. Armstrong Gulch - F3
- Site #3. Hanley Gulch - B3/F3 (This reach represents both the immediate effects of a bridge and 18" culvert as well as the influence of the tributary junction with Hanley Gulch)
- Site #4. Haskin's Gulch - B3
- Site #5. Pete's Camp - B3

**Palmer Creek**

- Site #1. Sourdough - B3
- Site #2. Lime Gulch - B3
- Site #3. Dark Canyon - B3
- Site #4. Upper Palmer - A3

**3. Stream Flow Regime; Character, Timing, and Distribution of Major Storm Events and Low Flow in the Watersheds.**

The density of a **stream network** reflects the climate patterns, geology, soils, and vegetation cover within a watershed. The drainage density in the basins is characterized by a finely divided network of streams with short lengths and steep slopes. The short lengths decrease the travel time of water down the channels and the steepness increases the potential for sediment delivery and transport. Additionally, the small sizes of these watersheds result in a more rapid stream flow increase in response to rainfall. Fish are presented with extreme habitat changes; winter to summer. As watersheds increase in size, total water yields increase, but peak flows are somewhat reduced. Response time to storm events will also increase as the size of the watershed increases.

**Intermittent channels** are the dominant stream type in the Beaver and Palmer Creek watersheds. These channels are located in the upper third of the stream network collecting ground water and influencing the energy and storage capacity for channels downstream.

The middle and lower third of the stream network is both intermittent and perennial. USGS stream gage data obtained from the Star Gulch gauging station (located adjacent to Palmer and Beaver watersheds) suggests that the flow regime may fluctuate between 1,400 CFS during storm events to 0 CFS during low flow. Since 1989 there has been only one bankful event (41 CFS or greater) in Star Gulch. Old stream classification maps indicate the lower third of both Beaver and Palmer Creeks were perennially flowing streams. Interviews with nearby private landowners and Forest Service personnel state that neither stream has seen perennial flow in recent years.

### 4. The Effects of Vegetation on Stream Flow

Overall, 85% of both watersheds have vegetative cover. However, in certain sub-basins such as Dark Canyon in Palmer Creek, the vegetative cover is only 55%. Hanley Gulch in Beaver Creek has 68% cover. Removal of vegetation has changed the natural drainage system in these sub-basins by increasing the amount of water and sediment available to the streams. In other sub-basins, past management activities have caused a change in the vegetative species composition with a net effect of decreasing the amount of water available to streams (Atzet, 1994).

### 5. The Effects of Climate and Weather Patterns on Stream Flow

As discussed earlier in this report (also see fire report in Appendix H), the unique orientation of the Siskiyou mountain range influences the manner in which storms are received across the landscape. Incoming storms are not uniformly received across the landscape although winter storms generally move in from the north and summer storms from the south. Winter storms are generally of long duration and low intensity while summer storms are of short duration and high intensity.

The drought condition persisting in southwest Oregon over the past eight years affects the amount of stream flow as well as the fisheries. The winter storm of 1974 was the largest recorded flood in both watersheds during the 57 year period of record. This flood is considered to be a 100 year event which caused considerable alteration to both Beaver and Palmer Creeks. During 1964, another 100 year flood event occurred. This event had low impact to the Beaver and Palmer Creek watersheds. This was due, in part, to minimal management activities during that time period and unique weather patterns associated with this storm. Probably with roads in both basins pre-1955 flood, channel was cleaned, gravels flushed, stream cutdown.

Maximum peak flows have resulted from **rain-on-snow events**, during which a substantial portion of streamflow comes from rapid snowmelt concurrent with the downslope movement of water. If snowmelt and rainfall are synchronized, substantial increases in peaks are produced and accompanied by flooding (Goodell 1959). The transient snow zone (where rain-on-snow events generally occur) within the Beaver and Palmer Creek watersheds occurs in the elevation band between 3,500- 5,000 feet (Figure 12). This covers approximately 40% of both watersheds. The remaining 60% of the area is below 3,500 feet and is rain dominated. This means that rain-on-snow events are prevalent in the headwaters, thus minimizing water storage for the summer months. In areas outside of Beaver and Palmer Creek watersheds, above 5000 feet, snow is the dominant type of precipitation. In these areas, water is held longer into the spring allowing for a slower release period.

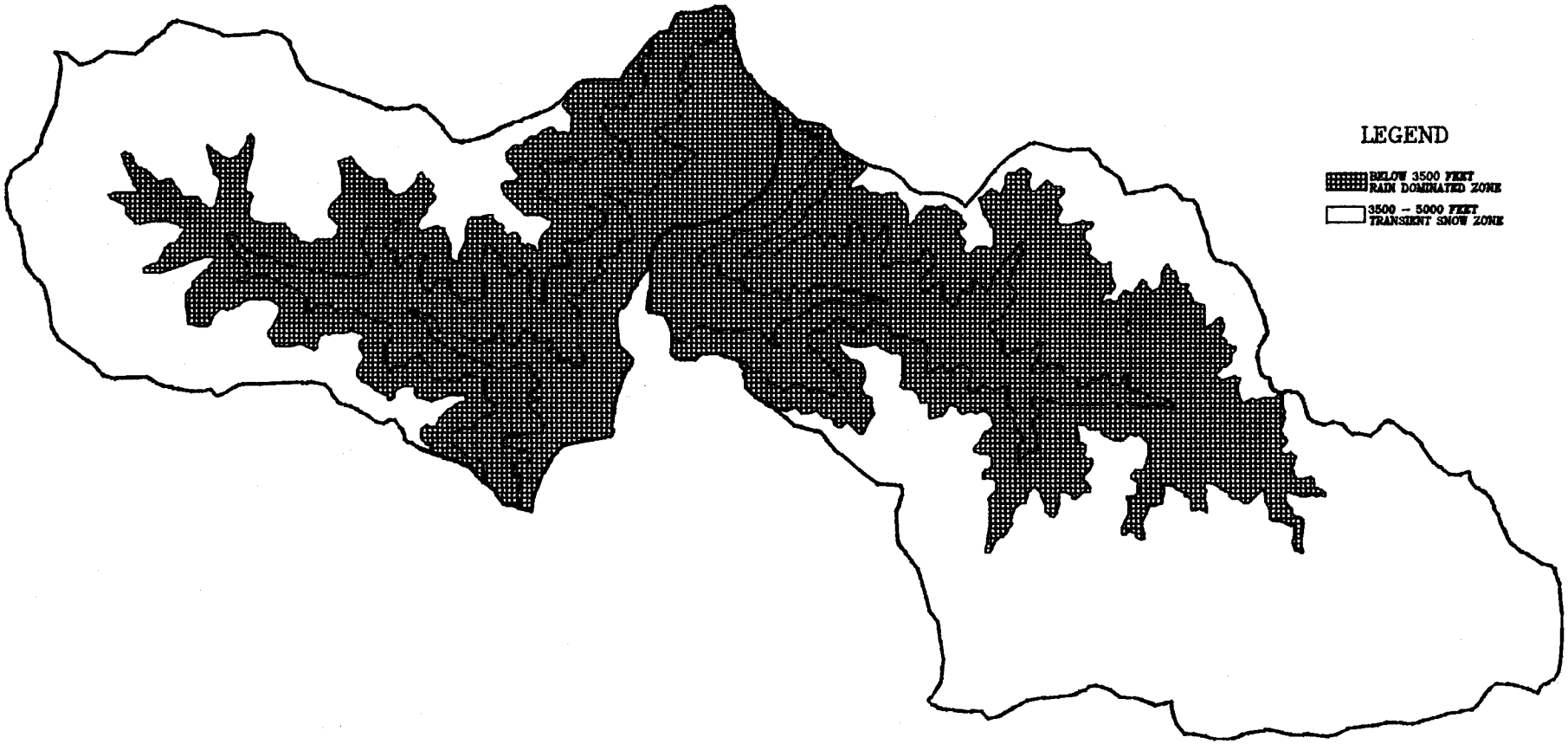
### 6. Human Processes Affecting Stream Flow

In Beaver and Palmer Creek watersheds the multiple **road crossings** quicken the response time of water delivery to the channel this causes streams to increase flow more quickly during winter storms and tend to make these streams "flashy".

There are three known **irrigation canals** on the main stem of Beaver Creek. These irrigation canals remove all of the flow from the stream system during periods of low flow. One of these canals is located .5 miles above Charlie Buck bridge, and the other two are located just above and at .6 miles from the mouth of Beaver Creek. Two irrigation canals exist in the Palmer Creek watershed, both are located on the mainstem near the mouth of the stream.

Both streams can be de-watered by irrigation withdrawals. De-watering can have catastrophic effects on aquatic populations, e.g., aquatic insects, amphibians and fish. This out flow of water can have a marked influence on low flow behavior by increasing the duration and frequency of low flow extremes including periods of zero flow.

# BEAVER/PALMER TRANSIENT SNOW ZONES




SCALE 1: 88000.

Figure 12

AUTOGIS

11/10/94 8: 8:20

In addition, canals can influence sediment movement, water quality, stream temperatures and downstream channel conditions. These effects will continue as water is diverted into irrigation canals.

Climatic conditions directly influence the volume of water available to these basins, such as the way the current drought has caused the streams to flow intermittently. However, changes in the distribution, timing and quantity of flow are effected by a number of contributing factors, including; vegetation manipulation, road construction, and livestock grazing. It is unknown whether the net effect of these activities have increased or decreased the volume of water in these watersheds.

**7. The Effects of Low Flow, Bankful or Flood Events on Stream Characterization and Aquatic Habitat.**

Within this region summer drought is common. Most of the annual precipitation occurs during the late fall and early spring storms. Minimum stream flows occur during late summer and early fall and may be 1,000 to 3,000 times smaller than maximum peak flows in winter.

**Low Flow:** During low flows, measurements showed that temperature and salinity levels in Beaver and Palmer Creeks were rising. Some species may rely on low-flow periods for a part of their life cycle; for others, it is a time of stress. The streams dried to a series of scattered pools connected only by subsurface flows. This limits animal movement and increases predation and competition for nutrients and space in the remaining waters.

Intermittent streams, which dry up completely for periods of time, experience a greater range of physical and chemical variation (e.g. in temperature and dissolved oxygen levels), and thus support unique biological communities. These channels also serve as conduits for sediment, nutrients, large wood and water. They can also serve as habitat and provide a source of cool water downstream to keep water temperatures low. Intermittent streams generally have a lower species richness as compared to perennial ones (Gordon et al., 1993). Due to drought conditions in the area the main stems have ceased flowing perennially and now flow on an intermittent basis, potentially reducing species richness (see Viability of fish populations; The function of habitat connectivity and Macroinvertebrates, positive indicator groups).

During this analysis, we were unable to verify the extent of intermittent drainages due to the necessity of collecting field data during the dry, summer season concurrent with an eight year drought. This has resulted in a lack of obvious drainage indicators.

**Bankful:** The discharge which just fills the stream to its banks, termed the bankful discharge, is assumed to control the form of alluvial channels. Flow resistance reaches a minimum at bankful stage. Thus, the channel operates most efficiently for the transport of water at this level (Gordon, et al., 1993). Bankful discharge generally occurs every 1-2 years during the winter season.

A stream can adjust its channel dimensions to accommodate the amount of water and sediment carried. The description of cross-sections and general trends in channel geometry over the length of a stream are valuable for defining patterns of aquatic habitats. Eight distinct, interrelated channel variables influence the shape of every stream system.

Both **depth** and **width** can respond rapidly to changes in **sediment load** and/or **discharge**. Whether a stream erodes downwards or outwards is influenced both by shear stress and by whether the bed or banks are most easily eroded. In the case of the lower portion of the mainstem of Beaver Creek, where the streambed is bedrock and the streambanks are gravel and sand, the banks are exposed, vertical and easily eroded. This in turn results in an increase of width to depth ratio causing higher stream temperatures, less diverse habitat, a decrease in dissolved oxygen and an increase in bank erosion. The **roughness of channel materials** in this stream system has little effect on the rate of flow except locally where fish structures are positioned incorrectly.

As the stream width in the lower portion of Beaver Creek continues to increase the meander pattern decreases, effectively channelizing the stream. As a stream straightens, its **slope** increases to more efficiently disperse energy. When the channel slope increases so does **velocity**. These series of adjustments will continue indefinitely in the stream's present condition creating higher peak flows, increased potential for sediment transport, and a change in the **sediment size**. Viable fisheries habitat is reduced in this situation because of simplified habitat (e.g., low pool/riffle ratio, less spawning gravel, reduced nutrient and food supply).

The lower reaches of Beaver Creek have evolved from a B type channel (moderately entrenched, moderate gradient, riffle dominated with infrequently spaced pools) to a F type channel (wide and shallow, entrenched, highly channelized with little to no developed floodplain). This may be due in large part to the catastrophic 1974 flood event. The increased magnitude of flow during the 1974 flood event increased the stream's energy potential enabling it to carry more sediment. This in turn, caused the channel to downcut to bedrock. Since 1974, stream flow energy is dissipated by scouring streambanks, accelerating bank erosion, increasing channel slope, reducing the meander pattern to an essentially straight, channelized stream, and increasing the width/depth ratio. These adjustments in channel geometry will continue to occur as the stream seeks a new state of equilibrium.

The channel geometry adjustments, as described above, impart significant effect on the quality of fish habitat. These effects include a reduction in; the quality and quantity of pools, spawning gravel, and the nutrient and food supply. As the width continues to increase an expected increase in temperature is also likely to occur.

The upper portion of Beaver Creek, above Pete's Camp, and the upper portion of Palmer Creek, above Dark Canyon, are in a stable hydraulic condition, meaning the stream is neither aggrading nor degrading. Measurements taken of the cross-sectional area, plan, and profile show moderate entrenchment, stable banks, moderate channel slope and low sinuosity. A stable hydraulic condition doesn't necessarily imply a healthy system for fish. For example, a lack of coarse woody debris (CWD) and zero flow during summer months created a simplified stream system and reduced habitat connectivity.

The lower reaches of Palmer Creek, below Dark Canyon, have aggraded significantly due to past mining activities (hyrdaulic mine tailings) causing the flow to move subsurface during the summer months. Low sinuosity in this same reach, caused by past and present mining activities and road construction, have decreased the amount and quality of habitat by reducing edge habitat, spawning gravel and decreasing the ratio of pools to riffles, as well as their frequency. Flow will continue to be intermittent as long as the channel bed remains in an aggraded condition.

**Flood Events:** A flood can be defined simply as flow which overtops the stream banks. An ecological definition was given by Gray (1981), who considered a flow to be a discharge which scoured substrates and disrupted the biota.

Floods affect the ecology of a stream by rearranging streambed habitats, scouring away aquatic or riparian plants and increasing the drift of aquatic insects. Most biota avoid high velocities and hurtling particles by sheltering behind rocks or snags, burrowing into the streambed and banks, moving to slower water along the stream's edges and in backwaters, or by having life cycles which are terrestrial or aerial during flood-prone seasons. To some fish, such as the summer and winter steelhead, floods act as a cue for spawning and/or outmigration, and they may migrate upstream during flood periods. When floods occur at unusual times the fauna may be severely depleted, requiring many years to recover (Goldman and Horne, 1983).

In Beaver Creek, below Pete's Camp, pre-1955, stream cleanout and record breaking flows caused considerable downcutting of the streambed and abandonment of the floodplain. It is also possible that concurrent with the abandonment of the old floodplain was a drop in the level of the watertable.

The new floodplain is vertically contained within the bankful width. Because flood flows are now contained, the stream system cannot dissipate energy over a wide flood prone area. This forces energy against the streambanks, causing further widening and straightening of the stream channel. This provides a continuous source of sediment, decreasing the frequency and depth of pool habitat, decreasing spawning gravels and decreasing interstitial space among the stream substrate. In contrast, private landowners and Forest Service personnel stated that Palmer Creek and the upper portion of Beaver Creek sustained minimal impact from the 1974 flood event.

**8. Water Chemistry**

Prior to this analysis, little or no water quality data existed. One exception is a well which provides water to the Beaver Sulfur campground. Data is collected on fecal coliform and total coliform (measured monthly), nitrates (measured annually) and nitrites (measured triannually). The levels of all of these contaminants are within state water quality standards.

Certain parameters are important for measuring fish viability and domestic water quality. For the purposes of this analysis we measured four water quality parameters: water temperature, TDS, pH and conductivity during the months of June and July. One other critical measurement is dissolved oxygen which we were unable to obtain.

In order to go beyond broad generalizations regarding water quality it is necessary to sample the stream at one station many times to construct some empirical relationships which can then be used in conjunction with a frequency analysis of streamflow to predict the concentration of chemicals at flows of various frequencies.

**Water Temperature** is an important parameter in water quality because of its significant effect on biological activity. Local variations in shade, stream depth and width, and flow will alter the temperature. The temperature of a stream is critical to aquatic organisms through its effect on their metabolic rates and thus growth and development.

Aquatic organisms will respire and eat more in warmer waters than in colder ones. Each organism will have maximum and minimum temperatures between which they can survive, and these limits may change with each life stage. All salmonid fish species are specialists: each require specific habitats. Summer water temperatures below 62 degrees F are preferable.

Water temperature is also an important factor in regulating the occurrence and distribution of riparian vegetation, fish, invertebrates and other organisms. Temperature affects other properties of the water such as sediment load, concentrations of nutrients and dissolved oxygen. It can be difficult to separate the direct effects of temperature on biota from the indirect effects of these other properties.

Beaver and Palmer Creek have good water temperature for most of the year. During the summer months when water quality and quantity are critical in these basins, water temperatures are high (above 68 degrees F) due to low water levels. In the past, data was collected during the noncritical months. This year, temperature monitors were placed throughout the basins during the eighth year of drought in southwest Oregon. Palmer Creek was dry by mid-July. By August 1, Beaver Creek was dry from Haskin's Gulch downstream (5 miles, 60% of stream). No connectivity between pool habitats existed; water temperature was 65 degrees F, there was no aeration from flow and fish were observed dying.

**pH** is defined as the concentration of the hydrogen ions in water in moles per liter. A pH range of 5.0 - 9.0 is not directly toxic to fish. But a decline in pH from 6.5 - 5.0 results in a progressive reduction in salmonid egg production and hatching success (EPA, 1991). The emergence of aquatic insects also declines below a pH of 6.5. The pH in both Palmer and Beaver Creeks during June and July, 1994 ranged from 7.6 - 8.2.

Mining that occurred in Palmer Creek, Lime Gulch, exposed limestone to weathering but had no significant effect on the pH during the sampling duration. Further testing over a longer duration is necessary before any conclusions can be drawn.

**Conductivity** (specific conductance) refers to the ability of a substance to conduct an electric current. The conductivity of a water sample is a function of the water temperature and the concentration of dissolved ions. Conductivity is an excellent indicator of the total concentration of dissolved ions and thus can be a very useful indicator of mining impacts or agricultural water quality (EPA, 1991). There is a strong relationship between conductivity and alkalinity ($CaCO_3$) thus providing insights into aquatic production potential of streams. $CaCO_3$ is extremely important for insect growth; therefore increased food production for fish.

The range for potable water in the U.S. is .30 to 15 microsiemens per cubic meter. The conductivity of streams emanating from forested areas in the Pacific Northwest almost always fall at the low end of that range. This holds true for Beaver and Palmer Creeks which ranged from .21 to .47 microsiemens per cubic meter. Further testing over a longer duration is necessary before any conclusions can be drawn.

**Total Dissolved Solids (TDS)** is also known as salinity. Data was collected in June and July, 1994 and showed a range of approximately 200 gm/L. This amount is normal for this type of geology and climate. During dry weather, when the base flow of the stream is dominated by ground water drainage, the concentration of the dissolved solids tends to be high. Therefore, further analysis over a longer duration needs to be conducted before a conclusion can be drawn. Conductivity is at least as useful as total dissolved solids for assessing the effect of diverse ions on chemical equilibria.

**Dissolved Oxygen** is critical to the biological community in the stream and to the breakdown of organic material. The concentration of dissolved oxygen in streams is important to salmonids during rearing and adult stages. At a high concentration (11 mg/L), fish can function without impairment. At a middle concentration (8 mg/L) the average individual of a species begins to exhibit symptoms of oxygen distress; at a low concentration (6 mg/L), a large portion of the fish population may be affected (Reiser and Bjornn, 1979). Currently no data exists on levels of dissolved oxygen in these basins.

Water quality data was also obtained from the Oregon Department of Environmental Quality (DEQ)(Oregon DEQ, 1992). Data was collected by visual observation on fish, aquatic habitat and drinking water supply. No pertinent information on Beaver Creek was obtained for this analysis.

**9. The Effects of Sediment on Channel Morphology and Aquatic Habitat.**

Streams have been subjected to change since the time they were formed -- change from such natural events as glaciation, floods, temperature changes, fire, droughts, and -- more recently -- by human occupation of streambanks and use of streams and their surroundings for mining, timber harvest, livestock grazing, road construction and recreation.

For many aquatic organisms the channel bed is a "substrate" to be used as a foothold, as a site to deposit or incubate eggs, as "grit" for grinding food or as a refuge from floods (Gordon, et. al., 1993). Species differ in their substrate preferences and requirements. The suitability of a substrate for colonization by aquatic flora and fauna depends on its average particle size, its mix of sizes, the size of pore spaces, degree of packing and embeddedness, and its surface topography. Salmonids require a mix of gravels with small amounts of fine sediments and rubble as an optimum spawning substrate mix. Algae, mosses and other aquatic plants also have specific substrate requirements. The plants, in turn, provide substrates for other organisms to cling to or shelter behind.

Thus, the distribution of sediment sizes along a stream will be one of the physical habitat factors influencing the distribution of organisms. In general, the highest productivity and diversity of aquatic invertebrates seems to

occur in riffle habitats with medium cobble and gravel substrate. Areas of shifting sands commonly have reduced species abundance and richness.

Biological activity in coarser substrates is dependent upon the maintenance of inter-gravel flow rates for the replenishment of nutrients and oxygen and the removal of metabolic wastes (Gordon et. al., 1993). Where excessive fines are washed into the streams, as for example, in Beaver Creek below Haskin's Gulch, a "mat" is formed on top of the coarser bed materials. The infilling of gravels with finer sediments can reduce inter-gravel flow rates, suffocate eggs, limit burrowing activity and trap emerging young. Gravel bed streams which become filled with silt may show a shift in the insect species composition (see Viability of Fish Populations; Macroinvertebrates)

**Roads**: A function of intermittent channels is the storage and transfer of sediment. In sub-basins, such as Haskin's and Hanley Gulches, in the Beaver Creek watershed where granitics are present, soils are easily eroded. Nonsystem roads and landings in both of these sub-basins are located in or adjacent to a number of intermittent channels. Due to drought conditions, sediment has been stored throughout these systems. During the next flood event this road network could deliver large concentrations of sediment into the main channel.

System and nonsystem roads also have an impact on the sinuosity of a stream system if constructed within the floodprone area. Roads confine the stream's ability to migrate laterally, straightening the channel, forcing energy to be dissipated in a downward direction and/or against the banks. In Palmer Creek, the impact from roads is minimal compared to the amount of mine tailings which have aggraded the stream.

These roads, skid trails, and landings in their current condition will continue to produce sediment, prevent lateral stream migration, divert and concentrate flow, inhibit the growth of vegetation for stream canopy cover and coarse woody debris recruitment, as well as potentially increasing water temperatures and suspended sediment.

**Drainage-ways Crossed**: Where roads cross drainages, the potential for direct sediment input increases. This occurs from road surface/ditch line/and fill slope erosion that is routed directly into the stream. Drainage-ways crossed on system roads occur primarily low in the watershed, adjacent to mainstems and large tributaries. The number of drainage-ways crossed is particularly high in the Beaver Creek watershed in the following sub-basins: Baldy, Beaverhead, Charley Buck, Boaz, Hanley Gulch, and Pete's Camp (Figure 5). No data was available for nonsystem roads. The number of system road drainage way crossings is moderate to low for the Palmer Creek watershed, Billy's Gulch, China Gulch, McKee and Flumet Gulch (Figure 5-6).

**Road Density**: As road density increases the potential for more sediment yield and delivery increases due to the larger acreage of exposed surfaces. These include cutbanks, fill slopes, ditch lines, and road surfaces. On steep side slopes and/or wide roads, larger acreages can be expected. Sub-basins with the highest system road density are Hanley Gulch (4.64 miles/sq. mile), Haskin's Gulch (4.18 miles/sq. mile), the headwaters in Beaver Creek (3.98 miles/sq. mile) and west Palmer (4.59 mile/sq. mile) and Sourdough Gulch (3.34 miles/sq. mile) in Palmer Creek (Figure 5-6).

**Culverts**: (see discussion contained in B. Geology; 5. The Effects of Human Activities on Slope and Soil Stability, Roads)

**Mining**: Mining is perhaps the greatest sediment source to Palmer Creek and its tributaries. Mining can produce significant sources of bedload sediment and cause suspended solids to enter aquatic ecosystems. Small scale mining occurred in Palmer Creek during the latter half of the 19th century. The 1930's saw large-scale hydraulic mining operations throughout most of the watershed. Pebble counts show the dominant substrate is cobble sized. Little variation in particle size exists in the streambed. This limits the amount of spawning gravel available. Large piles of tailings are now located within the floodprone area, constricting the active channel. Although the

channel is classified as a relatively stable B3 stream type, aggradation of the lower reaches has filled the natural stream channel. As in Beaver Creek, recent drought conditions have precluded movement of large quantities of bedload. The stream will be maintained in this condition until flows are significant enough to transport and remove bedload from the system.

Currently 237 mining claims exist within the Palmer Creek watershed, 104 of these claims are closed, 16 are open and the status of 117 are unclear. The BLM in Portland, Oregon mailed letters to the claimants of the 117 claims declaring them "abandoned and void" on August 12, 1994. Claimants have 30 days to appeal before their claim becomes closed.

**Irrigation Canals:** Irrigation canals in the Beaver and Palmer Creek watersheds contribute to increased sediment production in two ways. Diverted flow decreases the stream's power (velocity) allowing more sediment to fall out of suspension. Sediment is also input directly from rills and gullies formed by breaks in the canal.

**Livestock Grazing:** Livestock grazing can affect all four components of the aquatic system: streamside vegetation, stream channel morphology, quality and quantity of the water column, and structure of the soil portion of the streambank (Meehan, 1991). Livestock grazing can cause annual micro-changes in the environment that can accumulate over many decades. These subtle changes are difficult to detect, whereas environmental changes from such sudden catastrophies as the 1974 flood are usually readily observable and measureable. Whether a stream has suffered a catastrophic event or a long series of small annual events, the results for fish can be the same.

The most apparent effects on fish habitat are the reduction of shade and cover and resultant increases in stream temperature (grazing on shrubs and herbaceous vegetation), water quality (livestock defecation and addition of sediment by streambank trampling), changes in stream morphology, and the addition of sediment through bank degradation and off-site soil erosion (livestock trails along streambank cause channel widening and downcutting).

Grazing impacts in Beaver Creek are most prevalent in the headwaters. Livestock movement appears to depend on climatic conditions. In years of higher precipitation livestock tend to stay higher in the drainage. In drier years, they tend to concentrate lower in the drainage, along the mainstem. The headwaters have sustained greater impact, and if current grazing patterns are maintained these impacts will continue and may worsen, increasing recovery time. No cattle allotments exist in the Palmer Creek watershed.

**Fish Structures:** Stored sediment in the stream channel lies behind fish habitat structures. The substrate behind these dams tends to be embedded. Improper placement of some of these structures in both Beaver and Palmer Creeks have caused bank erosion where banks were poorly armoured. Inevitably, the improperly placed structures will fail, producing local increases in sediment.

**Timber Harvest:** Forest harvest activities can influence both upland erosional processes and the way that forest streams process sediment in their channels. The potential for surface erosion is directly related to the amount of bare, compacted soil exposed to rainfall and runoff. Hence, road surfaces, landings, skid trails, ditches, and disturbed clear-cut areas can contribute large quantities of fine sediment to stream channels. Not all hillside sediment reaches the stream channel, but roads and ditches form important pathways to them.

Harvested areas account for approximately 17% of the Beaver Creek watershed. Most of these areas were clear-cut and exist in the following sub-basins; the headwaters of Beaver Creek, in the headwaters of Pete's Camp Creek, along Haskin's Gulch, Hanley Gulch, Charley Buck Gulch, and Armstrong Gulch (see silviculture specialist's report). The combined effect of high road density and vegetative stands less than 30 years old lead to a moderate risk level for both basins (Figures 13-14).

Graph 12

# Watershed Risk Rating

*Road Density versus Vegetative Cover*

## Beaver Creek

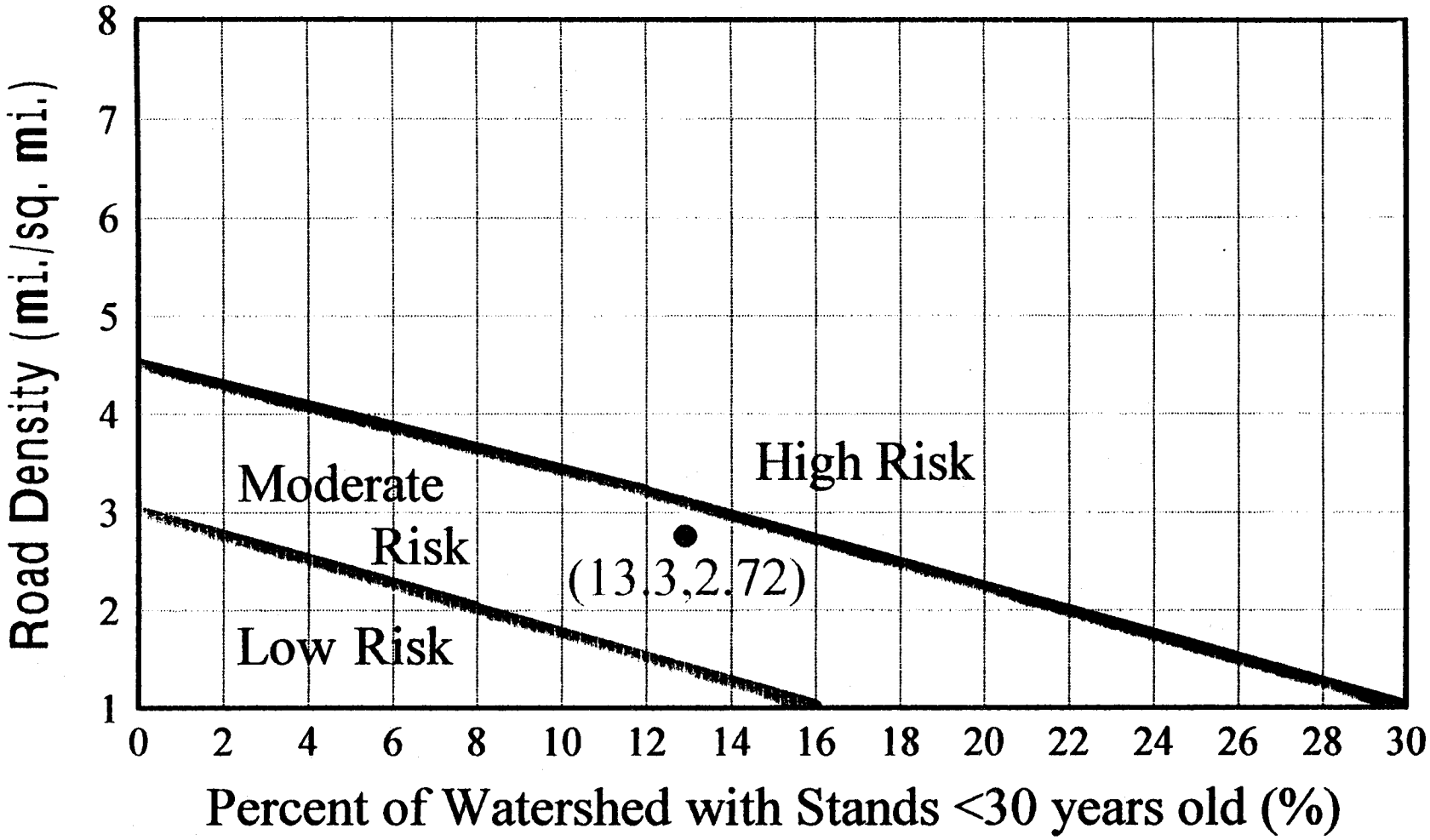



Figure 13

Beavpolm.prs

Graph 13

# Watershed Risk Rating

*Road Density versus Vegetative Cover*

## *Palmer Creek*

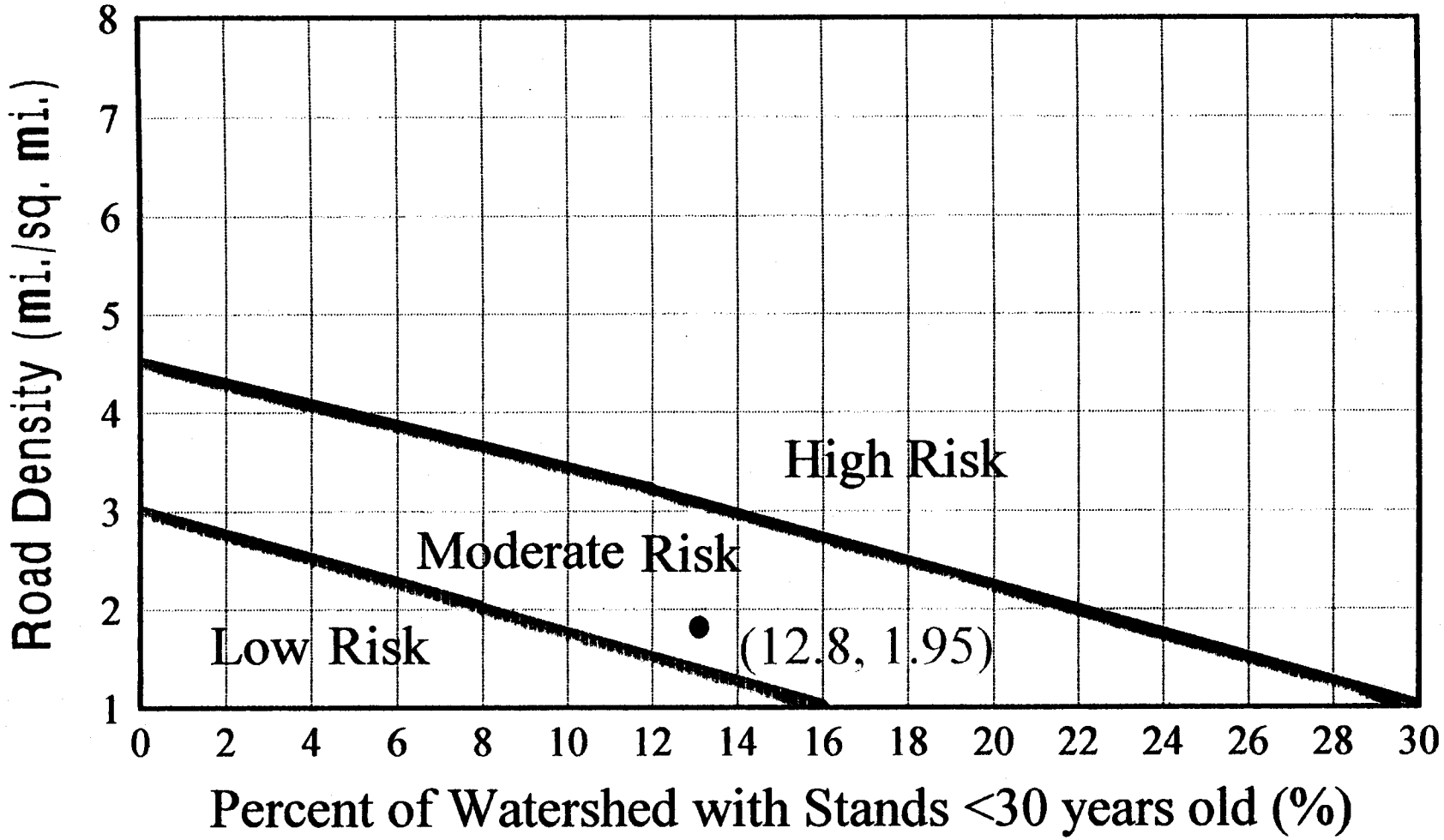



Figure 14

Beavpalm.prs

Site-specific analysis was not conducted on the effect of timber harvest in either watershed.

**Recreation:** Changes in vegetation from recreational activities in upland and riparian areas appear to be similar to effects of livestock grazing. The effects on soils in the Beaver-Sulphur Campground adjacent to Beaver Creek are compaction on the streambanks, root exposure from the loss of vegetation and soil, reduction in organic matter and reduction in soil moisture. Hiking and use of off-road vehicles or horses were not observed during this analysis. They have a potential to create ruts and trails that gather runoff, leading to increased erosion. Whether such changes will occur, or to what extent, depends on local soils, vegetation, topographic conditions, and the proximity of the damage to riparian areas.

**10. Riparian Zones**

**Vegetation:** Because of the close linkage between the stream and terrestrial ecosystems, logging, livestock grazing, mining, and other activities can have numerous effects on the stream ecosystem and its salmonid populations. Most effects of land uses on streams are mediated through changes in riparian vegetation (Meehan, 1991).

Riparian vegetation provides shade and an insulating canopy, preventing adverse water temperatures during both summer and winter. It also acts as a filter to prevent addition of sediment, and its roots provide streambank stability and cover for rearing salmonids. Riparian vegetation directly influences the food chain of a stream ecosystem by providing organic detritus and terrestrial insects, and by controlling aquatic productivity that depends on solar radiation. Road construction near streams often removes riparian vegetation directly.

Vegetative species composition, age class and percent canopy closure data reveal that within the riparian buffers (as defined by the Record of Decision) the overall percentage of medium to large diameter class trees between 71% - 100% canopy closure is extremely low. This may be due in part to road construction within the riparian zone (e.g., FSR 20, FSR 1095). After field reconnaissance, it was determined that canopy closure within 50 feet, either side of the stream, was approximately 90% to 100% canopy closure. However, the species composition within this 100 foot zone is predominantly alder, ash, big-leaf maple, and other shrubs. If this current condition is maintained, hardwoods will continue to dominate the riparian zone, limiting future recruitment of conifers and coarse woody debris.

**Coarse Woody Debris Recruitment:** The most productive habitats for salmonid fish are small streams associated with mature and old-growth coniferous forest where large organic debris (CWD) and fallen trees greatly influence the physical and biological characteristics of such streams (Maser, et. al., 1988).

Stream cleanout in the 1970's removed CWD from both watersheds. This standard procedure was carried out to remove potential fish barriers, to minimize damage during flood events and to aid water movement downstream. The existing supply of CWD is low in both Beaver and Palmer Creeks (Figures 15-16). Future CWD recruitment is poor due to the high hardwood to low conifer composition discussed above. This current composition is not adequate for sustaining a diversity of species.

**11. Other watersheds (Billy's Gulch, China Gulch, Flumet, Mckee)**

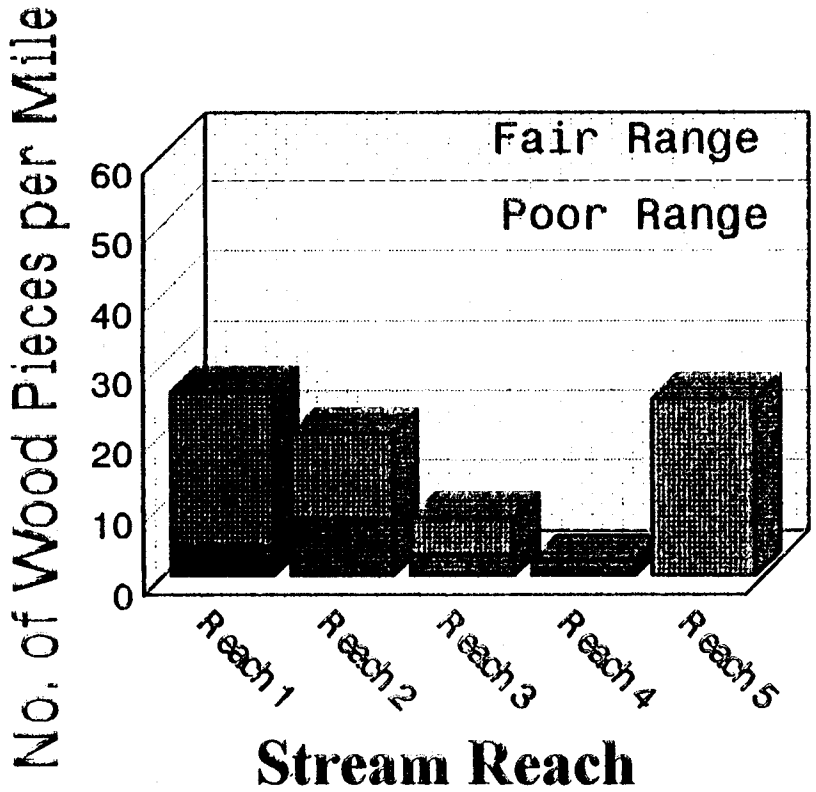
Many of the characteristics identified in the Beaver and Palmer Creek watersheds are similar in these smaller watersheds. All streams within these watersheds are intermittent and had nonexistent flow during this analysis. No information about fisheries is known. The following information needs to be collected at the project level to determine the stream type in each mainstem in addition to information on the fisheries; channel entrenchment, channel slope, width/depth ratio, sediment size, and sinuosity. If identified stream types are the same as those in Beaver and Palmer Creeks the condition trends and recommendations may be applicable.

Figure 15

# Large Wood Material Analysis

## *Beaver Creek*

Level II Stream Suvey




Large Wood Analysis

RANGE

- **Good: > 80 pieces/mile**
- **Fair: 50-80 pieces/mile**
- **Poor: < 50 pieces/mile**

**Wood/Mile ***
Small Size/ Mile
Large Size/ Mile

*** LARGE WOOD** = 36 in. DBH x 50 ft.; **SMALL WOOD** = 24-36 in. DBH x 50 ft. or twice the bankful width in length.

**Desired Future Condition** for Beaver Creek is **80 pieces of large and small wood per mile.** Note that all reaches are below wood levels needed for channel health, good insect production and optimum salmonid fish production.

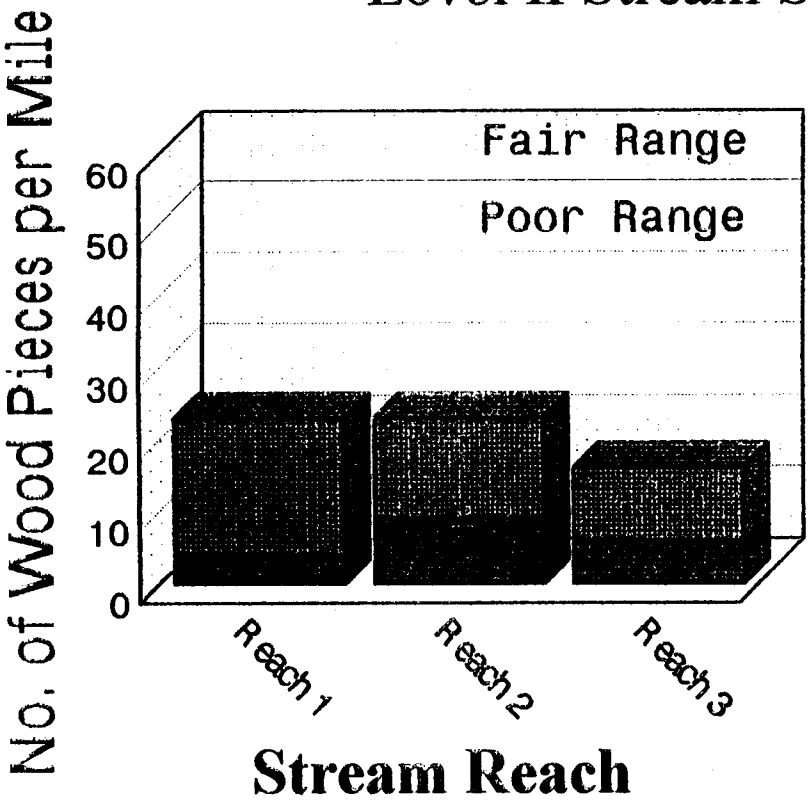
Beavwdpr.prs

Figure 16

# Large Wood Material Analysis

## *Palmer Creek*

Level II Stream Suvey




Large Wood Analysis

RANGE

- **Good: > 80 pieces/mile**
- **Fair: 50-80 pieces/mile**
- **Poor: < 50 pieces/mile**

**Wood/Mile ***
Small Size/ Mile
Large Size/ Mile

*** LARGE WOOD** = 36 in. DBH x 50 ft.; **SMALL WOOD** = 24-36 in. DBH x 50 ft. or twice the bankful width in length.

**Desired Future Condition** for Palmer Creek is **80 pieces of large and small wood per mile.** Note that all reaches are below wood levels needed for channel health, good insect production and optimum salmonid fish production.

Palmwdpr.prs

## D. VIABILITY OF FISH POPULATIONS

### 1. Diversity of Fish Species

Both watersheds contain a diversity of fish and aquatic fauna. Anadromous fish (steelhead trout and coho salmon), resident trout (rainbow and cutthroat), non-salmonid fish such as sculpins and crayfish are located in both watersheds (Figures 17-18). These species are typical of salmonids found in western Oregon where there is access for fish migrating from the Pacific Ocean. Beaver and Palmer Creeks are especially important to the health of Applegate River fish stocks because they are:

- the two largest streams accessible to anadromous salmonids below the Applegate Dam (a total migratory block for all fish).
- the only two watersheds listed as key watersheds under the President's Plan, substantially under Federal ownership and in the Applegate Adaptive Management Area (AMA).
- important diverse aquatic microhabitats for some aquatic species not found in the main channel of the Applegate River.

Coho salmon and winter steelhead are generally more dependant on tributary stream habitat and tend to stay in these habitats for one full year or more. Coho are on the Oregon Department of Fish and Wildlife's (ODFW) sensitive list. During low flow both basins have little to zero flow, thus, water quantity is a significant limiting factor to these fish species in the Beaver and Palmer Creek watersheds.

Summer steelhead and fall chinook salmon often spawn in streams which can dry up in the summer months, these fish are less-affected by summer low flow. Typically the juveniles of these two species migrate downstream to main river rearing areas in the spring. The eight-year drought has significantly reduced the amount of spawning in these two streams. Palmer Creek is an ODFW spawning index stream for assessing the escapement of summer steelhead to spawning areas. In the past, more than 50 summer steelhead redds have been documented in Palmer Creek. In the past several years, few redds have been observed by State and Federal biologists. Summer steelhead and fall chinook spawning areas have been greatly reduced throughout the Applegate River sub-basins by the drought.

### 2. Contributions of Beaver and Palmer Watersheds to Downstream Fisheries (Ie., Applegate River, Rogue River)

These headwater streams are important to the downstream fisheries because of their potential, through restoration, to produce high quality water (low water temperature, low sediment) and unique microhabitat for aquatic fauna. Although these two streams represent less than five percent (5%) of the total salmon and trout habitat in the Applegate River sub-basin, for reasons listed above they are critical refugia for salmonids and other aquatic fauna.

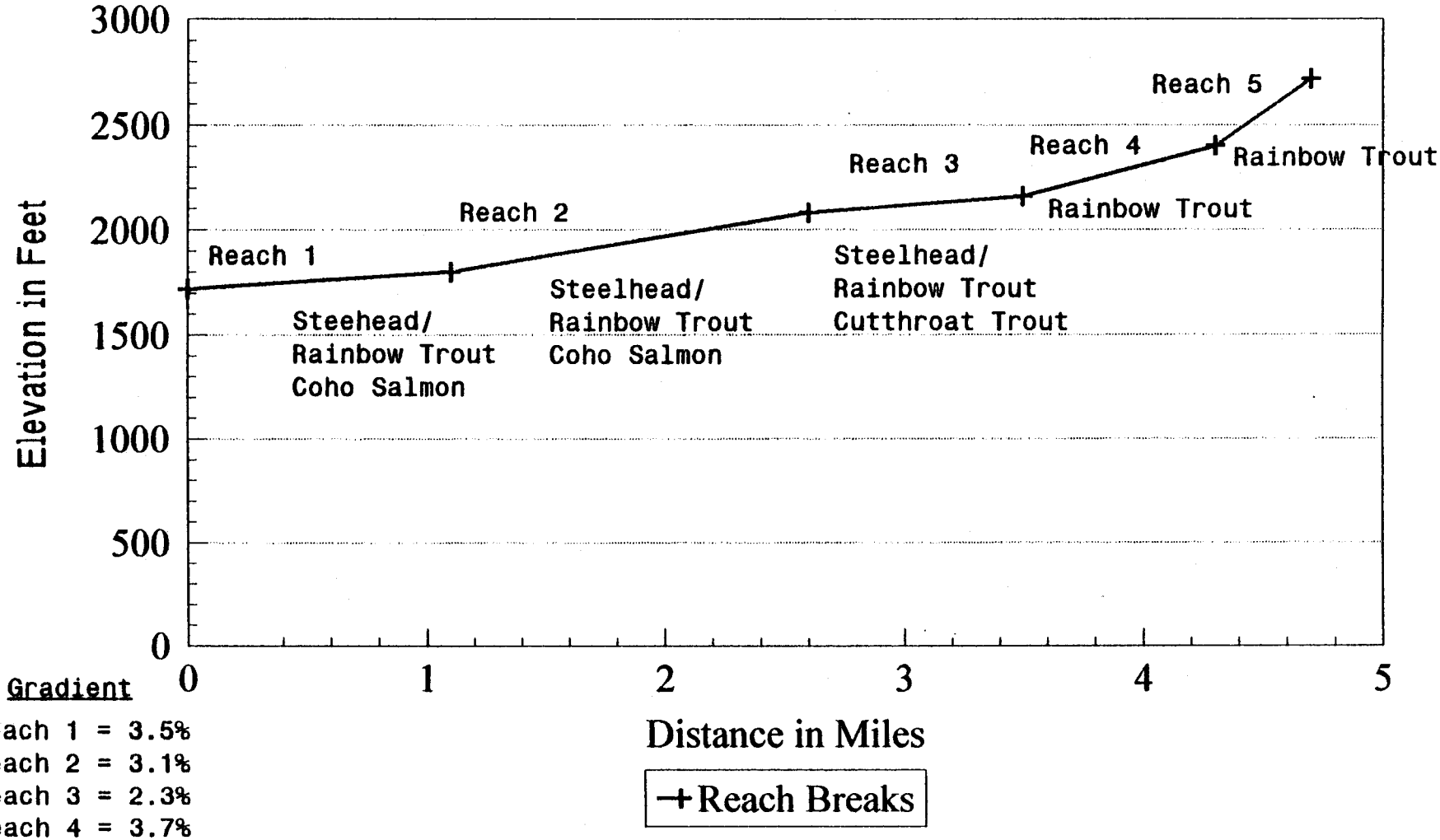
### 3. Habitat Connectivity and the Effects on Viable Populations of Fish.

**Flow regime** - The basins are located within the transitory snow zone. Flows vary considerably between the dry and rainy season. Summer base flows can be nonexistent while a 10 year rain-on-snow hydrologic event in Beaver Creek can reach 1,250 CFS. This presents salmonid fishes with a variety of habitat conditions in a stream channel that has been simplified by past management activities. Habitat simplification reduces refuge areas e.g., wood accumulations, boulder and cobble interspaces, alcove and off-channel pools.

During periods of low flow (2 cfs) to zero flow, connectivity between pool habitats is nonexistent. This allows little or no movement of anadromous or resident fish during these periods. This can result in stress, predation (no escapement) and poor water quality through increased temperatures.

Graph 10

# Profile of Stream Channel
## Beaver Creek




Gradient

Reach 1 = 3.5%
Reach 2 = 3.1%
Reach 3 = 2.3%
Reach 4 = 3.7%
Reach 5 = 5.8%

Data from 1990

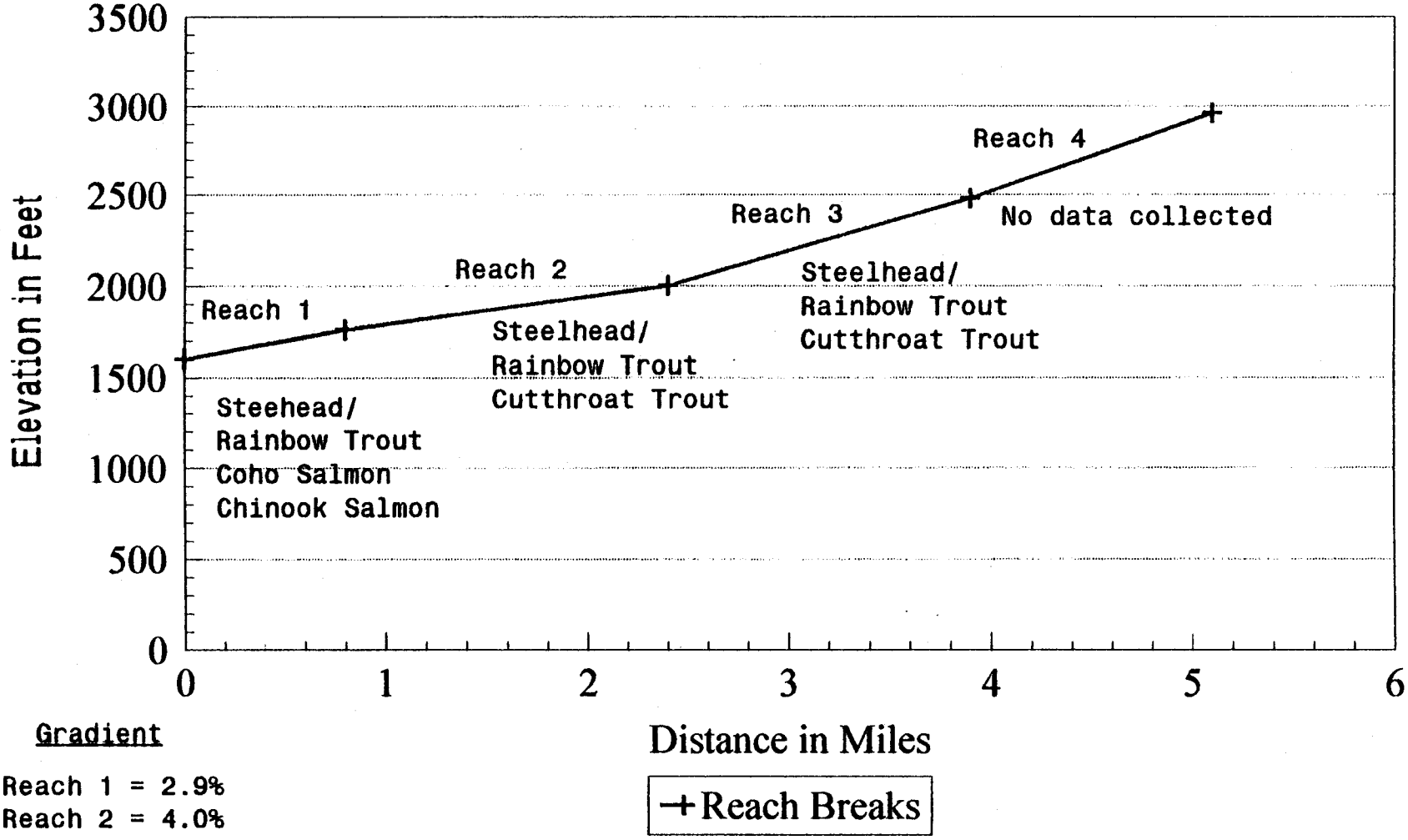
Beaver. prs

Figure 17

Graph 11

# Profile of Stream Channel

## Palmer Creek




**Gradient**

Reach 1 = 2.9%
Reach 2 = 4.0%
Reach 3 = 6.4%

Data from 1990

Palmsc. prs

Figure 18

**Falls** - Fish are able to move throughout both stream systems during high flow. During low flow periods, a falls (located halfway in reach 2 of Beaver Creek) may be an impass to steelhead trout.

**Fish Structures** (wood recruitment) - In the past, fish structures have been constructed to add wood to the stream and create plunge pools (upstream log weirs). Most pool habitat in these systems consist of step pools with an average depth of 2 feet. During low flow the plunge pools (approximately 5-6 feet deep) may lure the fish into staying in the human-made pools instead of migrating downstream. During drought years, fish have become trapped in the system. Palmer Creek frequently flows sub-surface in the lower segments of the stream during the late summer of normal rainfall years.

State and Federal biologists have surveyed the pools before and after the flow discontinued. Pools which held fish during low flow (2 cfs) were devoid of fish during zero flow. Habitat connectivity is important to ensure the flow of all fish.

The issue of pool enhancement in Palmer Creek and Beaver Creek is particularly complex. These log structures tend to form a sediment wedge upstream which collects fine materials and embeds stream gravels and cobbles. Downstream a pool is scoured which provides quality cover for adult fish while spawning and spawning gravel is available in the nearby pool tailout. These structures aggrade upstream quickly in periods of high runoff and the impounded sediment is a small fraction of the sediment moving through Palmer and Beaver Creek during bankful storm events. Many of these structures are widening the stream channel and causing some bank erosion.

The relative merits of this habitat work versus simplified stream habitat with few instream features is not proven. It would be expected that these streams at different times had considerable instream wood component with their location in a riparian forest of mixed hardwood and conifers. Pools were present in this past scenario that trapped fish in the summer months. These areas may be very important for amphibians and reptiles for estivation during summer drought (Clayton, personnal communication).

**Culverts & Bridges:** There are 3 bridges on Beaver Creek and 2 bridges on Palmer Creek. All of these bridges are passable for fish. No culverts are located on either of these main stems. Numerous culverts are located throughout the Beaver Creek watershed, however, because they are located higher in the watershed they do not effect fish passage. All of the main tributaries on the north side of Palmer Creek pass through culverts. It is undetermined if fish have historically used these small tributaries.

**4. Macroinvertebrates**

During 1991 a benthic macroinvertebrate biomonitoring survey was conducted on Beaver Creek by Bob Wisseman (Aquatic Biology Associates, Senior Scientist). Key points derived from this report were:

- Impairment is due to habitat quality limitations, rather than water quality limitations.
- Overall habitat complexity in Beaver Creek is moderately to severely impaired (the stream tends to be wide and shallow, is sluiced to bedrock in many reaches, fine sediment has filled in hyporheic interstitial spaces, reduced crevice space in the surface armor layer of riffles, and filled in pools.
- Fine sediment is a problem in the system. Both silt and sand are a problem. Silt levels are moderate in slack water areas. High levels of silt can smother margin and pool invertebrate communities. Low or moderate levels of silt greatly depress invertebrate abundance on the margins, and inhibit scrapers. High levels of sand were common in many of the streams sampled. Sand can fill in hyporheic interstitial space, embed crevices in the surface armor rocks of riffles, and fill in pools and spawning gravel. Sand appears to be mobilized during high flow, causing moderate to severe scour of surface substrates. Scour can cause direct mortality of many invertebrate taxa, or indirectly impact them by affecting their food source or habitat (e.g. Nostoc algae and moss).

- Highly intolerant taxa were not present in high numbers and richness in most systems. These small numbers can be attributed to the above habitat factors, plus in some systems, high water temperatures and reduced base flows probably contributed to their low levels.
- Many of the positive indicator groups or taxa in a healthy stream system are absent from Beaver Creek, or present in very low numbers.
    - Caddisflies of the families Arctopsychidae and Philopotamidae, and Corydalids (fish-fly or hellgrammite larvae) were not present. Nonimpaired, forested, montane streams in Southwest Oregon will almost always have these taxa present. Their absence is generally indicative of a closed hyporheic zone and lack of crevice space. High winter scour and resorting of surface substrates can also cause their decline.
    - Taxa associated with aquatic moss were rarely encountered. High winter scour, opening of the riparian canopy, reduction of channel depth, and summer drying of the stream channel has removed or substantially reduced this habitat in the streams. Moss is a normal constituent of nonimpaired streams in the region.
    - Nostoc algae, and its associated midge *Cricotopus Nostococladius*, was not present on Beaver Creek. Though not found in all nonimpaired streams in the region, its presence is common. This algae is sensitive to high summer temperature and winter scour.
    - Taxa which are particularly sensitive to high summer temperatures were under-represented.
    - The richness of caddisfly scrapers, caddisfly shredders, and exylophages were generally much lower than expected.
    - Large insect taxa with long life cycles (2+ years per generation) were present in very low numbers. Where they are absent, this indicates that disturbance of critical habitat occurs with enough frequency and magnitude to prevent successful completion of life cycles.

The site that was sampled appeared to have a long history of impairment. This impairment comes not only from logging and roading, but also from catastrophic floods which have greatly influenced habitat structure.

No sensitive or T & E aquatic invertebrate taxa were encountered at the Beaver Creek 1991 sampling site. No data was collected on Palmer Creek.

## E. TERRESTRIAL VEGETATION

### 1. Vegetation Zones and Vegetative Composition

Field validation of vegetative composition relative to vegetation zone locations took place by Bill Warner, Applegate Ranger District, Silviculturist. See Vegetation Zone Map for the Beaver/Palmer Watershed Analysis area. Within the Beaver/Palmer Analysis area, 74 percent is estimated to be within the Interior Valley Vegetation Zone, while 26 percent of the analysis area falls within the Mixed Conifer Vegetation Zone (see Figure 19 for a map of vegetation zones).

Field validation of the vegetation within the analysis area shows the following:

Interior Valley Vegetation Zone acres
9,522 Beaver
8,209 Palmer
17,731 acres

Mixed Conifer Vegetation Zone acres
4,488 Beaver
1,849 Palmer
6,337 acres

The southern exposures in the **Interior Valley Vegetation Zone/Douglas-fir series** (below 3,600 feet) support scattered ponderosa pine, black and white oak, poison oak, live oak, madrone, ceanothus, and manzanita. Douglas-fir is present in the draws and on the more favorable sites. Some small grass savanahs are also present in the lower elevations. The more northern and eastern aspects of this watershed are primarily occupied with Douglas-fir and scattered ponderosa pine, sugar pine, madrone, and black oak.

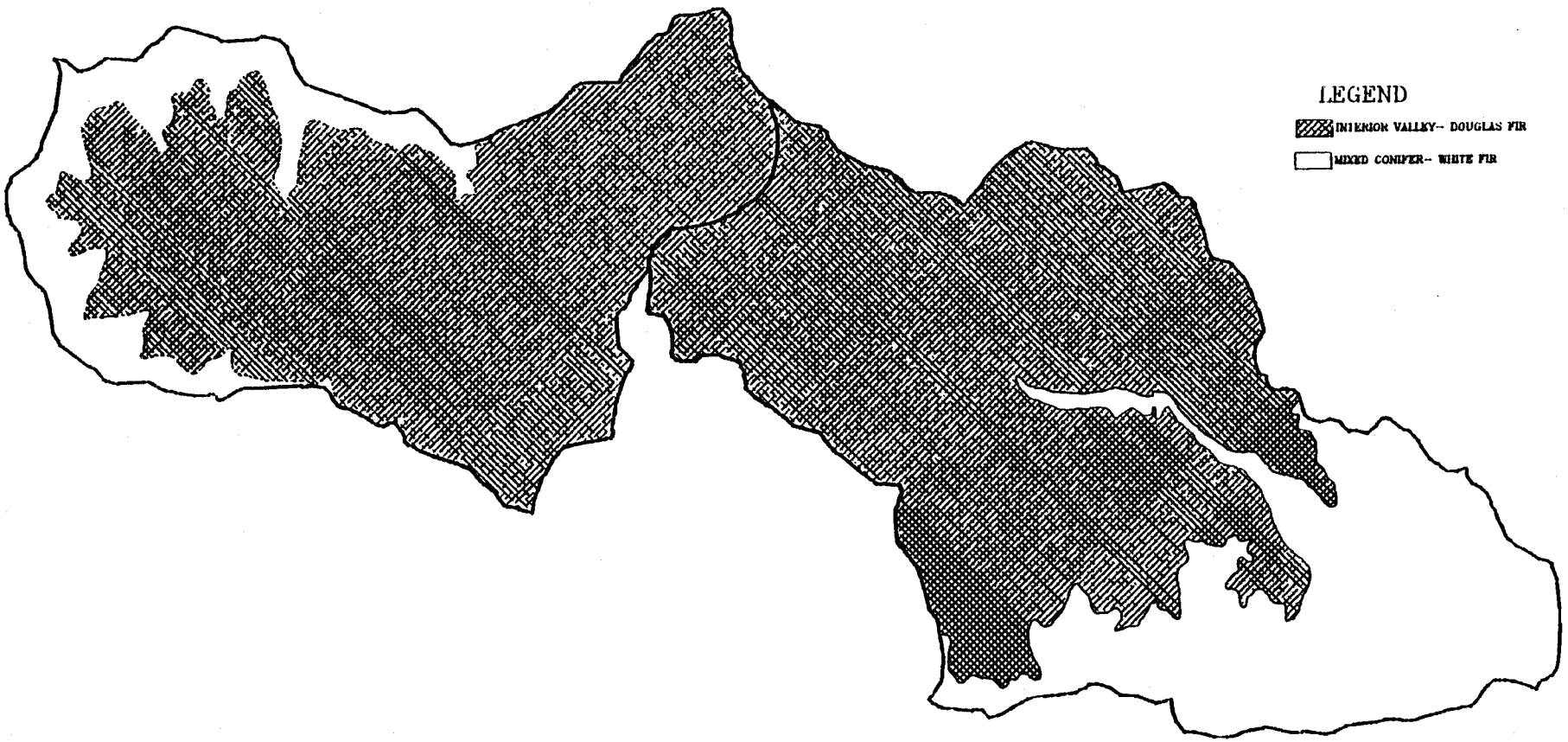
On the southern exposures in the **Mixed Conifer Vegetation Zone/white fir series** (above 3,600 feet), Douglas-fir becomes more predominate and white fir can be found intermixed with the other species. The vegetation is still very dense in spots with the live oak forming heavy thickets along with the madrone. Two exceptions to this are the presence of white fir in the bottom of Beaver Creek at an elevation of 2,200 feet, and the apparent absence of white fir on Baldy Peak, an elevation of close to 4,800 feet. The close proximity to the low valley conditions along the Applegate River and accompanying heat may account for the apparent lack of white fir on Baldy.

Just west of Squaw Peak is an overlayment of peridotite rock covering approximately 4 acres. Although the area is within the mixed conifer/white fir series, the high magnesium content of the soil favors a jeffery/ponderosa pine climax rather than the white fir as the pine are much more tolerant of the unusually high magnesium level in the soil.

Pacific Meridean Resources (PMR) mapping data has been used for the vegetation analysis. The mapping is from satellite imagery using pictals of approximately .15 acre each. The accuracy is around 80%, with the structure and canopy more accurate than the species delineation.

For Beaver Watershed, several hundred acres falling outside of the area covered by PMR mapping is not included in the analysis acres. The actual watershed is 14,011 acres but the PMR data only covered 13,797 of these acres. The acres not included in the vegetation analysis, are located over 1 mile outside of National Forest system lands.

# BEAVER/PALMER VEGETATION ZONES




SCALE 1: 88000.

N

Figure 19

OUTDGIS

11/ 9/94 14:32:44

The following table displays the general composition of seral stages/size classes within the Beaver and Palmer Watersheds and adjacent sub-basins included in the Analysis Area.

Figure 20; Summary Vegetative Composition

| Watershed | Acres of Permanent Grass, Shrub, Rock (% of watershed) | Acres of Capable Forest Lands (% of Capable Forest Land) | | | | |
|---|---|---|---|---|---|---|
| | | seeds/saps acres (%) | poles (%) | small timber (%) | Mature timber (%) m+ | % capable forest in hard-woods |
| Beaver Creek | 2,354 (17%) | 2,346 (21%) | 3,219 (28%) | 3,142 (27%) | 2,736 (24%) | 6% |
| Palmer Creek | 760 (11%) | 1,200 (19%) | 2,133 (35%) | 1,690 (27%) | 1,153 (19%) | 13% |
| China Gulch | 322 (32%) | 151 (22%) | 241 (36%) | 206 (31%) | 73 (11%) | 5% |
| Flumet Gulch | 494 (32%) | 252 (24%) | 350 (33%) | 304 (28%) | 157 (15%) | 7% |
| Billy's Creek | 176 (30%) | 97 (24%) | 117 (29%) | 132 (32%) | 59 (15%) | 3% |

When looking at data for individual sub-basins, there are some variations to the watershed averages that should be noted. They are as follows:

***Beaver Watershed***:

**Boaz sub-basin:** Close to 42% of the area is taken up by shrubs, grass, and rocks; 18% of the area is occupied by seedling and saplings for a total of 60% of the sub-basin currently in nonforest or "openings".

**Armstrong sub-basin:** Shows 25% of the area in grass and shrub cover; 17% of the area in seedlings and saplings for a total of 42% of the sub-basin currently in non-forest or "openings".

**Petes Sub-basin:** has that lowest component of shrubs at 8%.

**Jackson and Baldy sub-basins:** Displayed a significantly greater amount of stands with large (21+ inches) trees than the watershed average, they include Jackson with 49% and Baldy with 40%.

***Palmer Watershed***:

**East Palmer and the Sourdough sub-basins**: The shrub components are 24% and 20% respectively, as opposed to the 10% average for the watershed. In addition, the seedling and sapling component in sourdough covers another 26% of the area, for a total of 46% between the seedlings, saplings, and shrubs. The average for the watershed is 26%.

**Bailey sub-basin**: On the other hand supports a crown closure of over 70% in 56% of the drainage compared with a watershed average of 42%, and a 32% component of trees over 21 inches in diameter as opposed to the watershed average of 19%.

As previously mentioned, 13% of the capable forest land supports hardwood stands. Several subwatersheds support rather extensive stands. Those with stands covering more than 10% of the forested area include: Upper Palmer (27%), West Palmer (21%), Nine Dollar (19%), Dark Canyon (16%), Baily (12%), Lime (11%).

The following table displays the vegetative characteristics for riparian zones by watershed.

Figure 21; Summary of Vegetative Composition for Riparian Zones

| Watershed or Sub-basin | Acres of Permanent Grass, Shrub, Rock (% of watershed)) | Acres of Capable Forest Lands (% of Capable Forest Lands) | | | | |
|---|---|---|---|---|---|---|
| | | seeds/saps acres (%) | poles (%) | small timber (%) | Mature timber (%) | % capable forest > 70% Crown Closure |
| Beaver Watershed<br>Class 1 and 2<br>Class 3 and 4 | <br>156 (23%)<br>537 (17%) | <br>108 (21%)<br>534 (20%) | <br>180 (34%)<br>771 (28%) | <br>127 (24%)<br>738 (27%) | <br>110 (21%)<br>696 (25%) | <br>*<br>35% |
| Palmer Watershed<br>Class 1 and 2<br>Class 3 and 4 | <br>112 (26%)<br>153 (13%) | <br>77 (24%)<br>184 (18%) | <br>131 (39%)<br>353 (35%) | <br>76 (23%)<br>306 (30%) | <br>45 (14%)<br>176 (17%) | <br>*<br>* |
| China Gulch Sub-basin<br>Class 3 and 4 | <br>76 (26%) | <br>51 (23%) | <br>84 (38%) | <br>70 (31%) | <br>17 (8%) | <br>16% |
| Flumet Sub-basin<br>Class 3 and 4 | <br>49 (25%) | <br>34 (21%) | <br>58 (36%) | <br>54 (33%) | <br>17 (10%) | <br>23% |
| Billy's Creek Sub-basin<br>Class 3 and 4 | <br>286 (30%) | <br>14 (23%) | <br>22 (35%) | <br>20 (32%) | <br>6 (10%) | <br>11% |

* Information not available at the time of publication of this report.

The mainstem of Beaver Creek and Palmer Creek were further broken down by reaches for analysis. A summary of the reach data is displayed below showing the range in variation between stream reaches.

The following table displays the vegetative characteristics for riparian zones by reach number.

Figure 22; Summary of Riparian Zone Vegetative Composition by Reach (Beaver/Palmer Creeks)

| Watershed or Sub-basin | Acres of Permanent Grass, Shrub, Rock (%) | Acres of Capable Forest Lands (%) | | | | |
|---|---|---|---|---|---|---|
| | | seeds/saps acres (%) | poles (%) | small timber (%) | Mature timber (%) | % capable forest > 70% Crown Closure |
| Beaver Creek | | | | | | |
| Reach 1 | 34 (30%) | 16 (30%) | 20 (38%) | 11 (21%) | 6 (11%) | 19% |
| Reach 2 | 32 (26%) | 22 (23%) | 34 (37%) | 20 (21%) | 18 (19%) | 24% |
| Reach 3 | 15 (23%) | 9 (18%) | 19 (38%) | 12 (24%) | 10 (20%) | 18% |
| Reach 4 | 22 (24%) | 13 (14%) | 29 (41%) | 17 (24%) | 12 (17%) | 23% |
| Reach 5 | 27 (31%) | 12 (17%) | 3 (5%) | 38 (59%) | 11 (17%) | 11% |
| Palmer Creek | | | | | | |
| Reach 1 | 35 (42%) | 12 (25%) | 16 (33%) | 11 (22%) | 10 (20%) | 6% |
| Reach 2 | 22 (24%) | 13 (19%) | 27 (40%) | 21 (31%) | 7 (10%) | 18% |
| Reach 3 | 24 (21%) | 22 (24%) | 36 (40%) | 18 (20%) | 14 (16%) | 23% |
| Reach 4 | 18 (24%) | 14 (25%) | 22 (38%) | 14 (25%) | 7 (12%) | 35% |

## 2. Timber Stand Health Issues

With the exclusion of fire in the ecosystem since the early 1900's, high vegetation densities are causing extreme competition for moisture, nutrients, and growing space. The result has been an increase in mortality rates, especially in the large tree component. In addition, an 8 to 9 year drought in southwest Oregon has contributed to the increased mortality.

Ponderosa pine which are less tolerant of high stand densities than other conifer species, are experiencing the highest mortality rates. The bark beetles are responding to the weakened condition of the larger pine and making successful attacks. A vigorously growing tree can usually survive beetle attacks by literally pitching out the insects. The smaller pine can successfully compete at this time as their water distribution systems (given their smaller size) is much more efficient. However, they may never reach the size and age of the pine now dying while the current vegetation density levels remain.

Dwarf mistletoe is a major problem in the Douglas-fir in both the Interior Valley and the Mixed Conifer Vegetation Zones. White fir also is heavily infected with dwarf mistletoe in various locations. The dwarf mistletoe seems to be much more of a problem on the northerly aspects in the Interior Valley Vegetation Zone and the Mixed Conifer Vegetation Zone. The reason is probably related to the fire frequency intervals. If stands remain untreated, mortality will be accelerated in those trees infected with the disease, the younger healthy trees that are growing close to the currently infected trees will become infected. Growth and yields from infected trees will be reduced up to 80%. The impacts will be much more pronounced on the Douglas-fir than on the white fir. The end result will be a decreased ability to produce large trees and quality old-growth habitat.

Specific areas of concern to be observed within the analysis area are as follows:

**Beaver Watershed:** Last year, accelerated mortality began to occur on the southern aspects. The mortality begins at the mouth of Beaver Creek and continues to Beaver Ranch. Since mortality is recent, it is likely still merchantable.

White fir have continued to die over the last 10 years on the northern and western aspects in the mixed conifer series. The trees have generally been the dominate 10 to 24 inch diameter trees. The white firs inability to conserve moisture leaves the dominate trees especially vulnerable during periods of low moisture. Although large trees will survive and smaller white fir are available to replace those that die, it leaves in question whether any specific individual tree can be identified as risk free with a good chance of living for a protracted period of time. It also leaves in some doubt the temporal and spatial abilities of white fir to completely dominate the site. The fir engraver beetle (Scolytus) appears to be the insect responsible for the mortality in the white fir.

**Palmer Creek Watershed:** Heavy mortality has been occurring in spots throughout the watershed. Large old-growth ponderosa pine on the southern aspects are disappearing at a significant rate and will not be completely replaced in the future as long as the current stand densities remain. Large numbers of old-growth sugar pine and Douglas-fir have been lost on the northern aspects, however many large Douglas-fir and sugar pine still remain. To some degree the same impacts are targeting the Douglas-fir and the sugar pine. The Douglas-fir bark beetle is taking out the stressed Douglas-fir while the ponderosa pine bark beetle is successfully attacking the sugar pine.

Dwarf mistletoe infections are common in spots in the Douglas-fir throughout the drainage including a substantial infection on Boise Cascade land. Many of the Douglas-fir that recently died were infected with dwarf mistletoe. If untreated dwarf mistletoe in Douglas-fir will cause early mortality and a reduction in growth of up to 80%. Promptly removing the currently infected trees will lead to a reduction in the infection levels of the reproduction.

**China Gulch Watershed:** Mortality began occurring in the ponderosa pine several years ago as the drought deepened. Most of the larger ponderosa pine are now dead and are likely no longer merchantable. On the more northerly exposures, accelerated mortality has not occurred yet. The large tree component comprised of Douglas-fir, ponderosa pine, and sugar pine still remains. Many of the stands located in the lower portions of the drainage on Forest Service land, are between 80 and 100 years of age.

**Flumet Gulch Watershed:** The vast majority of the large, and many of the smaller ponderosa pine have died over the past several years; only a low amount of merchantable material still remains. Plans are under way with the Partnership I project to reintroduce fire and begin to reduce the vegetation densities.

Several pockets of dwarf mistletoe infection were noted in the drainage. By far the heaviest infection centers are in Douglas-fir located near the top of the drainage, and a substantial infection on Boise Cascade land. Many of the Douglas-fir that recently died were infected with dwarf mistletoe. If not treated the disease will shorten the life of the infected trees, reduce growth by up to 80%, and spread the disease to now healthy seedlings which will reduce the ability of the stands to achieve old growth characteristics by reducing the ability of the younger trees to grow.

**Billy's Gulch:** Some recent mortality is occurring on the southern slopes within this drainage. However, the frequency of ponderosa pine on these slopes is less than in surrounding drainages; therefore, less mortality.

**3. Site Potential**

Site potential in the analysis area is generally around a site class IV (McArdles). However, some of the lower elevation, drier, rockier, and peridotite soil areas are closer to a site class V. Where the lower site class occurs (site class V), tree growth potential is poor. The better growing sites (site class IV and above) are usually found on the northern aspects and riparian areas where moisture is not as limiting, while the lower growing sites are found on the drier southern exposures.

## F. SOIL PRODUCTIVITY

Soil biology, chemistry and physics act both independently and collectively to create soil characteristics that determine "Soil Productivity". Productivity is the ability of a soil to yield vegetation.

Before talking about the activities which affect soil biology, chemistry and physics (mechanics) we need to first identify the three characteristics and their relationship remembering each is a study within itself. Soil biology is the living, both plant and animal, populations within the soil. Each type functions somewhat differently. They utilize the existing organic matter as energy and tissue building material. The populations are sensitive to temperatures, aeration (both aerobic and anaerobic conditions), and moisture conditions (saturation etc.). They are the primary factors in nutrient cycling and organic (humus) development. Soil chemistry is generally related to the fertility characteristics of the site. It is dependent on the parent material of the soil, the clay content, the humus content, vegetative regime etc. These give the soil its ability to supply and or hold the nutrients. Other chemical soil characteristics relate to the soils ability to tie-up nutrients thus making them unavailable to plants. The soil physical characteristics important to soil productivity are the structure, texture, mineralogy, etc. Soil structure is altered by mechanical forces and organic characteristics and affects the infiltration rates, permeability, aeration, etc. which directly affect productivity. Texture relates to soil infiltration and permeability rates which determines aeration and water holding capacities. It also relates to nutrient holding capacity for the fertility levels.

The surface soil (topsoil) is where most of the biological and chemical activity occurs. It is the major zone of root development, carries most of the nutrients for plant use and supplies a large portion of the water used by plants. It is easily altered by management activities yet is extremely important to maintaining productivity of the soil. Research has shown that as much as 80 to 90 percent of the productivity can be attributed to the topsoil.

The productivity of a soil is determined in a large degree by the nature of its subsoil. It is much less active and provides less of the nutrients and water to plants than the surface soil however it is the zone that carries the plants over during times of stress etc. If its permeability or structure is altered it may affect the rooting capability of the plants through aeration or lack of aeration and increased resistance (strength of soil) to rooting. This sometimes changes the suitability of the existing vegetation through stress and die-off.

### 1. The Effects of Management Activities on Soil Productivity

**Tractor logging:** The use of tractors for logging has created the potential for compacted soils over various percentages of sites harvested by this method. Primary roads and landings used for skidding logs are impacted the most. Monitoring has shown that both of these as well as secondary skid roads exceed Regional standards and guidelines for percent of increase in bulk density for the soils measured. The LRMP, Standards and Guidelines limit the percent of area compacted to 10 percent of the activity area upon completion of a project. No more than 20 percent of an area should be compacted or displaced resulting under circumstances resulting from previous management practices. Communication with FIR revealed that adequate skidding could be done if 3 percent of the area was dedicated to skid trails.

**Machine piling:** Machine piling with tractors has been used for post harvest site preparation, reducing slash, removing competing vegetation and/or to create planting spots. This activity has occurred in the past, generally without consideration for its cumulative effect on the percent area compacted. In addition to the concern for compaction, machine piling also removes surface soil (topsoil) and places it in the piles. In general, piling can create the same compactive effort as found on primary and secondary skid trails. The biggest variability is the percent of area piled and the amount of material piled. Piles commonly occupy 10 to 20 percent, with scarification making up the remaining 80 to 90 percent of the site prepped area. The combination of compaction and surface soil removal can be very impacting to soil productivity.

Using GIS condition class mapping and average slope mapping, it is estimated that around 1000 acres (4 percent) of the Analysis Area has potentially been tractor logged. It is likely that a good percentage of this 1000 acres may have been machined piled for site preparation. These calculations assumed that tractor logging may have occurred in harvested units (represented on the condition class mapping) on slopes up to 40 percent. The actual acres tractor logged and machine piled are not known at this time. These percentages were calculated for the purpose of presenting an estimate of the area potentially impacted in the analysis area by tractor logging and machine piling. Site specific analysis at the project level is needed to determine the current soil conditions and potential effects of future activities.

**Windrowing:** Windrowing is the systematic piling of brush in rows and is very similar to machine piling. Very little windrowing has occurred in this area. As with machine piling, soil compaction and surface soil removal are very impacting to soil productivity.

**High-lead yarding:** This system of logging has had the most detrimental effect on the soils of all the cable yarding systems. It does not suspend the logs rather it drags them from the unit to the landing which is in a cone shape. Soil gouging occurs where logs dig into the soil as they are pulled into the landing. The area nearest the landing is completely scalped of its surface soil. This may have various effects depending on the localized topography and soil characteristics. The loss of soil can be impactive to soil productivity. Current soil conditions need to be assessed where new activities are proposed to assess the extent of past activities and the potential effects of new activities on soil productivity.

**Skyline yarding:** This type of cable yarding has various forms. Generally, skyline yarding is not detrimental to soil productivity. An exception may be in cases where suspension logging was not used and soil gouging occurred.

**Fire:** High intensity (hot) burning can remove duff and litter layers that protect soils and hold them in place. Under burning and other types of prescribed burning practiced today are low intensity burns (i.e. late winter/ early spring when fuel moistures are optimal) prescribed to retain organic material for soil protection.

In general, compaction effects the soil biology by reducing the macropore space changing the air and water relationships within the soil, thus changing the soil chemistry. Soil displacement and removal effects the soil biology by removing the source for food, altering the air and water relationships, and changing the structure. The extent of impacts of past activities needs to be considered on a site specific basis at the project level.

**2. Other Processes Affecting Soil Productivity**

Wildfire is a natural process that can remove duff layers and vegetative cover that protect soils and holds them in place. With fire exclusion, there is a potential for large stand replacing fires to occur. If this type of fire occurred there would be affects to soil productivity as seen through loss of duff layers, nutrient cycling, and erosion.

Fires were used extensively in the late 1800's and early 1900's for clearing trees and brush for livestock grazing, farming, and mining (see 1. Human Processes). Livestock grazing in large numbers also occurred during this time period. The extent of impacts on current soil productivity, from these historic activities in not known at this time.

## G. BOTANICAL RESOURCES

Fourteen rare plant species have been found within and/or adjacent to the Beaver Creek, Palmer Creek, China Gulch and Flumet Gulch watersheds. Seven of these species are currently listed as sensitive, three on the review list, and four on the watch list. These species are:

| | |
|---|---|
| *Cypripedium fasciculatum* | Sensitive |
| *Mimulus bolanderi* | Sensitive |
| *Mimulus kelloggii* | Sensitive |
| *Rhamnus ilicifolia* | Sensitive |
| *Sedum oblanceolatum* | Sensitive |
| *Sedum radiatum* ssp. *depauperatum* | Sensitive |
| *Sedum spathulifolium* ssp. *purdyi* | Sensitive |
| *Camissonia graciliflora* | Review List |
| *Linanthus bakeri* | Review List |
| *Pinus sabiniana* | Review List |
| *Cypripedium montanum* | Watch List |
| *Lewisia cotyledon* var. *howellii* | Watch List |
| *Mimulus douglasii* | Watch List |
| *Smilax californica* | Watch List |

### 1. Area Surveyed; Palmer Creek/Billy's Gulch/Flumet Gulch/China Gulch watersheds

Approximately 30% of the drainage has been surveyed for sensitive plant species fairly recently (within the past 5-7 years). Most of the unsurveyed area is within brushfields and forested areas. Rare plant species found within these watersheds are: *Camissonia graciliflora*, *Cypripedium montanum*, *Cypripedium fasciculatum*, *Linanthus bakeri*, *Mimulus douglasii*, *Rhamnus ilicifolia*, *Sedum oblanceolatum*, and *Sedum radiatum* ssp. *depauperatum*.

### 2. Area Surveyed; Beaver Creek watershed

Approximately 35% of the drainage has been surveyed for sensitive plant species but only half of this survey has been within the past 5 years. Older surveys in this area probably did not include many of the plant species currently on the sensitive species list. Rare plant species found within and adjacent to this watershed are: *Camissonia graciliflora*, *Cypripedium fasciculatum*, *Lewisia cotyledon* var. *howellii*, *Mimulus bolanderi*, *Mimulus douglasii*, *Mimulus kelloggii*, *Pinus sabiniana*, *Sedum oblanceolatum*, *Sedum radiatum* ssp. *depauperatum*, and *Sedum spathulifolium* ssp. *purdyi*. In addition, *Smilax californica* is found along the Applegate River adjacent to the Beaver Creek watershed in the Jackson Campground area.

### 3. Rare Plant Habitat

*Cypripedium fasciculatum* and *Cypripedium montanum* are found in forested habitats, often in low to mid elevation sites of mixed conifer and hardwoods. One *Cypripedium fasciculatum* plant located in 1980 in the Palmer Creek area has not been relocated in recent surveys. Another *Cypripedium fasciculatum* site in the Beaver Creek drainage that was on the edge of a timber sale unit in 1989 could not be found after the timber sale. Historically these species of orchids survived low intensity and frequent fires that were part of the ecology of the area. Old-timers of the Applegate Valley recall when these flowers were more abundant and sometimes bouquets of *Cypripedium montanum* were picked or plants dug which may have contributed to their decline. At present these species are generally found in very small numbers and widely scattered populations. These

species appear to have an association with deer as they are often located adjacent to deer trails. Studies are being conducted to isolate the mycorrhizal associate that aids in germination of the seed. Undiscovered populations of these species are likely present in these watersheds.

*Camissonia graciliflora*, *Mimulus kelloggii*, and *Mimulus douglasii* are all small annual plants found on open, vernally moist slopes at low to mid elevations. Their habitat is usually quite dry by flowering time and often rather barren and gravelly although the *Camissonia graciliflora* does grow in areas of more grass.

*Linanthus bakeri* is another small annual that has been added to the review list recently so has not been surveyed in many areas. It is located in open low elevation sites and appears to tolerate some disturbance as seen in a location near Palmer Creek.

*Mimulus bolanderi* is an annual that was discovered near the Beaver Creek drainage after a burn study was conducted in 1991. It had never been found in Oregon before as its range is normally not north of Amador County, California. It is found in open areas particularly after a recent burn. It has not been relocated at the site since the first year after the burn. This plant could show up in additional sites within the Beaver Creek drainage before or after a burn. This plant was added to the sensitive species list after the siting in 1991 but had not been noticed or surveyed particularly for before 1991.

A lone *Pinus sabiniana* tree is found very close to a ridge on the edge of the Beaver Creek drainage. This is the only location of this species on the Applegate Ranger District and it is far from the known natural range of this species. It is possible that this is not a natural occurrence of this species.

*Rhamnus ilicifolia* is found in chaparral and foothill woodland habitat in many parts of California and into Arizona and Baja California. It is found in only three locations in Oregon (two within the Applegate Ranger District). This species is endangered in Oregon due to the small number of populations and the sizes of these populations. The plant located in the Palmer Creek/Flumet Gulch area is a large individual that does not appear to be reproducing. If humans have had an impact on its abundance it is probably through a result of changes in fire frequency and intensity. The other population on the Applegate RD is composed of numerous shrubs that have been browsed heavily by deer. The shrub within the Palmer Creek drainage is large enough not to be disturbed by deer browse.

*Lewisia cotyledon* var. *howellii*, *Sedum oblanceolatum* and, *Sedum radiatum* ssp. *depauperatum* are found in rock outcrops and in areas where rock is mixed with bare soil. *Sedum radiatum* ssp. *depauperatum* is also found in areas with less vegetation in the woods and along road cuts. Because vegetation in areas where these species are found is usually light, fires have probably had little effect on them. The main impacts to these plants have been by road building, rock pit development, and occasional logging if logs were skidded through the site. These species have colonized road cutbanks where plants have been left above the road.

*Sedum spathulifolium* ssp. *purdyi* is found in rocky areas that are shaded. The location of this species in the Beaver Creek watershed is found near a creek and should be protected by riparian management. Other sites on the district have been effected by rock pit development and road building. This species has colonized road cutbanks where plants were left above the road.

*Smilax californica* is a prickly vine that is found in riparian areas generally along major streams. Because much of its habitat along major streams is located on private land, only a few sites are found on the Applegate Ranger District. Major threats to this species are from blackberry invasion and clearing by private landowners to make their streamside look park-like. This species should be protected by riparian management but can also be threatened by trail and park management because it is found around Jackson Campground.

**4. Appendix J species - Plant species from Table C-3**

Vascular plants from Table C-3 (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl) have been surveyed within the Palmer/Beaver Creek watershed. Of these species, *Cypripedium fasciculatum* and *Cypripedium montanum* have been located here. Not much is known about the other plant species from Table C-3 in these watersheds and they have not been surveyed for in any of the watersheds within Palmer and Beaver Creeks. It is assumed that they generally grow in mature to late successional stage forests but some grow in a variety of forest types including mixed forests with hardwoods. All plant species in Table C-3 in survey strategies 1 and 2 need to be surveyed within these watersheds.

**5. Non-native populations of local plant species:**

No known non-native populations of local plant species have been introduced in the Beaver/Palmer watersheds.

**6. Non-native species:**

Non-native plant species have been introduced within the watershed. Various grass species have been introduced in timber sale units, wildlife projects, and roadsides that were seeded for "forage replacement" as well as for erosion control. A 15 acre site in the Flumet Gulch area (NW1/4 of section 5, T.40S., R.3W.) was scarified and seeded with a non-native species of Agropyron which is aggressively taking over the site. An area in the Beaver Creek vicinity (west 1/2 of section 4, T.40S., R.3W.) was cut and burned (apparently as a brush conversion project) and the area is now a mix of native and introduced species (Elymus caput-medusae included). The suppression of the native vegetation by cattle in this area causes the less palatable non-natives to increase more than the palatable preferred native grasses.

Star thistle is a problem along the lower 4-5 miles of Beaver Creek Road as well as scattered locations along roads in the Charlie Buck, Armstrong Gulch, Palmer Creek, Flumet Gulch, and Jackson Campground areas. This is a major problem in dry grasslands because the plants are so competitive with native plant species. All known star thistle sites in the Beaver/Palmer watersheds are along roads. One nearby site southwest of Baldy Peak and just outside of the Beaver Creek drainage is away from a road on a trail junction.

One site of scotch broom has been found within a timber sale unit in the upper Beaver Creek area as well as a site near the Beaver Creek drainage in the Jackson Campground area (this site had scotch broom plants pulled in June, 1994).

One tansy plant was found in the upper part of Beaver Creek several years ago. This plant was pulled and none have been observed at that site since then.

## H. FIRE REGIME

Landscapes and associated ecosystems are not static. Landscapes are dynamic and patterns change (sometimes radically) through time. The stability of the landscape character can be described by identifying the disturbance processes, natural range of variability and general trends. Fire is identified as the key natural disturbance and has helped shape the landscape of the Applegate Watershed, of which Beaver and Palmer watersheds are part. Therefore, this discussion begins with a general characterization of the entire Beaver and Palmer Watersheds in relation to the fire regime. A discussion of the components of the local fire regime will include fire frequency (return interval), fire intensity, smoke production, and the extent and duration of fire.

### 1. Historic Fire Environment - Before Organized Fire Suppression

Before aggressive organized fire suppression began in 1902, fires within ponderosa pine vegetation communities were oftentimes described as frequent, low-intensity, ground/surface fires, which may spread over periods of weeks or months in Siskiyou Mountain forests (James K. Agee; 1993).

Generally fire maintained a set of vegetative conditions, particularly for pine dominated, hardwood stand characteristics. Characteristics for a pine dominated forest before fire suppression had little dead and down woody fuel on the forest floor and fewer dead standing snags as compared with today. On slopes above riparian zones there was much less understory vegetation. Specifically, "Low elevation sites burned more frequently than higher elevation sites, mostly as a result of more frequent low-severity fires" (Peter H. Morrison and Federick J. Swanson; May, 1990). On a landscape basis fires were estimated to result in stand replacement for about 20% of an area. "The intensity of pre-settlement fires encompassed a wide range of fire severity with many fires, or large portions of them, burning at low to moderate severity" (James K. Agee; 1993).

The Siskiyou Mountain Range is located within the east and northeast portion of the Klamath Mountain Province. Fire return intervals for the Siskiyou Mountain, Interior Valley Vegetation Zone which interfaces with Ashland, Oregon and the upper Applegate Valley area is estimated at 8 to 10 years. This represents fire return intervals on a landscape basis rather than site specific point fire-frequencies (Atzet; May and June 1994).

Given this frequent fire return interval for the Interior Valley and Mixed Conifer Vegetation Zones, heavy accumulations of down coarse woody debris did not occur. Frequent low intensity fires consume a great deal of ground fuels, especially given that these fires generally occurred during the months of August and September when fuel moistures are their lowest. Live woody fuels (trees and shrubs) were also at lower density on the landscape basis during this time before organized fire suppression. With the low fuel accumulations, high intensity fires generally did not occur (on a landscape basis) at lower elevation vegetation zones. As a result of the low intensity ground and surface type fires, recruitment coarse woody debris from fire killed trees was also low during this time. This is due to the role of fire as a major disturbance mechanism and the site specific fire return interval considerations.

Within riparian areas, wetlands, and mesic sites of the Interior Valley and Mixed Conifer Vegetation Zones, fires occurred less often. The amount of coarse woody debris accumulations for these particular sites was much greater than the drier sites where fires occurred more often.

**Smoke Production:** The amount of smoke and particulates that were produced during wildfires that burned durning the pre-fire suppression era, can be generally described as having produced less smoke and particulates. The previous statement is relative to todays vegetative conditions; more bio-mass burning today would produce more smoke. The size of particulates of concern to human health, according to the EPA, are those that are 10 microns or less in size. When the combination of live and dead vegetation burns, the amount of particulates produced that are 10 microns or less in size, is estimated at 50-75 lbs per ton of vegetation that is

ize the wildfire potential across the landscape using tested and universally used methods for the calculation of fire occurrence density rating, fire risk, and fire hazard. The fire hazard and fire risk assessment can provide insight from a landscape perspective as to potential areas of concern to focus attention on fuels management, fire prevention, and forest health issues. This can be of value when prioritizing of areas for further review and possible prescriptions to improve forest and watershed health. However, this process of assessing fire hazard and fire risk at the watershed level is only a coarse filter. This information will require a good deal of refinement for use at the project level, particularly for prescribed fire or fire hazard reduction projects.

The character of the vegetation, as influenced by climate and affected by natural or human created ignition sources, provides interesting challenges in Fire Ecology. The inter-relationship of the human environment upon the natural environment often times results in various risks and hazards. For this watershed analysis, fire is the focal point of disturbance influencing successional processes. The same mechanism that provides the disturbance influencing the successional process, also is the mechanism that influences fire risk.

**Hazard Map**: Fire hazard is defined as vegetation by the kind, arrangement, volume, condition, and location that forms a special threat of ignition, spread, and difficulty of control. Thick, continuous, multi-layered stands with heavy accumulations of dead and down woody debris, on steep southerly or west facing slopes, is an example of high fire hazard vegetation that has a high probability of a stand replacing fire event.

To start the process of assessing fire hazard ratings for the Beaver and Palmer Watersheds, vegetative conditions were assigned to the National Forest Fire Laboratory fuel models. These models characterize major physical properties of vegetation and how they react to fire. Assigning fuel models is the first step in developing fire hazard delineations. Using a vegetation information layer (stand type, canopy closure, etc.) from the district GIS and overlaying known slash and conifer mortality locations, a close approximation of fuel model conditions for the analysis area can be delineated.

The next step in the process of evaluating the fire hazard is determining the steepness of slope and aspect characteristics for the analysis area. These topographic characteristics are used in determining and comparing fire behavior applicable to each assigned fuel model, given a set of moisture and wind conditions (See Appendix for detailed Topographic Data).

The basic assumption of the spread model which uses fuel models as one of many input components, is that the fire is a ground/surface fire; forward progress for the projection period is not impeded by suppression actions or a change in the fuel model. Many projections were made to evaluate the representative fuel models.

The spread model and its assigned fuel models does not include crown fires and the spot fires resulting from crowning. Crown fire and spotting are considered in a separate process and is part of the fire hazard rating evaluation.

An important consideration of fuel characteristic not yet presently modeled is the influence of understory regeneration. The development of understory within a stand changes the the "character" of fire dramatically. In other words, the assumptions of the fuel modeling system must be altered to fit the real conditions on the ground. The presence of an understory component in sufficient quantities would create ladder fuels which contribute to the potential of crown fire. This would put moderate hazard fuels (such as 8 and 9) into a high hazard class.

A four layer process using an aspect map, slope map, and a fuel model map is used to develop a hazard map for the Beaver and Palmer Watersheds. These map layers provide a link to fire behavior projections, which link to a fire hazard assessment on the landscape basis. Fire hazard ratings of low, medium, and high are assessed. Given the gross acres of the Beaver/Palmer area, the resulting ratings are on a landscape basis and are not intended to supersede site specific project level planning.

Each assigned fuel model is run through the BEHAVE program. Weather conditions from local records were used to model late summer afternoons of late July and August. The program uses this information to predict flame lengths and the rate of spread which then determines the resistance to control.

Although flame lengths are generally used to define hazard it should be noted that some fuel models will have low flame lengths but extremely rapid rate of spread, which will place them into a higher hazard class. For example, some of the grass fuel models don't produce significant flame lengths, but their rate of spread exceeds 100 chains per hour on long steep slopes. This exceeds the ability of hand crews, or equipment for direct attack without air support.

Using the above analysis process for fire hazard determination, there are 7,872 acres assigned with a high fire hazard rating for the Beaver and Palmer Watersheds. Another 16,224 acres are assigned with a medium fire hazard rating. There are no acres assigned to a low fire hazard rating.

In reality fire spread and intensity (particularly in certain types of fuel conditions within the Beaver/Palmer Analysis area) would result in stand replacement fires given late summertime weather conditions. The more dead vegetation, either standing or on the ground, the greater the fire intensity. The greater the density of multi-layered closed canopy vegetation with the combination of substantial dead wood, the greater the chance of crown fires of high intensity resulting in stand replacement. Calculations for fire hazard include this important adjustment: areas on south facing aspects and west aspect, with >70% canopy closure, located on greater than 40% slopes with a fuel model 10 were assumed to have a 80% chance of crown fire. Fire hazard calculations used this adjustment.

The enhanced fuel model 10 at certain elevations and aspects is also the same vegetative conditions that is optimum owl habitat. Obviously it will be difficult to maintain this habitat in the long run, particularly at elevations below 4,800 feet, unless systematic fire ecology principles such as the re-introduction of prescribed fire and various vegetative management strategies are applied.

**Risk Map:** Fire risk is defined as the chance of various ignition sources causing a fire, threatening valuable resources, property and life.

Based on fire occurrence records for the Applegate R.D., lightning and human-caused fires during the decades of the 1960s through the 1980's were analyzed and plotted. From this plot a fire occurrence zone map was developed. A fire risk assessment based on recent fire history records (32 years) indicate 86 fires occurred within the analysis area. Fifty four of the fires were lightning fires. Thirty-two of the fires were human-caused. Lightning fires on an individual fire basis burned the greatest number of acres.

Based on the location of these fires, a fire occurrence zone map displays the high, moderate, and low zones. These zones are established by grouping the fires based on their density.

Number of Fire Starts by Occurrence Zone (32 years of records)

| *Low* | *Moderate* | *High* | *Total* |
|---|---|---|---|
| 10 | 21 | 55 | 86 |

These zones are relative to the watershed analysis area. If compared to other areas of the Cascade side of the Rogue River National Forest (on a per thousand acre basis) this low occurrence zone for Beaver/Palmer would probably rate moderate to high. The majority of the occurrences are lightning caused and predominately occur above 2400 feet in elevation; however, lightning fires do occur randomly across the landscape. The human-caused fires seem to occur primarily along road corridors, residential locations and places of frequent outdoor recreation and camping).

From this information a fire risk map of the Beaver/Palmer Watershed Analysis area was developed. The following formula was used to calculate the risk rating: {(x/y)10}/z = Risk rating where

x = number of starts recorded for area from fire history records
y = period of time records cover (32 yrs. for this analysis)
z = number of acres analyzed (displayed in thousands)

| | |
|---|---|
| Low Risk = | 0-.49 |
| Moderate Risk = | .5-.99 |
| High Risk = | >1.0 |

Fire Frequency and Risk Rating by Occurrence Zone

| Risk *Zone* | *Acres* | *# of Fires* | *Frequency** | *Risk Rating* |
|---|---|---|---|---|
| Low | 6,411 | 10 | 3.2 yrs | 0.49 |
| Mod | 9,273 | 21 | 1.52 yrs | 0.71 |
| High | 8,412 | 55 | .58 yrs | 2.04 |

*Mathematical estimation of how many years it takes for a fire to occur within the 3 fire occurrence zones.

As values associated with the land increase, given relative ignition occurrences and probabilities, risk increases. Life, property and resource values are the basis for risk ratings. High fire probabilities without high values associated with the land is of low fire risk.

Values used to develop the various risk rating zones, primarily reflect the traditional values associated with the concentration of human habitation and traditional values associated with forested land. Management should consider risk assessment for various important species habitats to evaluate and rate the threat to their habitat. Eventually, assigning monetary value to these habitats so that comparative analysis can take place with traditional values will need to take place. Areas that have high risk to animal habitats would be logical candidates for management action.

burning. Over one hundred years ago, most fires located within the Mixed Conifer and Interior Valley Vegetation Zones were described as ground fires burning within much less vegetation as compared with today. It follows that with less vegetation on the landscape available for consumption, less particulates were produced in an actual fire, given relative fuel moisture conditions of comparison.

**2. Historic Fire Environment - After Organized Fire Suppression**

A very different set of conditions exists today within the Fire Regime for southwest Oregon. Fires are described now in general terms as: infrequent, either inconsequential or extreme during drought, extended duration, and not easily extinguished.

Fuels (live or dead) have built up to an un-natural state due to the increased fire return interval (longer period of time in between fires) for the area. For example, below 4,800 feet in the Beaver and Palmer Watersheds there are many more dead standing snags or dying trees in the overstory. Stress as brought about by competition for moisture, nutrients, and growing space will continue to increase mortality of trees. With this increase in dead standing and down coarse woody debris and live woody fuels, there is an increase in fire intensity, and the chance of crown and stand replacement fires; especially when fires occur during hot dry weather conditions. Fires are now estimated to result in a greater percentage of the total fire area to result in stand replacement. Ground and surface fires during these months at lower elevation (not meseic or riparian or wetland sites) almost always consume 100% of the coarse woody debris given late summer dead fuel moisture within the eastern Siskiyou Mountain climate conditions (Rose, 1994).

With rapidly moving crown fires the likelihood of downwind spotting from prolific firebrand production well in advance of the "main fire head" is great. Consequently, considering firefighter safety, suppression actions are not effective until a change in wind and relative humidity allows a change in fire behavior. One must remember that most large fire episodes for interior southwest Oregon occurred during the months of August and September. This fact holds true today as it did in the past.

Fire results in a "stand replacement" role when fire occurs during dry weather conditions within dense multi-layered (canopy) vegetation with heavy dead and down fuels.

**3. Vegetation Zones; Influence to the Fire Environment.**

The type and location of vegetation influences fire probability and occurrence. From a fire management standpoint stand age and type, fuel loading, fuel arrangement and continuity of fuels are important considerations how fast a forest dries, how hot it burns and low long fire persists. These considerations are as true today as they were in the past. The make up of vegetation, either dead or live, must be considered when discussing a fire and fuel complex. The amount of "dead and down" fuel loading is directly related to the amount of coarse woody debris on a site. The greater the amount of dead vegetation (standing or downed) the greater the intensity of fire and the residence time of fire front passage; not to mention fire suppression safety issues.

Jerry Franklin in his Vegetation of Oregon and Washington, publication states that zonal description of vegetation is most helpful in defining areas in which one plant association is the climatic climax. Vegetation on undulating topography is primarily a product of macro-climate and occur sequentially on mountain slopes, but often they interfinger. By describing the environmental composition and successional processes of each zone, conclusions can be drawn as to the types of vegetation that exist(ed) either live or dead.

**4. Developing Fire Hazard and Fire Risk Maps**

The following is an outline of the process steps and assumptions used in development of the fire hazard and risk assessment portion of the Watershed Analysis for Beaver/Palmer watersheds. The attempt was to character-

# BEAVER/PALMER FIRE HAZARD AREAS

SCALE 1: 88000.

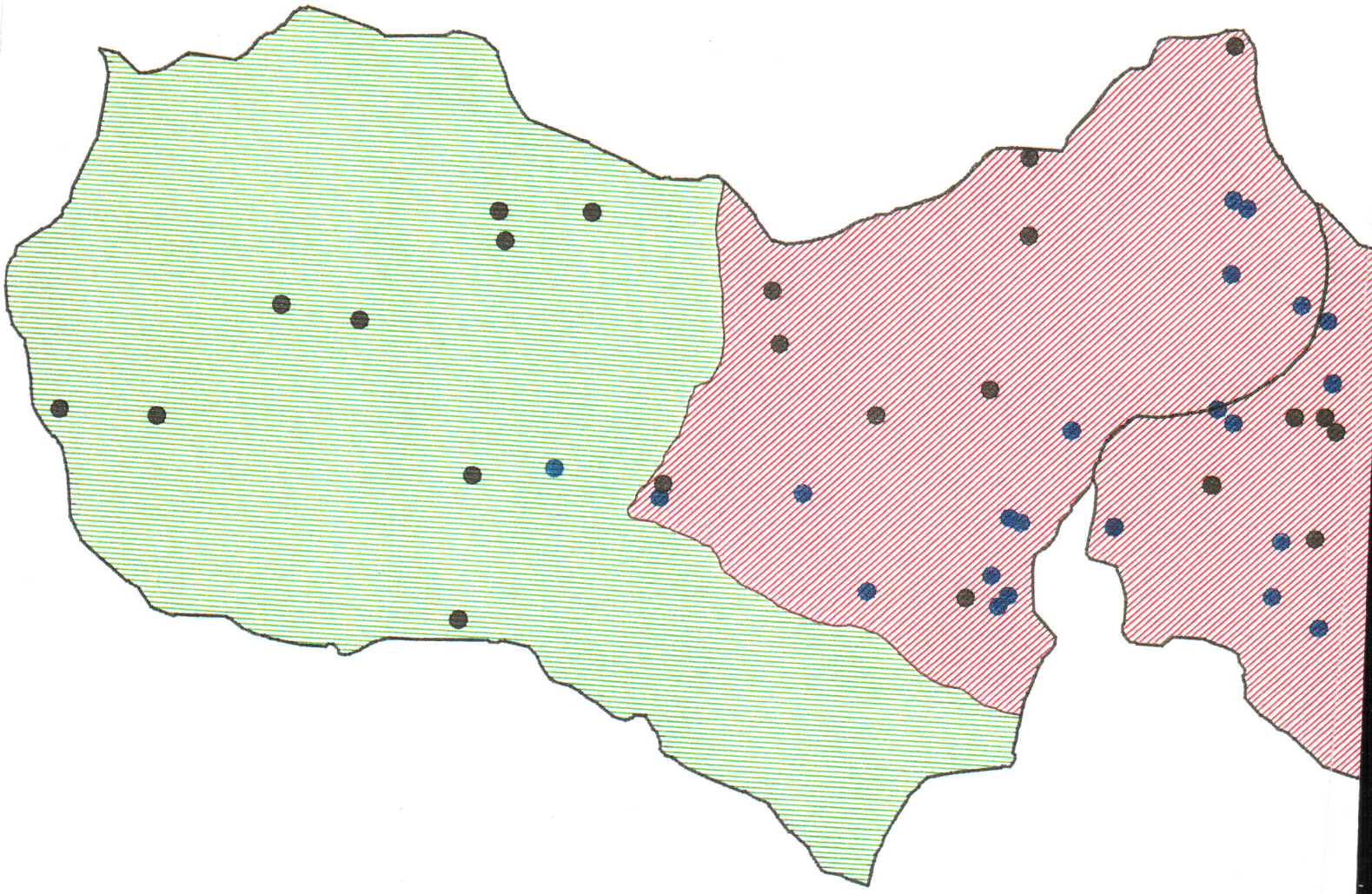
N

Figure 23

AUTOGIS

11/ 9/94 13:57:42

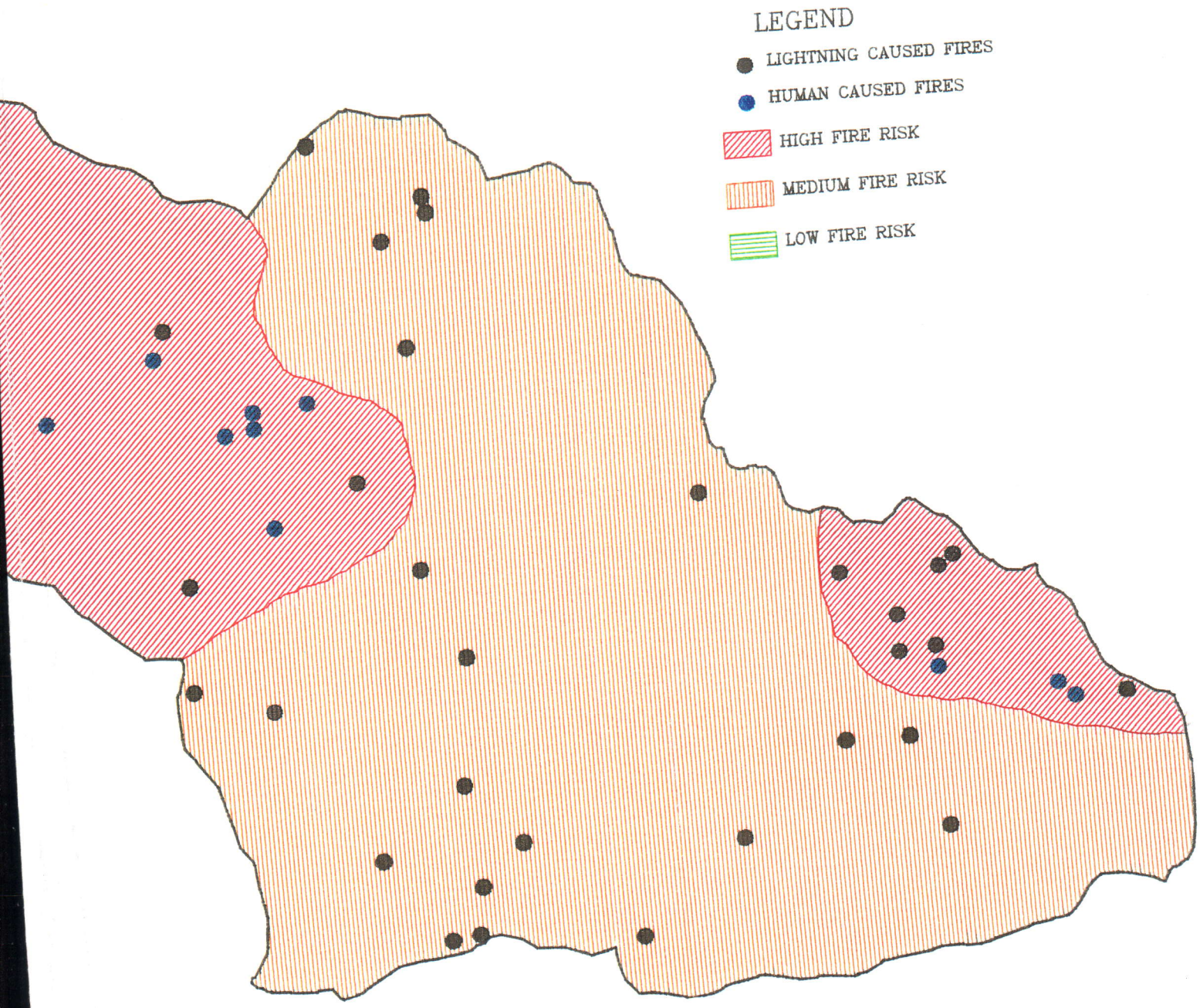
# BEAVER/PALMER FI



SCALE 1: 52

N

# RE OCCURRENCE/RISK

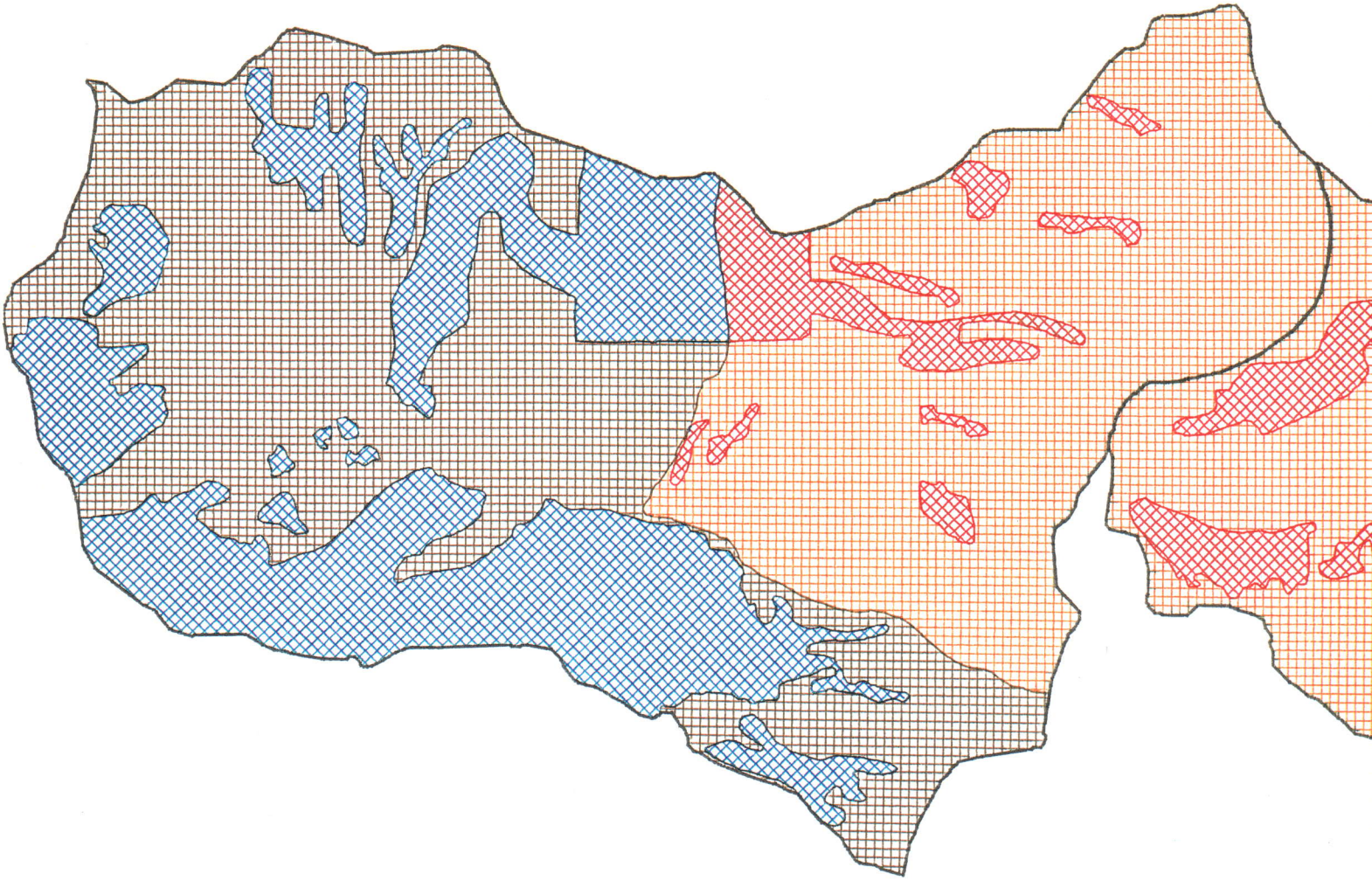



1: 52000.

Figure 24

9/13/94 10

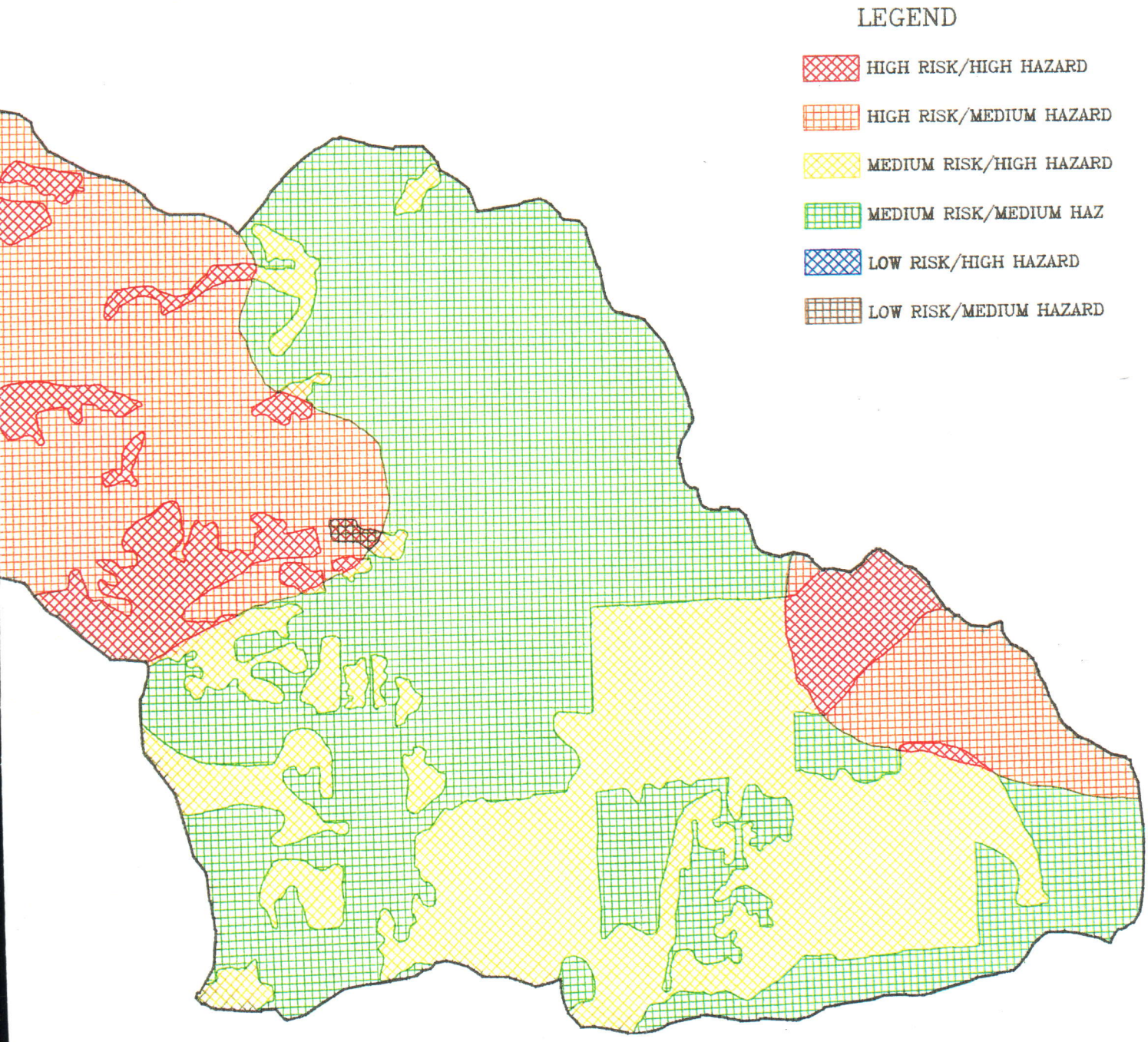
# BEAVER/PALMER FIRE



SCALE 1:

N

# RISK/HAZARD INTERSECT




52000.

**Figure 25**

9/12/94 10:21:

## I. TERRESTRIAL WILDLIFE

This section presents information on wildlife species and wildlife habitats for the Beaver Creek, Palmer Creek, Billys, China, Flumet, and McKee Gulches watersheds. These six watersheds are referred to as the watershed analysis area. All six watersheds are tributary to the Applegate River. These watersheds support a diverse group of plant communities and the juxtaposition of these plant communities through time and space creates habitats for a large group of wildlife species. Conifer forests cover much of the landscape within these watersheds, but are broken up by hardwood forests, brushfields, and grasslands. Unique, or special wildlife habitats are provided by streams, riparian zones, talus, and rock outcrops. The diversity of wildlife species that may utilize habitats found within these six watersheds is illustrated by the wildlife species list compiled for the Applegate Adaptive Management Area (AAMA) (BLM, 1993). This species compilation indicates that the AAMA may be home to 12 amphibian species, 19 reptile species, more than 100 bird species, and greater than 60 mammal species. These watersheds are also home to uncommon species (i.e., the northern goshawk), endemic species (i.e., Siskiyou Mountains salamander), and Federally listed species (i.e., northern spotted owl).

### 1. Wildlife Habitats

For this report, the vegetated lands within the six watersheds have been grouped into the following categories of wildlife habitats: **late-successional forests; mature closed-canopy forests, young closed-canopy forests, early-seral/open canopy forests, hardwood forests, hardwood/conifer forests, brushfields**, and **grasslands.** Special habitats found within the watersheds are **riparian zones, caves, rock-outcrops, talus, bridges, buildings, snags**, and **down logs**. Pacific Meridian Resource (PMR) satellite imagery data was used to develop all habitat types, except for the non-vegetated habitats. PMR data was used instead of Geographical Information System (GIS) data because the PMR vegetation data is available for the almost the entire watershed, whereas GIS data only covers Forest Service lands. Also, PMR data is the most up-to-date vegetation information available, whereas GIS data has not been updated since 1990. However, PMR data was not field verified, so the accuracy of my habitat groupings is questionable. Groupings were based on written descriptions of the PMR data. A synopsis of how the PMR data was grouped into wildlife habitat types, can be reviewed in Wildlife Report contained in the Appendix. The relative amounts of each forested habitat type is based on the total acres of land within the watershed capable of supporting forests. The relative amounts of brushfields, grasslands, and all non-vegetated habitat types is based on the total acres of land within the watershed. This report did not separate the amounts of these habitats found on private, Forest Service, and BLM lands, although this information may be useful in project planning. A description of each of these habitat types follows (see Figure 26, 27, and 28 for tables summarizing habitat types).

**Late-Successional forests**, often referred to as old-growth forests can be characterized as multi-storied, with the overstory consisting of scattered large conifer trees and the understory of smaller trees. Snags and down-logs are common components of late-successional forests. Canopy closure in these forests is generally high averaging greater than 70%, but the canopy is often broken by scattered small openings. Wildlife species commonly associated with Late-successional forests include the northern spotted owl, northern goshawk, pileated woodpecker, the pallid bat, northern flying squirrel, shrew-mole, Siskiyou Mountain salamander, cascades frog, rough-skinned newt, black salamander, tailed frog, and numerous species of snails and slugs (USDA, 1993a).

Late-successional forests are uncommon throughout the entire watershed analysis area. Late-successional forests range from a low of 5% of the forested habitats within the China Gulch watershed, to a high of 11% within Billys Gulch watershed. For the Beaver Creek and the Palmer Creek watersheds, late-successional forests comprise 10% and 8%, respectively, of the forested habitats. The relative amounts of late-successional forests

within each watershed of the analysis area is misleading because there are few acres of this habitat type within four watersheds. Billys, China, Flumet, and McKee watersheds each have less than 75 acres of late-successional forests. Historically, a considerably larger amount of late-successional forests were present within Beaver Creek and Palmer Creek watersheds. This assumption is based on the fact that past timber harvest by both private landowners and by the Federal agencies (BLM and USFS) has removed large tracts of late-successional forests from both watersheds. Past management practices used by private and Federal land-managers centered on the harvest of old-growth forests. The levels of past timber harvest within Beaver Creek watershed is illustrated by PMR data which indicates that 21% of the forested lands within Beaver Creek watershed are currently categorized as early-seral forests and most likely the majority of these areas were timber harvested. Thus, prior to extensive timber harvest up to 30% of Beaver Creek watershed may have been in Late-successional forest habitats. An analysis of PMR data for Palmer Creek watershed would likely show similar results.

The condition, or health, of the late-successional forests within the watershed analysis area has not been evaluated. Components of late-successional forests that should be analyzed are: (1) are the stands large enough to provide interior forest conditions, or are they fragmented; (2) are the patches of late-successional forests interconnected, or are they isolated from one another because of management activities such as timber harvest, or natural fragmentation; and (3) have the late-successional forests been impacted by management activities so that forest structure has been negatively impacted (i.e., removal of snags, down logs). A general analysis of conditions of late-successional forest habitats within the watershed analysis area should be considered prior to implementation of projects that may be proposed for these forest types.

For Beaver Creek watershed, a summary by sub-basins indicates that late-successional forests are most common in Petes Camp, Hanley Gulch, Beaverhead, and Haskins sub-basins. Petes Camp sub-basin has the largest amount of Late-successional forest habitat, but it is important to note that Petes Camp area is mostly privately owned, and a considerable amount of these late-successional forests are not located on Federal lands. Late-successional forests are nearly non-existent within all other sub-basins within Beaver Creek watershed. For example, Texter, Armstrong, Charley Buck, and Medite sub-basins all have less than 50 acres each of late-successional forest habitats.

For Palmer Creek watershed, a summary by sub-basins indicates that late-successional forests are most common in Bailey Gulch and Nine Dollar Gulch. Late-successional forests are nearly non-existent within all other sub-basins of Palmer Creek watershed. East Palmer, Upper Palmer, Sourdough, and Section-1 sub-basins all have less than 20 acres each of late-successional forest habitats.

The lack of late-successional forest habitats within the watershed analysis area likely has had a negative effect on presence, abundance, and distribution of wildlife species that are dependent on old-growth forests. For example, spotted owl nest sites are restricted to only several locations within each of these watersheds, but prior to removal of large tracts of late-successional forests spotted owl nest sites were likely more plentiful. Each spotted owl pair within Beaver and Palmer Creek watersheds are presently in an incidental take situation because of lack of adequate amounts of suitable habitat; another indication of the effects to wildlife of past timber harvest of late-successional forest habitats.

**Mature Forests.** Many of the species that utilize late-successional forests may also utilize mature forests. However, mature forests do not provide the same kinds of wildlife habitat as late-successional forests because they are structurally different. Mature forests often do not contain large overstory conifers with mistletoe brooms. These mistletoe brooms provide nest locations for a number of wildlife species such as the northern spotted owl and northern flying squirrel. Mature forests can be multi-storied, but more often consist of even-aged stands that generally lack the broken canopy common in late-successional forests. Trees in mature forests are often smaller and snags and down-logs are less common than within late-successional forests. Canopy closure within mature forests is often greater than 70%.

Mature closed-canopy forests habitats are found scattered throughout through out the watershed analysis area. This habitat type is most common on the Billys Gulch watershed and least common on the Flumet Gulch watershed. Mature closed-canopy forests comprise 23% and 19% of the forested habitats on the Beaver Creek and Palmer Creek watersheds, respectively. A sub-basin analysis indicates that mature closed-canopy forests on the Beaver Creek watershed are most common within Hanley, Beaverhead, Texter, and Haskins sub-basins, but are much less abundant in the Jackson, Beavermid, Medite, and Baldy sub-basins. For the Palmer Creek watershed, this habitat type is most common in Bailey, Nine Dollar, and Lime sub-basins, but uncommon within all other sub-basins.

**Young closed-canopy forests** commonly consist of dense stands of pole sized conifer trees. Generally these forests are single storied, contain few snags or down-logs, and have canopy closures averaging greater than 60%. Young closed-canopy forests can be used by a variety of wildlife species. Spotted owls can utilize these forests for dispersal; Siskiyou Mountain salamander habitat may be found under these forest types; blacktail deer often use these forests for thermal cover, hiding cover, and travel corridors; and many species of rodents, birds, and amphibians utilize these habitats for foraging, breeding, and cover.

Young closed-canopy forests are the most common forest habitat type found across the watershed analysis area. Young closed-canopy forests comprise 41% and 49% of the forested habitats on the Beaver Creek and Palmer Creek watersheds, respectively. Within the Beaver Creek watershed, young closed-canopy forest habitats are most common in Hanley, Texter, and Boaz sub-basins. For the Palmer Creek watershed, young closed-canopy forests are most common in Bailey, Lime, and Nine Dollar sub-basins.

**Early-seral and Open-canopy forests.** Early-seral habitats most commonly consist of areas where timber harvest has occurred and now are young conifer plantations. Open-canopy forests consist of forests with scattered overstory trees, but with canopy closures that are less than 40%. Understory vegetation within open-canopy forests often consists of seedling trees, and/or shrubs. Early-seral habitats are the second most common habitat type within the watershed analysis area and comprise 21% of the forest lands in Beaver Creek watershed. Early-seral habitats are most common within the, Texter, Hanley, Beaverhead, Petes Camp, and Haskins sub-basins.

Nearly 1,500 acres (24%) of Palmer Creek watershed are comprised of early-seral/open-canopy forests. Sub-basins within this watershed with the greatest amounts of early-seral/open-canopy forests are Bailey, Lime, Nine Dollar, and West Palmer.

Early-seral/Open canopy forest habitats function similarly as wildlife habitat. Both lack dense overstory canopies and have well developed shrub/seedling/herbaceous layers. These habitat types support a diverse group of game and non-game wildlife species that do not require closed canopy forest habitats. Blacktail deer and black bear forage extensively through these habitats and non-game species such as flycatchers, woodpeckers, and rodents are common in these habitats.

Open canopy forests were likely more abundant prior to intensive fire suppression efforts. Historically, open forests of ponderosa pine and associated tree species were more common on the hotter drier portions of the watershed, i.e., low elevation sites and south slopes, than they are today (see Silvicultural Report). These open forest habitats could be described as savannahs consisting of an overstory of scattered large ponderosa pines with an understory of large oak and madrone trees; ground cover consisted of scattered shrubs and numerous grass and forb species; snags and down logs were present, but were widely scattered and were mostly in the large size classes. These forest types are mostly non-existent today and the wildlife species associated with the pine savannahs have likely been negatively impacted by the loss of this habitat type. The flammulated owl is an example of a species that utilizes pine savannah habitat.

**Hardwood and hardwood/conifer forests** are common throughout the watershed analysis area. This habitat type can consist of pure stands of hardwoods, or a mix of hardwood and conifer trees. Common hardwood trees in these forests are pacific madrone, canyon live oak, chinquapin, Oregon white oak, and California black oak. Conifer trees commonly associated with these forests are ponderosa pine, Douglas fir, and incense cedar. Shrubs are also common in these forests, i.e., silktassel, ceanothus, and manzanita species. Canopy closure within this forests often averages greater than 60%.

Hardwood and hardwood/conifer forests are utilized by a diverse group of wildlife. These forest types are limited in total acres and in their distribution across the landscape as compared to conifer forests. Hardwood and hardwood/conifer forests contain a high diversity of tree and shrub species which provide a high diversity of habitat niches. Black-tail deer and black bear heavily utilize these forests because of the availability of a diverse food source, as well as for the hiding cover and thermal cover. Neotropical migratory birds and resident birds utilize these forests for nesting, foraging, and resting. Band-tail pigeons heavily utilize Pacific madrone berries, a common tree species in these forests. The northern spotted owl may also utilize these forest types for foraging because of the large populations of woodrats found in Hardwood and Hardwood/Conifer forests. Woodrats are heavily utilized by spotted owls. Hardwood and hardwood/conifer forests are generally open enough to allow spotted owls to fly through and have a canopy closure (>60%) which provides the owls protection from aerial predators.

The acres of Hardwood and hardwood/conifer forests are included within the acreage figures shown for Late-successional forests; Mature closed-canopy forests, and Young closed-canopy forests. The present analysis of PMR data did not determine within which of those three forest age-groups the Hardwood and Hardwood/Conifer forests are included. However, PMR data analysis did provide the acres of each of these habitat types. For the Beaver Creek watershed, hardwood forests comprise 4% (452 acres) and hardwood/conifer forests comprise 3% (368 acres) of the lands capable of supporting forests. These habitat types are most common in Petes Camp, Haskins, Hanley, and Beaverhead sub-basins. For the Palmer Creek watershed, hardwood forests comprise 8% (522 acres) and hardwood/conifer forests comprise 6% (346 acres) of the lands capable of supporting forests. These habitat types are most common in Bailey, Lime, Nine Dollar, and West Palmer sub-basins.

Similar to the ponderosa pine savannah described previously, a hardwood forest type, the oak savannah, was historically more common within the watershed analysis area than they are today, particularly on hot, dry sites at low elevations. However, fire suppression efforts beginning in the early 1900s has created conditions that has mostly eliminated this habitat type within the watershed. Oak savannahs provide important wildlife habitat for black-tail deer, black bear, western tree squirrel, lizard species and numerous bird species.

**Brushfields** are common in the drier portions of the watershed analysis area, especially on south facing slopes and along ridge-tops. Brushfields generally consist of a mix of shrub species, i.e., green and white leaf manzanita, buckbrush, deer brush, and silktassel. In the more moist sites, conifer trees and hardwood trees can be found scattered within brushfields. Ponderosa pine, Oregon white oak, California black oak, and Pacific madrone are the most common trees associated with brushfields.

Brushfields provide important habitat for both game and non-game wildlife. Black bear heavily utilize berries produced by shrub species common in brushfields, e.g., whiteleaf manzanita. Black-tail deer utilize brushfields for foraging, hiding, and escape cover. Resident birds such as mountain quail, California quail, wild turkey, and rufus-sided towhee use brushfields for nesting, cover and forage. Neotropical migratory birds utilize brushfields for foraging and nesting, e.g., house wren, hummingbirds, bushtit, and plain titmouse.

Within the Beaver Creek watershed, brushfields occupy nearly 15% (2,068) of the total land area. Shrub communities are most common in Texter, Hanley, Petes Camp, and Beaverhead sub-basins. Brushfields are uncommon in Beavermid, Jackson, and Medite sub-basins. For the Palmer Creek watershed, brushfields

occupy nearly 700 acres, or 10% of the total watershed acres. Brushfields are well distributed within all sub-basins of the Palmer Creek watershed.

Brushfields throughout the watershed analysis area if classified into seral stages would mostly fit into the mature and older categories. Because of fire suppression efforts since the turn of the century, these brushfields have experienced little to no disturbance. Without fire suppression efforts it is likely that some of these brushfields would have burned during the past 100 years. These wildfires at the landscape level would have created a mosaic of brushfields in various age-classes. From the standpoint of ecosystem health, the brushfield plant communities are unhealthy throughout the watershed analysis area because they are almost entirely in mature and older age classes. Early seral stages of brushfields as compared to later stages consist of numerous young shrubs, have a diverse assortment of grasses and forbs, and may have conditions that help the establishment of conifers and hardwood trees, i.e., such as ponderosa pine and Oregon white oak. Early seral stages of brushfields provide wildlife habitats not found in the older age classes For example, young brushfields often provide excellent black-tail deer foraging habitat and the diversity and density of herbaceous vegetation provides food sources and nesting opportunities for many bird species such as the lesser and American goldfinch, dark-eyed junco, and indigo bunting.

**Grasslands** are an uncommon habitat type within the watershed analysis area, except for Billys Gulch and China Gulch watersheds which have the highest relative amounts of grasslands. Only 140 acres of grasslands were identified within the Beaver Creek watershed and a majority are found in Hanley, Boaz, and Baldy sub-basins. For the Palmer Creek watershed, only 38 acres of grasslands were identified and they are evenly distributed within nearly all sub-basins. Grassland communities may have been more common on the landscape prior to organized fire suppression. It is likely that because of fire suppression brushfields and possibly forest types have expanded their distribution and are now occupying areas that are potential grasslands.

Grasslands are important to a number of wildlife species. Blacktail deer utilize these areas for foraging throughout the year, except when they are snow covered. Many birds utilize grasslands for nesting and feeding. Grasslands may also be important habitat for many insect species such as butterflies, flies, beetles, wasps, and bees. These insects play an integral role in pollination of many plant species.

**Rock outcrops** are uncommon throughout the watershed analysis area and are most common on the Beaver Creek watershed. Rock outcrops are most often found along ridges and mountain tops, but some are associated with road cuts and rock quarries. Some of these rock-outcrops are associated with road cuts and rock quarries. Rock outcrops can be lightly vegetated, but most often have no vegetative cover. The PMR data used for this analysis is not able to penetrate the vegetation to see what lies below, thus rock outcrops may be hidden from view. Rock outcrops provide habitat for bat species (pallid bat), reptiles (fence lizard and western skink), snakes (western rattlesnake), birds (turkey vulture and rock dove), and for salamanders where canopy closure exists over the rock-outcrops.

On the Beaver Creek watershed rock-outcrops comprise 1% (145 acres) of the total watershed and are most common in Boaz, Hanley, and Armstrong sub-basins. Thirty-four acres of rock-outcrops were identified on the Palmer Creek and are evenly distributed in all sub-basins, except for Babbit sub-basin, where no rock-outcrops were identified. Rock outcrops are likely more common within Palmer Creek watershed than is indicated by PMR data. Large portions of this watershed, particularly along the north side of the watershed, appear to have extensive rock outcrops, but may not be visible by PMR technology.

**Bridges, Buildings, and Caves** provide unique wildlife habitats. Residential buildings and outbuildings provide roosting habitat for many bat species. The Brazilian free-tailed bat and Townsends big-eared bat are two species commonly associated with buildings. The latter bat is listed as a sensitive species by the Forest Service (Region-6). For the Brazilian free-tailed bat, Beaver Creek watershed is the northern-most portion of the range for this species. Bats use buildings for maternity roosts and hibernacula, particularly residential buildings which

provide relatively stable year-round temperatures. All the residential buildings within the watershed are privately owned. The Forest Service outhouses located at campgrounds are often utilized by bats for roosting sites.

Bridges provide night roosts for bats. Many bat species forage over and along streams and then stop under bridges to consume prey, or to rest. Some bridges may also provide day roosts. No caves are known within the Beaver Creek watershed, but are found in the Palmer Creek watershed. Caves provide environmental conditions (i.e., cool, stable temperatures; high humidity, air flow, and protection form disturbance) essential for some bat species, i.e., Townsends big-eared bat. This bat species uses caves for maternity roosts and day roosts. Caves are also used by other wildlife species such as banana slugs, snails, and insects.

Residential buildings, private and Federally owned out-buildings are found on or adjacent to each of the watersheds within the watershed analysis area. Three bridges are found on Beaver Creek watershed and two bridges are located on the Palmer Creek watershed. Caves within the watershed analysis area are uncommon and are only known for the Palmer Creek watershed. These caves are important habitats for bats, including Townsends big-eared bat, a sensitive species. Use of these caves by people negatively impacts bats using the caves. Bats are extremely sensitive to human disturbance and will abandon sites from the slightest disturbance. Closing caves so people can not access them, but are still accessible to bats, should be considered.

**Snags and Down Logs** can be found in all forested habitats and brushfield habitats discussed above. However, because of the importance of snags and down logs to a very large group of wildlife species this habitat type is discussed separately. Snag and down log habitat throughout the watershed analysis area has not been evaluated, but a general evaluation was done to provide a qualitative description of this special habitat type. Snag habitat is likely good within unmanaged timber stands, including hardwood and hardwood/conifer stands. Excellent snag and down log habitat can be found within the Ranch Fire which burned in 1993 (T40S, R2W, S. 16). Snag and down log habitat is good on south slopes where many ponderosa pine and Douglas fir trees have died during the last eight years of drought. Conversely, snag and down log habitat is poor within all managed forest stands because past management practices did not adequately address needs for snag and down-log dependent species. Numerous managed stands throughout the Applegate Ranger District have been surveyed for snag habitat and this data indicates that snag numbers in these managed stands most often do no meet minimum guidelines.

**Riparian habitats** within the analysis area are found along perennial streams such as Beaver Creek and Palmer Creek, but are also found along intermittent streams which are common throughout the watershed and adjacent to springs. Riparian habitat within the analysis area has been analyzed through the use of PMR data and is presented in the Silvicultural Report of this watershed analysis report. In summary, the information provided in Silvicultural Report indicates that the riparian habitats along Beaver Creek and Palmer Creek as well as along many of the tributaries to these streams consists of rock, grass, shrubs, and conifer stands. One important result of the analysis presented in the Silvicultural Report is that riparian habitats throughout the analysis area have been negatively impacted by placement of roads within the riparian zones. The continuity of forest cover along streams has not been evaluated, although indications are that breaks in the riparian corridor do exist. Continuity of the riparian habitat will affect how these riparian zones function as wildlife habitat, for example, do they function as travel corridors . A considerable portion of these riparian zones have had some level of timber harvest. Often the large overstory conifer trees have been removed from the streamsides, especially where roads are adjacent to the streams.

Riparian habitat is one of the most important habitat types found within the watershed analysis area. Some wildlife species are restricted to streamside habitats while other species utilize riparian zones to a greater degree than upland habitats. Results of a study of small mammals in riparian habitats versus upland habitats conducted on the Butte Falls Ranger District, Rogue River National Forest, demonstrates the importance of riparian habitats to small mammals. In the study by Mamone (1994) small mammal species diversity was significantly higher and abundance was greater in riparian zones than within adjacent upland sites. He also reported that four species

(Richardsons water vole, *Arvicola richardsoni*; shrew-mole, *Neurotrichus gibbsii*; vagrant shrew, *Sorex vagrans*; and broad-footed mole, *Scapanus latimanus*) were only captured in riparian habitat, and two other species (deer mouse, *Peromyscus maniculatus* and Pacific jumping mouse, *Zapus princeps*.) were captured significantly more often in riparian than in upland habitat. Although small mammals do not comprise the entire fauna that utilize forest habitats, they may be indicators of the high diversity of wildlife that use riparian zones, and may also indicate the importance of riparian habitats to wildlife in general.

In the same study, Mamone (1994) also reported higher plant species richness, thirty-nine plant species were found in riparian habitat, but only 30 species were found in upland habitat. He also reported that mean percent cover of grasses/sedges, herbs, and moss were significantly higher in riparian than in upland habitat.

Figure 26; Total acres and relative amounts[1] (%) of wildlife habitats found within the watershed analysis area.

| WATERSHED | EARLY SERAL/ OPEN CANOPY | YOUNG CLOSED CANOPY | MATURE CLOSED CANOPY | LATE SUCCESSIONAL | ROCK | GRASS | SHRUB | TOTAL ACREAGES |
|---|---|---|---|---|---|---|---|---|
| BEAVER CREEK | 2935 (26%) | 4718 (41%) | 2683 (23%) | 1108 (10%) | 145 (1%) | 140 (1%) | 2068 (15%) | 13797 |
| PALMER CREEK | 1465 (24%) | 3025 (49%) | 1178 (19%) | 508 (8%) | 34 (0%) | 38 (0.5%) | 689 (10%) | 6936 |
| BILLYS | 19 (6%) | 201 (66%) | 52 (17%) | 34 (11%) | 17 (4 %) | 49 (10%) | 110 (23%) | 481 |
| CHINA | 191 (28%) | 369 (55%) | 76 (11%) | 36 (5%) | 2 (0 %) | 140 (14%) | 180 (18%) | 993 |
| FLUMET | 327 (31%) | 523 (49%) | 145 (14%) | 67 (6%) | 13 (1 %) | 18 (1%) | 393 (26%) | 1487 |
| MCKEE | 78 (18%) | 166 (39%) | 143 (34%) | 38 (9%) | 18 (2 %) | 41 (4%) | 81 (8%) | 564 |

[1] the percent of each forested habitat is based on the total acres within each watershed capable of supporting forests; the percent of non-forest habitats (rock, brushfields, and grasslands) are based on the total acres of land within each watershed.

Figure 27; The acres and relative amounts[1] (%) of wildlife habitats found within the sub-basins of Beaver Creek watershed.

| BASIN NAME | EARLY SERAL/ OPEN CANOPY | YOUNG CLOSED CANOPY | MATURE CLOSED CANOPY | LATE SUCCESSIONAL | ROCK | GRASS | SHRUB | TOTAL ACREAGE |
|---|---|---|---|---|---|---|---|---|
| BOAZ | 275 (40%) | 293 (43%) | 106 (16%) | 6 (0%) | 51 (4%) | 19 (2%) | 420 (36%) | 1170 |
| HANLEY | 450 (25%) | 710 (40%) | 469 (26%) | 163 (9%) | 25 (1%) | 37 (2%) | 255 (12%) | 2112 |
| BEAVERHEAD | 368 (26%) | 593 (42%) | 331 (24%) | 108 (8%) | 5 (0%) | 3 (0%) | 161 (10%) | 1569 |
| MEDITE | 80 (24%) | 143 (44%) | 74 (23%) | 31 (9%) | 1 (1%) | 4 (2%) | 49 (13%) | 383 |
| CHARLEY | 149 (28%) | 206 (39%) | 132 (25%) | 45 (8%) | 11 (2%) | 2 (0%) | 93 (15%) | 638 |
| ARMSTRONG | 198 (27%) | 306 (42%) | 183 (25%) | 37 (5%) | 18 (12%) | 4 (0%) | 215 (22%) | 961 |
| JACKSON | 39 (19%) | 106 (50%) | 42 (2%) | 23 (11%) | 1 (0%) | 1 (0%) | 21 (9%) | 232 |
| BEAVERMID | 44 (26%) | 70 (42%) | 41 (25%) | 12 (7%) | 1 (0%) | 0 (0%) | 20 (10%) | 188 |
| BALDY | 174 (32%) | 233 (43%) | 90 (17%) | 42 (8%) | 7 (0%) | 16 (2%) | 100 (13%) | 762 |
| TEXTER | 498 (31%) | 762 (48%) | 304 (19%) | 21 (13%) | 6 (0%) | 6 (0%) | 355 (18%) | 1951 |
| PETES | 371 (28%) | 13 (0%) | 548 (42%) | 370 (23%) | 0 (0%) | 0 (0%) | 167 (8%) | 2169 |
| HASKINS | 212 (22%) | 416 (43%) | 219 (23%) | 112 (12%) | 1 (0%) | 7 (0%) | 131 (12%) | 1098 |

[1] the percent of each forested habitat is based on the total acres within each watershed capable of supporting forests; the percent of non-forest habitats (rock, brushfields, and grasslands) are based on the total acres of land within each watershed.

**Figure 28;** The acres and relative amounts[1] (%) of wildlife habitats found within the sub-basins of Palmer Creek watershed.

| BASIN NAME | EARLY SERAL/ OPEN CANOPY | YOUNG CLOSED CANOPY | MATURE CLOSED CANOPY | LATE SUCCESSIONAL | ROCK | GRASS | SHRUB | TOTAL ACREAGE |
|---|---|---|---|---|---|---|---|---|
| LIME | 199 (17%) | 558 (46%) | 198 (16%) | 53 (4%) | 4 (0%) | 3 (0%) | 68 (6%) | 1082 |
| UPPER PALMER | 118 (28%) | 218 (52%) | 66 (16%) | 19 (5%) | 6 (1%) | 7 (1%) | 76 (15%) | 509 |
| EAST PALMER | 44 (26%) | 92 (54%) | 35 (20%) | 0 (0%) | 2 (0%) | 3 (1%) | 57 (25%) | 232 |
| WEST PALMER | 175 (33%) | 252 (48%) | 70 (13%) | 29 (6%) | 4 (0%) | 9 (1%) | 80 (13%) | 619 |
| SECTION 1 | 93 (29%) | 163 (50%) | 60 (19%) | 7 (2%) | 5 (1%) | 0 (0%) | 41 (11%) | 369 |
| SOURDOUGH | 126 (4%) | 116 (40%) | 46 (16%) | 1 (0%) | 6 (2%) | 6 (2%) | 77 (21%) | 379 |
| BABBIT | 76 (26%) | 178 (61%) | 33 (11%) | 4 (1%) | 0 (0%) | 0 (0%) | 29 (19%) | 321 |
| NINE DOLLAR | 213 (30%) | 487 (46%) | 264 (25%) | 103 10%) | 4 (0%) | 4 (0%) | 97 (8%) | 1171 |
| DARK CANYON | 132 (32%) | 204 (50%) | 61 (15%) | 14 (3%) | 1 (0%) | 3 (0%) | 54 (11%) | 470 |
| BAILEY | 290 (17%) | 760 (45%) | 347 (21%) | 277 (17%) | 1 (0%) | 3 (0%) | 109 (6%) | 1785 |

[1] the percent of each forested habitat is based on the total acres within each watershed capable of supporting forests; the percent of non-forest habitats (rock, brushfields, and grasslands) are based on the total acres of land within each watershed.

## 2. Connecting Habitats within Beaver Creek and With Adjacent Watersheds

A review of wildlife habitats within the watershed analysis area to be complete must include a discussion on the connectivity of habitats within the watershed and with habitats in adjacent watersheds. Connectivity has been described as a measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers (Diaz, 1992; p. 2.9). Movement corridors provide routes for wildlife to travel within and between watersheds. Connectivity between habitats is important for wildlife because it facilitates dispersal of juvenile and adult animals, it provides travel corridors between different habitat types that may be utilized by a particular wildlife species, and it may provide connections between source and sink habitats.

The analysis for connectivity of habitats within and with adjacent watersheds for each watershed discussed in this report has not been conducted. The only connectivity analysis conducted for this report is for connecting habitats between Beaver Creek watershed and adjacent watersheds.. However, as soon as maps are available this analysis should be prepared.

Beaver Creek watershed because of its location on the landscape is important because it connects with seven adjacent watersheds, McKee Gulch, Boaz Gulch, Yale Creek, Squaw Creek, Mule Creek, Grouse Creek, and Rock Gulch. In addition, Beaver Creek is a main tributary to the Applegate River and is directly across the Applegate River from Palmer Creek, Flumet Gulch, and China Gulch watersheds.

The analysis for connectivity between Beaver Creek and adjacent watersheds was concerned with the availability and the condition of connecting habitat between Late-successional forests and Mature closed-canopy forests within Beaver Creek and adjacent watersheds. The following habitat types were considered suitable as connecting habitat: Late-successional forests; Mature closed-canopy forests, Young closed-canopy forests, Hardwood forests, and Hardwood/Conifer forests. Forested riparian zones also provide connecting habitat. Early-seral/Open canopy forests and brushfields were considered barriers to wildlife movements. Two underlying assumptions of this analysis were that wildlife species that require/utilize closed canopy forests will not travel through Early-seral/Open canopy forest habitats, and that wildlife species that utilize older forests are of greater management concern than those that utilize open forest habitats. For example, the northern spotted owl a threatened species and the Siskiyou Mountains salamander a sensitive species are closely associated with mature and older forests.

The following narrative provides a description of the availability and the condition of connecting habitats between Beaver Creek watershed and adjacent watersheds. This analysis is based on the 1987 orthophotos and no attempt has been made to update these quads, that is, areas that have been harvested since 1987 and that no longer provide connecting habitat are not shown on the orthophotos. Thus, connecting habitats discussed below may be in worse condition than is presented.

*Squaw Creek Gap*: This is an important location for habitat connectivity because in this area three watersheds come together - Beaver Creek, Yale Creek, and Squaw Creek. In addition, this area leads into the Dutchman Peak/Silver Fork Basin/Jackson Gap areas which are important points of connection with Mount Ashland, and sub-basins of the Klamath River watershed. The Squaw Creek Gap area has been heavily impacted by timber harvest. In this area, no connecting habitat is available between Beaver Creek and Yale Creek drainages.

*Yale Creek (Waters Gulch, Box Canyon, Grouse Creek, Sulphur Gulch, Crepsey Gulch, and unnamed tributaries of Yale Creek):* The areas along the crest between Yale Creek and Beaver Creek watersheds have been highly modified by timber harvest. Also, the existing plant communities on the south slope above Beaver Creek are naturally fragmented except within the riparian zones. The existing connecting habitat is primarily found in two areas: from the Headwaters sub-basin into Box Canyon; and from Texter sub-basin into Sulphur Gulch. These two areas of connecting habitat appear to be of low quality because of their narrowness, due to timber harvest.

*Squaw Creek (Slickear Creek, Newt Gulch, Slick Taw Gulch, Slickear Gulch, and Doe Hollow):* The following sub-basins of Beaver Creek watershed connect with Squaw Creek watershed: Hanley Gulch, Haskins Gulch, Petes Camp, and Headwaters. The connecting habitat between these two watersheds has been heavily impacted by timber harvest along the ridgetop and on both the north and south side of the ridge between the two watersheds. An area nearly 2.5 miles long by 1.0 mile wide (running east to west) on both sides of the ridgetop (north and south slope) has been modified by timber harvest (clear-cut, shelterwood, or partial removal). In essence, there is a total lack of connecting forested habitats along this entire 2.5 mile long ridgeline. The only areas that appear to connect between these two watersheds is at Slickear Gulch and Doe Hollow on the Squaw Creek side and Haskins and Hanley Gulches on the Beaver Creek side.

*Mule Creek*: This watershed flows directly into the Applegate River and drains Baldy Peak, Mule Peak, and Little Grayback Mountain. Hanley Gulch is adjacent to Mule Creek and the connecting habitat between these two areas is for the most part intact, although a portion of the Hanley Gulch side has been modified by timber harvest. Natural fragmentation on the south side of Baldy Peak limits the availability of connecting habitat between these two watersheds.

*Rock Gulch*: Charley Buck Gulch is the sub-basin in Beaver Creek watershed that connects to Rock Gulch. Rock Gulch drains directly into the Applegate River. Forested connecting habitat is present between these two watersheds, although timber harvest has modified the forests in Charley Buck Gulch and natural fragmentation limits the availability of forested connecting habitat on Rock Gulch watershed. Rock Gulch also provides connecting habitat with Mule Creek drainage.

*Grouse Creek*: This stream flows into the Little Applegate River and is one of the streams that drains Cinnabar Mountain. Armstrong Gulch located in Beaver Creek watershed is the adjacent sub-basin. Timber harvest within Armstrong Gulch as well as on the north side of Cinnabar Mountain has modified forested habitats, but connecting forests are still present.

*Boaz Gulch*: This stream system drains Boaz Mountain. Armstrong Gulch is the adjacent watershed. Connecting forested habitats are present between Armstrong Gulch in Beaver Creek watershed and Boaz Gulch. Some timber harvest and natural fragmentation limits the availability of suitable connecting habitats.

*Applegate River*: Beaver Creek flows through approximately 0.75 miles of private land before it meets the Applegate River. Forested habitats on private lands have been modified by timber harvest, conversion to pasture, or conversion to home sites. Riparian forested stands along on private lands along Beaver Creek are in various condition. In some areas tree cover is totally lacking, whereas in other areas tree cover is present. Riparian forested corridors on private lands consist almost entirely of hardwood trees with only scattered large conifers. Forested connecting habitat between Beaver Creek the Applegate River and ultimately into Palmer Creek Flumet Gulch, and China Gulch watersheds are primarily located along the north slope of Beaver Creek along the ridgetop (west of Charley Buck Gulch) and on the north slope above an unnamed drainage that is located between Rock Gulch and Beaver Creek.

**3. The Effects of Roads on Wildlife Habitat**

Roads in forested habitats can have an negative impact on wildlife species and their habitats. Roads can reduce the effectiveness of deer and elk habitat, roads can fragment habitats, and roads can be a barrier to wildlife movements (Thomas, et al., 1979). Roads may also have negative impacts because they are often dispersal pathways for weedy, noxious, and non-native plant and animal species (i.e., star thistle and opossum). These unwanted species can change native flora and fauna communities. Roads under some circumstances can have a desirable affect on wildlife by providing travel routes and creating edge habitat for those species that utilize edges.

Road density within the Beaver Creek and Palmer Creek watersheds is high. For the Beaver Creek watershed, Hanley and Haskins sub-basins have the highest road densities with over 4.0 miles of roads per square mile of land in each sub-basin. Several other sub-basins have greater than 3.0 miles of roads per square mile of land. For Palmer Creek watershed, road densities are highest within West Palmer, Sourdough, Section 1, East Palmer, and Babbit sub-basins. It is important to note that these road densities are for system roads (roads maintained by the Forest Service) and do not include non-system roads and roads found on private lands. For some sub-basins, road densities would increase greatly with the inclusion of non-system and private roads into the road density analysis. Where possible, road densities should be reduced by closing, or removal of unneeded roads. See Figures 5 and 6 for a summary of road densities for the Analysis Area.

**4. Wildlife Species**

The watershed analysis area supports a diverse group of wildlife species. The watershed is year-round home for some species and for other species it is a migratory stopover. A comprehensive list of the wildlife species that potentially could be found on the watershed analysis area has been prepared by Biologist with the BLM-Medford District. This species compilation was prepared for the entire Applegate Adaptive Management Area, but applies to the analysis area discussed in this report. The species listed below were selected for discussion based on their status as Federally listed (Threatened or Endangered), or because they are listed as Sensitive by the Forest Service, Region-6, or because they are a species of concern (i.e., State listed). Several species that could potentially be found on the watershed analysis area and are either listed as sensitive, or are a species of concern, have not been discussed in this report, but should be considered in project level planning. The information provided for each species is not complete because very little is know about many of these species, or their habitats within the watershed analysis area. For example, considerable information is available for spotted owls on the watershed analysis area, but little is known about fishers.

**a. Northern Spotted Owl**

The northern spotted owl is Federally listed as a threatened species. Surveys and monitoring has provided a considerable amount of information about spotted owls within the analysis area. Six spotted owl pair activity centers are known to occupy habitats within Beaver Creek watershed and three activity centers are known for the Palmer Creek watershed. An additional four pair activity centers are located on National Forest lands within 1.3 miles of the Beaver Creek watershed and two pair activity centers are located within 1.3 miles of Palmer Creek watershed. Five spotted owl pair activity centers are located on BLM lands north of Beaver Creek and three activity centers are located on BLM lands north of Palmer Creek; these BLM spotted owl pairs are not discussed in this report. The owl pair activity centers located on the Applegate Ranger District are located on lands allocated as Matrix and Riparian Reserves. The allocations of BLM lands is not presented in this report. The most recent surveys of spotted owl habitat within Beaver and Palmer Creek watersheds was conducted in 1989-90, but since that time only visits to specific nest sites has occurred. Surveys conducted to Forest Service protocol were conducted during 1993 in China Gulch and Flumet Gulch sub-basins.

**Spotted Owl Habitat Analysis:** Spotted owl habitat data presented below is based on 1989-90 aerial photo interpretation data found in GIS. This data is fairly accurate, but should be updated when planning at the project level. Updated habitat mapping is important because private and Federal timber harvest has occurred since 1990 which has decreased the habitat available to some owl pairs. Also, additional habitat could possibly be identified because of the increased knowledge of habitat use by spotted owls on the Applegate Ranger District. The habitat data presented in this report is not separated as to what is found on private versus Federal lands, although this information is essential for project planning within the home ranges of any of these owl pairs. PMR vegetation data is available for habitats within the home ranges of all owl pairs within and adjacent to the watershed analysis area, but interpretation of this data is questionable because it has not been field verified. Project level planning will provide an excellent opportunity to use PMR data.

Analysis of habitat conditions for spotted owl pairs is generally based on guidelines provided by the U.S. Fish and Wildlife Service (USDI, 1990). These guidelines call for a minimum of 500 acres of suitable habitat within 0.7 miles of spotted owl activity centers and that 40% of the area within 1.3 miles of activity centers be in suitable habitat. Additionally, 100 acre activity centers are required around each spotted owl nest as directed in the Record of Decision for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA/USDI, 1994b). If habitat amounts and the activity center is not available then the owl pair in question is considered in an incidental take situation. Habitat analysis has been conducted for all spotted owl pairs within and adjacent to Beaver Creek and Palmer Creek watersheds. These analyzes are not complete because they do not include spotted owl habitats found on private and BLM lands. The missing information is important for project planning. Also, 100 acre activity centers have not been identified around owl pairs located within the watershed analysis area.

The 1989-90 spotted owl habitat analysis conducted for the for Beaver Creek watershed indicates that on National Forest lands there is 1,244 acres of suitable habitat. This habitat is primarily within the following sub-basins: Petes Camp (429 acres), Baldy (208 acres), Hanley (197 acres), and Haskins (183 acres). Four spotted owl activity centers are located in the upper two thirds of the Beaver Creek watershed, with no known sites below Hanley Gulch. The four known activity centers are located in Hanley, Haskins, and Petes Camp sub-basins. The Petes Camp activity center is located on private (Boise Cascade and Spalding, Inc.) and Federal land. Four additional spotted owl pairs are located on National Forest lands in adjacent watersheds (Squaw Creek, Mule Creek, and Yale Creek). Additional spotted owl pairs (3, or 4 pair) are located to the north on BLM lands, but are not included in this report.

For each known spotted owl activity center within or adjacent to Beaver Creek watershed, the habitat analysis data indicates that each owl pair is presently in an incidental take situation because of lack of suitable habitat within 0.7 and 1.3 miles of their nest sites. The availability of 100 acre activity centers has not been determined

On the Federal lands within Palmer Creek watershed there are 771 acres of suitable spotted owl habitat. A majority of this spotted owl habitat is concentrated within Bailey (370 acres), Lime (153 acres), and Nine Dollar (131 acres) sub-basins. For each known spotted owl activity center within or adjacent to Beaver Creek watershed, the habitat analysis data indicates that each owl pair is presently in an incidental take situation because of lack of suitable habitat within 0.7 and 1.3 miles of their nest sites. The three known activity centers are located in Lime, Bailey, and Nine Dollar sub-basins. Two additional spotted owl pairs are located on National Forest lands in adjacent watersheds (Kinney Creek and Benson Gulch). Additional spotted owl pairs are located to the north on BLM lands, but they are not included in this report.

**Spotted Owl Pairs Reproductive History**: Spotted owl activity centers within and adjacent to Beaver and Palmer Creeks watersheds have been monitored to varying degrees for reproduction during the past several years. Monitoring for reproduction at each owl activity center has only been sporadically monitored and for only a short period of time. No firm conclusions can be drawn from this data. However, this data indicates that spotted owl pair activity center #115, Crepsey Gulch, may have been abandoned. Reproductive data for 1994 is not yet available, but should be included in this report when it is available. Table 9 and 10 indicates the number of spotted owl young fledged for a given year. Zeros signify that the site was monitored, but no spotted owl young were fledged for that year. A question mark (?) signifies that the site was not monitored during that year.

**Figure 29. Reproductive history by years for spotted owl pairs within Beaver Creek and Palmer Creek watersheds.**

| Activity Center # | 89 | 90 | 91 | 92 | 93 |
|---|---|---|---|---|---|
| Petes Camp | ? | 1 | ? | ? | ? |
| 109 | 0 | ? | 0 | 0 | 0 |
| 153 | 0 | 0 | 1 | 2 | 0 |
| 154 | 0 | ? | 0 | 0 | 0 |
| 169 | ? | 0 | 0 | 1 | 2 |
| 182 | ? | 0 | ? | 0 | 0 |
| 126 | ? | ? | ? | ? | ? |
| 162 | ? | ? | ? | ? | ? |
| 163 | ? | ? | ? | ? | ? |

**Figure 30. Reproductive history by years for owl pairs adjacent to Beaver Creek and Palmer Creek watersheds.**

| Activity Center # | 89 | 90 | 91 | 92 | 93 |
|---|---|---|---|---|---|
| 105 | 1 | 2 | 2 | 1 | 0 |
| 106 | ? | * | * | ** | * |
| 115 | 0 | * | * | * | * |
| 199 | ? | ? | ? | ? | 0 |

*No male or female owls found at the activity center.
**Single male spotted owl found at the activity center.

**Dispersal Habitat:** Spotted owl dispersal habitat within Beaver Creek and Palmer Creek watersheds was determined through the use of GIS-stand condition mapping. Information is on file on the Applegate District on how GIS data was grouped to determine dispersal habitat. The dispersal habitat analysis was conducted in 1990 and is likely not totally accurate because (1) it was based on several assumptions that were not field verified about the ability of various stands to meet dispersal habitat, (2) only Forest Service lands were included in the analysis, BLM lands were excluded, and (3) the dispersal habitat data has not been updated since 1990 and Federal timber harvest has occurred within the watershed since 1990 which likely will change the dispersal habitat calculations. The definition of dispersal habitat used for this analysis is that found in the Interagency Scientific Committee report (ISC) (USDA, 1993b). The ISC recommends that 50% of the Federal lands within each quarter-township have forest stands that consist of trees averaging 11 dbh or greater and with an average canopy closure of 40% or greater. This is often referred to as the 50-11-40 rule.

Beaver Creek watershed encompasses all of quarter-township #13 and a portion of four additional quarter-townships, #12, #14, #23, and #24 (Figure 31). These quarter-townships all exceed the ISC recommendations for dispersal habitat, except for QT #13 which is below ISC recommendations. Considerable timber harvest has occurred within QT #13 and this is a primary reason for this QT not meeting 50-11-40. Timber harvest within QT #13 has occurred on the north slope above Beaver Creek and in Hanley, Haskins, and Armstrong sub-basins.

**Figure 31. Quarter-townships (QT) within the Beaver Creek watershed, legal description, and percent of QT that meets the 50-11-40 rule.**

| *QT #* | *Legal* | *11-40* |
|---|---|---|
| 14 | T40S,R2W,NW1/4 | 61% |
| 24 | T40S,R2W,SW1/4 | 58% |
| 13 | T40S,R3W,NE1/4 | 46% |
| 23 | T40S,R3W,SE1/4 | 77% |
| 12 | T40S,R3W,NW1/4 | 72% |

Palmer Creek watershed encompasses portions of six quarter-townships (Figure 32). These quarter-townships all exceed the ISC recommendations for dispersal habitat.

**Figure 32. Quarter-townships (QT) within the Palmer Creek watershed, legal description, and percent of QT that meets the 50-11-40 rule.**

| *QT #* | *Legal* | *11-40* |
|---|---|---|
| 4 | T39S,R3W,SW1/4 | 76% |
| 3 | T39S,R4W,SE1/4 | 55% |
| 2 | T39S,R4W,SW1/4 | 63% |
| 12 | T40S,R3W,NW1/4 | 72% |
| 11 | T40S,R4W,NE1/4 | 61% |
| 10 | T40S,R4W,NW1/4 | 54% |

**Critical Habitat:** Critical habitat (CH) for the spotted owl has been identified within the Beaver Creek watershed, but it is entirely located on BLM lands. Critical habitat is located in T39S, R3W, S. 35 and 36; T40S, R3W, S. 1 and 12; T39S, R2W, S. 31, 32, and 33; and T40S, R2W, S. 4, 5, and 9. For the Palmer Creek watershed, CH is located on both Forest Service (T40S, R4W, S. 33, 34, and 35) and BLM (T39S, R3W, S. 29 and 30, and in T39S, R4W, S. 25, 26, 27, and 28).

Habitat analysis for critical habitat within the watershed has not been accomplished. The CH analysis would include data on the amount of suitable spotted owl habitat within the CH and the status of spotted owl pairs within CH in relation to incidental take guidelines.

**Late-Successional Reserves:** No Late-Successional Reserves (LSR) are located within or immediately adjacent to the watershed analysis area. The nearest LSRs to Beaver Creek and Palmer Creek watersheds are located greater than 4.0 miles to the southwest (LSR #810) and greater than 4.0 miles to the east (LSR #908). Spotted owl dispersal habitat for the areas between Beaver Creek/Palmer Creek watersheds and LSR #810 and #908 was not evaluated for this report but may be essential for landscape planning.

**b. Bald Eagle**

Bald eagles, a threatened species, are not known to utilize the habitats on the watershed analysis area, except for the riparian and aquatic habitats immediately adjacent to the Applegate River. The nearest known bald eagle nest site is located at Applegate Lake, greater than 5.0 miles south of the watershed analysis area. Palmer Creek and Beaver Creek watersheds, although immediately adjacent to the Applegate River are not known to be used for nesting or foraging by bald eagles. Both streams are narrow with a fairly dense tree canopy which may prevent bald eagles from using the stream for foraging. Also, these streams do not support large populations

of fish, particularly during the summer when the streams become quite small and have actually dried-up during 1994.

**c. Peregrine Falcon**

This endangered bird species has not been reported for the watershed analysis area. Nesting habitat for this species is not found on the watershed. The nearest known nest site is greater than 10 miles to the southwest of the watershed analysis area.

**d. Northern Goshawk**

This species utilizes late-successional forest habitats for nesting and foraging. However, because of the large home range of this raptor, they also utilize many other forest habitats for foraging. This species is listed as sensitive by Region-5 and has been petitioned for Federal listing as a threatened species. Nest sites are suspected and most likely are located in the late-successional forests and mature forests within the watershed analysis area. One known nest site is located in Palmer Creek watershed and a nest(s) are suspected for the Beaver Creek watershed. It is possible that the other watersheds within this analysis area may also contain northern goshawk nests.

Surveys for northern goshawk are recommended prior to management activities. The Rogue River National Forest Plan provides specific management guidelines for known nest sites. These management guidelines include protective buffers and seasonal restrictions for activities that could disrupt goshawk nesting (USDA, 1990). The Applegate AMA Ecosystem Assessment team in their final report suggests consideration of goshawk management guidelines utilized by National Forests in Region-5 (California). These guidelines call for maintaining 60% of the foraging area (approximately 12,000 acres) of a northern goshawk pair in commercial-sized forests with at least 40% canopy cover (USDA/USDI, 1994c).

**e. Pileated Woodpecker**

This large woodpecker species is associated with late-successional forests, but also utilizes a variety of other habitats. Late-successional forests provide nesting habitat, while other habitats are primarily for foraging. Pileated woodpeckers utilize large snags for nesting and forage on large snags and down logs. This species is found within the watershed analysis area, particularly within older forest types. Surveys have not been conducted for this species, or for their nest sites.

**f. Band-tail Pigeon**

The band-tail Pigeon has been included in this discussion because of national concerns about their declining populations. This species is common on the watershed analysis area during the Fall migration, but are not known to nest within area. It is possible that this species nests within the watershed analysis area because individual band-tail pigeons have been observed on the Applegate District during the summer (personal observations by the author). Band-tail pigeons have been observed utilizing the higher elevations of the Beaver Creek watershed for feeding and resting, although they may also use other watersheds in this analysis area. Two favorite food sources of band-tail pigeons are the berries produced by blue elderberry and Pacific madrone. Beaver Creek and adjacent watersheds, particularly Yale Creek, are important feeding areas for band-tailed pigeons because of the large concentrations of elderberry plants. Unfortunately, within the Beaver Creek watershed, elderberry have been negatively impacted (number reduced, range reduced, and age-class distribution changed) because of silvicultural practices within conifer plantations and because of the exclusion of fire from the landscape.

**g. Great Gray Owl**

The great gray owl is not listed as sensitive within Region-6, but is listed as such by Region-5, California. This is a species of concern as stated in the ROD. This owl species has been reported for the Beaver Creek watershed, Petes Camp sub-basin, and for several adjacent watersheds. A nest site has not been confirmed in Petes Camp sub-basin, but surveys have not been conducted. This owl species most commonly nests in older forests adjacent to meadows. Timber harvest, particularly shelterwood harvests, appear to be beneficial to this species and this type of forest habitat are common in the higher elevations of Beaver Creek watershed.

According to directions in the ROD, within one year of the signing of the ROD, a standardized protocol for great gray owl surveys is to be developed and implemented. No surveys for this species have been conducted within the watershed analysis area. Additionally, the ROD provides guidelines for managing known great gray owl nest sites: a no-harvest buffer of 300 feet around meadows and natural openings and establishment of a 1/4-mile protection zones around known nest sites.

**h. Siskiyou Mountain Salamander**

The Siskiyou Mountain Salamander is listed as a sensitive species by the Forest Service, Region-6. This species occurs within an extremely narrow range on the Rouge River, Siskiyou, and Klamath National Forests, with the majority of their habitat located on the Applegate Ranger District. Within the Beaver Creek watershed, this salamander has been found in Haskins Gulch and several small unnamed tributaries to Beaver Creek. These unnamed tributaries are located on both the north and south side of Beaver Creek. Sightings of this species have also been made for Palmer Creek watershed and for other watersheds within the analysis area.

Habitat for this species has been described as moist, mossy or humus covered talus and rocky outcrops, especially on north-facing slopes with dense overstory canopy (USDA/USDI, 1994a, Appendix J2; p. J2-426). Some field mapping of suitable Siskiyou Mountain salamander habitat has occurred, but the majority of the potential habitat within the watershed analysis area has been identified with the use of GIS data. Potential habitat was defined as areas where suitable landtypes, soil types, and canopy closures intersected. The GIS mapping indicates that nearly the entire lower 1/2 of Beaver Creek watershed and a large portion of Palmer Creek watershed is potential habitat. This potential habitat is found on both north and south slopes and is associated with drainages, ridgetops, and side-slopes. Field verification is necessary to confirm the accuracy of this habitat analysis technique.

Surveys for this species are labor intensive and can only be done when environmental conditions are suitable. A study conducted on the Siskiyou National Forest for a related salamander species, the Del norte salamander, found that this species could only be found when temperature and humidity conditions were within a certain range (Del Norte, 1992). Survey work for Siskiyou salamander conducted over the last several years on the Applegate Ranger District indicates that this salamander can only be found when environmental conditions are within a very narrow range.

The ROD provides specific management guidelines for this species habitat (USDA/USDI, 1994b). In essence, the guidelines call for protecting all known populations and avoiding disturbance of talus throughout the site. Additionally, a buffer of at least the height of one site-potential tree or 100 feet horizontal distance, whichever is greater, surrounding the site, must be retained around the outer periphery of known sites; overstory trees must not be removed within the boundary of this buffer. The ROD also calls for surveys prior to implementing management activities.

A research project is presently on-going on habitat characteristics and affinities for Siskiyou Mountain salamander. This study will be completed and a final report issued by October, 1995. A conservation strategy for this species will be prepared as a result of this research study.

**I. California Mountain Kingsnake**

This species is listed as sensitive by the Forest Service, Region-6. The California mountain kingsnake is known within the watershed analysis area, particularly at the lower elevations. This species is closely associated with talus/rock outcrops and riparian habitats. Surveys have been conducted for this species in various locations along Beaver Creek and Palmer Creek watersheds. These surveys were conducted in conjunction with fish habitat improvement projects.

**J. Western Pond Turtle**

The western pond turtle is the only turtle species native to this area. This species is listed as sensitive by the Forest Service, Region-6. Western pond turtles occupy riparian and lacustrine habitats at low to moderate elevations. This species aquatic habitats commonly include aquatic vegetation, and basking sites (logs or rocks). Nesting sites for this species are often located in upland areas and often at great distance from their aquatic habitats. Grassy areas are known to be used for nest sites, but it is likely that areas within forests may also be used. This species may also hibernate within forest habitats, i.e., under down logs.

This species is known for several locations along the Applegate River and immediately adjacent to the watershed analysis area. Western pond turtles have not been observed, or reported for Beaver or Palmer Creeks. Surveys for this species have been conducted along both streams in conjunction with fish habitat improvement projects.

**k. Bat Species**

All of the bat species found on the Applegate Ranger District are likely to occur on the watershed analysis area (Figure 33). *Plecotus townsendi*, Townsends big-eared bat, a sensitive species, and *Myotis thysanodes* utilize the caves found on Palmer Creek watershed.

*Myotis* species are the most common group of bats found on the watershed analysis area (Figure 33). Riparian zones within the watershed analysis area are the primary foraging areas for all bat species listed in Figure 33, except for the pallid bat that seems to forage in upland forests. The Applegate River is a major foraging area for these bats, but very likely they also forage along all the permanent flowing streams on the watershed analysis area. Other habitats for bats are found within the watershed analysis area. *Myotis* species are known primarily as snag dependent, that is, they utilize snags as maternity sites and roost sites. The hoary bat, *Lasiurus cinereus* and the silver-haired bat *Lasionycteris noctivagans* are foliage roosting bats. Pallid bat *Antrozoas pallidus* roost sites are located along the Applegate River adjacent to Beaver and Palmer Creeks. Primary roosts for Pallid bats are snags, rock outcrops; and bridges. Buildings are used as hibernaculums in the winter because of the warmth provided and because of the many cavities (crevices) found in buildings. The pallid bat, long-eared myotis, big brown bat, and Brazilian free-tailed bats have all been observed in houses on Beaver Creek. There are unsubstantiated reports of a large cloud of bats coming from an area near Baldy Peak.

**Figure 33. Bat species likely to utilize habitats on the watershed analysis area.**

| | |
|---|---|
| *Tadaarida brasiliensis* | Brazilian free-tail bat |
| *Antrozous pallidus* | Pallid bat |
| *Lasionycteris noctivagans* | Silver-haired bat |
| *Lasiurus cinereus* | Hoary bat |
| *Eptesicus fuscus* | Big brown bat |
| *Myotis californicus* | California brown bat |
| *Myotis evotis* | Long-eared brown bat |
| *Myotis volans* | Long-legged brown bat |
| *Myotis thysanodes* | |
| *Myotis yumanensis* | Yuma brown bat |
| *Myotis lucifugus* | Little brown bat |
| *Myotis ciliolabrum* | brown bat |

**l. Furbearers**

Furbearer species (fisher, American marten, and wolverine) have not been reported for the watershed analysis area. Furbearers have not been surveyed for within the analysis area. Furbearer surveys are recommended, particularly along riparian habitats. There is only one reliable sighting of a fisher on the Applegate Ranger District (approx. 10 miles to the southwest), but no substantiated sightings of marten or wolverine. The fisher is probably more common on the District then is indicated by recorded sightings, but are rarely observed because of their nocturnal nature and shy behavior. The American marten is a species that utilizes older-age, high elevation forests. This species has not been reported for the Applegate Ranger District, although habitats for this species are found on the watershed analysis area and throughout the rest of the District . Wolverine utilize high elevation forests and avoid human contacts. This species has not been reported for the District.

**m. Wildlife Species Listed in Appendix J2**

Appendix J2, (Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl) provides survey and management direction for several wildlife species that have been found within the analysis area, or have habitat within the analysis area (USDA/USDI, 1994a). The species listed in Appendix J2 are as follows:

*Amphibians*: Black salamander, tailed frog, Siskiyou Mountains salamander, and Oregon slender salamander.

*Birds*: Black-backed woodpecker and common merganser.

*Bats*: Fringed myotis, hoary bat, long-eared myotis, long-legged myotis, pallid bat, and silver-haired bat.

*Mammals*: Fisher and American marten.

## III. DESIRED FUTURE CONDITIONS (DFC); MANAGEMENT RECOMMENDATIONS

Based on the analyis conducted, this chapter identifies the Desired Future Conditions (DFC) and Trends that would indicate a more stable and resilient watershed ecosystem. Included are recommendations that would move this watershed towards this stable condition.

**PROCESS: Human Access and Travel (Roads)**

**DFC:** Forest Access and Travel Management (A&TM) plan amends the LRMP, to facilitate closing and decommissioning of FS roads based upon long-term transportation planning needs.

**RECOMMENDATION:**

1. In planning long-term transportation needs the following is considered:

   a. Road densities are reduced in areas where road densities are high especially in riparian areas, sensitive granitic and unstable soils, and in black tailed deer winter range;
   b. Adequate fire suppression response times are maintained;
   c. Interim steps are taken on a watershed basis to facilitate the closure and restoration of roads not currently being used until long-term forest wide plans are completed and implemented. Utilize the Rogue River National Forest Access and Travel Management Process Guide to facilitate both interim and long-term transportation planning.

**PROCESS: Stream Flow Regime**

**DFC:** Channel maintenance flows provide for the orderly conveyance or uninterrupted transport of water and imposed sediment supply produced from the watershed through the stream channel network such that over time, channel dimensions and patterns are self-maintained. B-type channels are created and/or maintained in both Palmer (mouth to 1/2 mile above Dark Canyon) and Beaver watershed (mouth to Pete's Camp)

**RECOMMENDATIONS:**

1. Recreate a B type channel in the lower Reaches of Beaver Creek.
2. Reestablish the floodplain and the meander pattern to the lower Reaches of Palmer Creek.
3. Work toward the establishment of a Memorandum of Understanding (MOU) with the private irrigation users (as well as other water users), to ensure adequate flow for aquatic species and stream channel maintenance in Beaver and Palmer Creeks.

**PROCESS: Water Chemistry**

**DFC:** Water quality is restored and/or maintained to protect beneficial uses and support healthy riparian, aquatic, and wetland ecosystems.

**RECOMMENDATIONS:**

1. Improve water temperature and increase dissolved oxygen by reducing width/depth ratios by recreating a B channel in the lower Reaches of Beaver Creek.
2. Test water and talus for potential toxic metals in mine sites. Obtain any existing test results from mine claimants.

**PROCESS: Sediment Regime**

**DFC:** The sediment regime is more consistent with the historic range of variability.
- Road prisms, landings, human-caused slides and other sources are no longer sources of erosion. The most important areas are riparian zones of steep tributaries and sensitive (granitic) uplands with slopes greater than 30 percent.

- Road densities are reduced, especially within the riparian zones and on sensitive (granitic) uplands, and unstable slopes.
- Soils exist in a noncompacted condition.
- Streambanks are stable and contribute to a high quality habitat for anadromous and resident fisheries.

RECOMMENDATIONS:

1. Reduce road density in the following sub-basins: Baldy, Beaverhead, Charley Buck Gulch, Hanley Gulch, Haskin's Gulch and Pete's Camp in the Beaver Creek watershed and West Palmer and Sourdough Gulch in Palmer Creek.
2. On roads that will be closed, remove culverts, pull back sidecast fill material, outslope to restore natural drainage, deep rip where appropriate, and plant with native species. Priority roads are midslope, cross live creeks, or are actively contributing sediment.
3. On roads that will be left open but infrequently maintained, evaluate drainage for functioning during storms. Perform work such as outsloping, removing outside berms, waterbarring above culverts, surfacing roads and armoring drainage structures (draindips, diverterdips, waterbars, and culvert cut and fill slopes) on sensitive soils and/or unstable lands (see geology report for specific restoration proposals).
4. Inventory all nonsystem roads and evaluate need for restoration.
5. Stabilize eroding streambanks.
6. Update range allotment management plant (AMP) to control livestock movement through riparian areas.
7. Readjust fish structures as needed to decrease accelerated streambank erosion and to decrease embeddedness upstream.
8. Timber management strategies (especially ground-based systems) meet desired condition for restoring sediment regime to historic range of variability.
9. Complete slope stability mapping and updates to Soil Resource Inventory prior to any ground disturbing land management activities.
10. Restore unstable lands especially in or near riparian zones.

PROCESS: **Riparian Zones**

DFC: The riparian zone is in proper functioning ecological condition. It supports a diversity of native plants, supports bank stability, provides shade to maintain water temperature adequate for aquatic species, provides connecting habitat, and supports a healthy population of native and desired nonnative birds, animals, and plant species.
- Mature age classes are maintained within the riparian zone. Microclimate and ecological conditions found in unmanaged systems are maintained. Desired conditions will require between 50 and 150 years to attain.
- A diversity of vegetation age classes are well distributed and maintained within the watersheds, ultimately allowing no more than 25 percent of the basin in age classes less than 30 years of age.
- Streambanks are stabilized to a condition contributing to a high quality habitat for anadromous and resident fish.

RECOMMENDATIONS:

1. Create and maintain a diversity of seral stages, species, and vegetation structure. Ultimately allowing no more than 25 percent of the basin in age classes less than 30 years of age.
2. Restore riparian habitat to increase the average age class of riparian forests to improve connectivity.

PROCESS: **Viability of Fish Populations**

DFC: Viable populations of individuals of all life stages throughout the watershed for all anadromous and resident fish are maintained. Aquatic habitat is restored and protected for all anadromous and resident fish. Spatial and temporal connectivity is restored and protected within and between watersheds.

- 25 pools per mile of stream channel are created and/or maintained and a pool/riffle ratio or step/pool ratio approaching approximately 40/60 ratio is also maintained (determined by channel morphology).
- Riparian zones are in proper functioning ecological condition (discussed in more detail under PROCESS: Riparian Zones).
- Lower stream temperatures, in the short term - attain a summer seven day average of the maximum daily stream temperatures less than 68 degrees F throughout the basin. In the long term - maximum daily temperatures are reduced to historic levels which pre-date European settlement.
- Average between 25-80 pieces of large and small coarse woody debris (CWD) exist per mile of stream channel. This will vary by channel morphology and will not be achieved for 100 years unless artificial wood structures are placed. These artificial wood structures may not be appropriate until the sediment regime has been corrected in the upland portion of the watersheds.
- Channels with gradients of less than 2 percent will have less than 35 percent embeddedness.
- Natural gravel/cobble/small boulder substrate mixture is recreated and maintained, eliminating embeddedness.
- Culverts are replaced and maintained to allow for 100-year events and facilitate fish passage.
- Viable populations of anadromous coho salmon and summer and winter steelhead are maintained, as well as resident rainbow and cutthroat trout.
- Instream flows are restored and maintained at a level which improves water quality in the lower main stems, and which support a viable anadromous and resident fishery.
- Irrigation canals will be regulated at a level which prevents sediment from entering nearby streams.

RECOMMENDATIONS:

1. Reinstate the aquatic ecosystem that existed prior to the 1950's. (See recommendations for PROCESS: Stream Flow Regime)
   a. After channel morphology is reestablished, add spawning gravel.
2. To increase short term supply of coarse woody debris, strategically place large-sized CWD throughout both basins in the main stems.
3. To reduce embeddedness and to recreate pool habitat see recommendations for PROCESS: Sediment Regime.
4. Replace culverts identified as not designed to carry 100 year flow events.
5. In addition to, or separate from, recommendations in PROCESS: Flow regime, work with private irrigation users, in preventing fish movement through canals.

PROCESS: **Natural Disturbance (Fire, Insects & Disease)**

DFC: Landscapes are in a stable condition in relation to their response to disturbances such as fire, insects, and disease.

*FIRE*

DFC: Landscapes are relatively resistant (within range of natural variation) to large scale stand replacing fires.

RECOMMENDATIONS:

1. Take action, to protect, restore, or stabilize these landscapes. High priority areas for managing vegetation to lower the risk of large stand replacing fires, are in areas where high fire risk and high fire hazard areas intersect (see Figure 25 for a map showing these areas).

   a. Mimic natural disturbance to meet landscape objectives. Tools to be considered include: density management, prescribed fire, and manual manipulation of live/dead vegetation. Work toward developing new techniques for meeting landscape objectives that consider economically feasibility.

   b. Construct strategically located shaded fuel breaks to lower the risk of large stand replacing fires.

   c. Integrate the analysis of habitat requirements, site productivity and other ecological considerations with site specific fire hazard and fire risk analysis. Relative risk and fire hazard rating should be considered when deciding what actions to be taken.

2. Analyze and provide for adequate presuppression and preattack facilities such as helispots, access and safety zones.

3. Strong prevention programs should be developed with local communities emphasizing defensible space and hazard reduction around private property. Encourage private commercial forestry, to practice adequate live and dead fuels treatment, particularly at lower elevations.

4. The following table, using the best existing information, recommends the amount of coarse woody debris within vegetation zones based on aspect, as influenced by the pre-fire suppression fire return interval. The recommended amounts would be primarily justified for planning the amount of coarse woody debris **for projects emphasizing fire hazard reduction to reduce stand replacement fires precluding LSR, AMA and Matrix land objectives.** The recommendation provides reasonable amounts (within the range of natural variation) of coarse woody debris with the objective of meeting the intent of the ROD standards and guidelines while being consistent with that which would be expected for specific fire return intervals as influenced by the specific fire environment. Integration must take place when making final decisions as to the amount of coarse woody debris within the range of natural variation that should be planned for.

| Vegetation Zones (a) | Primary Successional Phase | Fire Return Interval (b) | Recommended Amounts of Coarse Woody Debris by Vegetation Zone and Aspect |
|---|---|---|---|
| Interior Valley (ponderosa pine & driest Douglas-fir series) | Seral | 8-10 years | 0 to 3 pieces/acre on south aspect; 2 to 5 pieces/acre on north aspects. |
| Mixed Conifer (Douglas-fir and driest white fir series) | mostly seral | 15-20 years | 3 to 7 pieces/acre on south aspects; 5 to 10 pieces on north aspects. |
| Riparian Areas | | | 16 inch diameter, 120 lineal feet/ acre minimum; Mattrix S&Gs, ROD, pp C-40. |

(a) taken from Jerry F. Franklin and C. T. Dryness. Vegetation Of Oregon & Washington. - U.S.D.A. Forest Service Research Paper PNW-80. 1969. (b) Fire return intervals are on a landscape basis. Intervals determined from personal discussion with Tom Atzet, Area Ecologist, 1994, concerning fire return interval for the forest/urban interface above Ashland, Oregon and the upper Applegate Valley eastern Siskiyous.

## INSECTS AND DISEASE

DFC: Landscapes are relatively resistant to large scale insect and disease infestations. Site productivity is restored and maintained at levels conducive to healthy vegetative growth and survival. Vigorously growing vegetation is less susceptible to insect and disease attacks than poorly growing stagnated vegetation.

**RECOMMENDATIONS:**

1. Manage vegetation according to recommendations of the *Applegate Adaptive Management Area Ecosystem Health Assessment*, Landscape and Stand Level Goals.
2. Analyze existing soil conditions when designing vegetation management projects. Design new projects to restore or maintain soil productivity characteristics.

## TERRESTRIAL SPECIES VIABILITY

DFC:
- Habitats support diverse and viable populations of terrestrial native wildlife species, and exist in locations that are important in providing for connectivity with adjacent watersheds.
- Late-Successional habitat exists at ranges closer to historic levels which takes into account growing site capabilities and pre-suppression era fire return intervals.
- Black tailed deer winter range, summer range and fawning habitat has been identified and used to update the LRMP Big Game Winter Range Land Allocation mapping.
- Habitats for other species of concern for this area have identified.

**RECOMMENDATIONS:**

1. Identify black-tail deer winter range , summer range, and fawning habitat within each of these watersheds. This activity will update the winter and summer ranges identified within the Forest Plan, which is inaccurate for much of this area.
2. Identify areas within the watershed analysis area that are important for providing connecting habitats with adjacent watersheds, e.g., Squaw Gap which leads from Beaver Creek watershed into the Yale Creek and Squaw Creek watersheds. Also, identify areas that are presently serving as connecting habitat and should be maintained for this purpose. For areas where connecting habitat is important but is not available because of past timber harvest, identify and implement appropriate silvicultural projects that would speed up the growth of forests in order to provide suitable connecting habitats.
3. Implement prescribed fires within brushfield habitats to increase the amounts of brushfields in early seral stages and to increase the distribution of age-classes.
4. Improve band-tail pigeon habitat by planting and encouraging blue-elderberry plants and Pacific madrone trees within high elevation areas, particularly in conifer plantations. One area to consider is along Beaver ridge between Beaver Creek and Squaw Creek watersheds.
5. Remove from future mineral exploration, areas within Palmer Creek watershed that are known to be used by Townsends big-eared bat. This will provide long-term protection for this sensitive bat species within the Palmer Creek watershed.
6. Close-off to human activities caves (mine adits) within Palmer Creek watershed that are known sites for Townsends big-eared bat and other bat species. Human activities are a major disturbance to Townsends big-eared bat.
7. Complete data collection for information lacking or not included within this report, such as spotted owl habitat amounts on private and Federal lands, connecting habitats within and adjacent to the watershed analysis area
8. Review the status of ponderosa pine and oak savannahs within the watershed analysis area and design projects to re-establish, or to maintain existing savannah communities.

9. Implement prescribed fire where (compatible with other resources) to restore TE&S plant communities.
10. See monitoring for recommended surveys needed to identify current populations of species of concern for these watersheds.
11. Field verify PMR data used in this report.

## IV. MONITORING AND RESEARCH

The Rogue River National Forest (RRNF) Monitoring Vista Group has evaluated the RRNF current monitoring plan and developed a new methodology to assess the health of ecosystems through indicators of biological diversity. This new strategy " An Integrated Ecosytem Monitoring Framework" establishes a scientific approach for observing and recording the forest ecosystem.

Monitoring and research opportunities abound with the analysis area, particularly since this area is within the Applegate Adaptive Management Area. The following list highlights several areas of monitoring or research that are presently on-going or proposed, or in areas where information is totally lacking but may be important to conduct forest management activities.

### BIOLOGICAL

*Siskiyou Mountain salamander*: Research concerning habitat parameters is presently on-going. Additional survey work has been conducted which has increased the known range of this salamander. Additional research is needed to learn more about this species natural history and the extent of their range. The natural history of this species is a long-term research endeavor, but the identification of the range of this species can be learned through intensive, short-term surveys. Research into the effects on the species from timber management activities should also be considered.

Field verify all potential Siskiyou Mountain salamander habitat to determine if the species is present. Considerable portions of these watersheds have been identified as potential habitat, but they have not all been surveyed for presence of Siskiyou Mt. salamander. Survey for Siskiyou Mountain salamanders. Several areas within theses watersheds are known to be occupied by this salamander species. The ROD provides specific management guidelines for this species and their habitat.

*Furbearers*: Conduct camera station monitoring along the major drainages within the watershed analysis area in order to determine presence/absence of furbearers (fisher, pinemarten).

*Bats*: Continue with telemetry studies of bat species to learn about maternity roosts, day roosts, feeding areas, and migration patterns. Conduct surveys to determine the locations of important roosts for Townsends big-eared bat, fringed myotis, and other cave dwelling bat species.

*Spotted Owl*: Implement the Applegate Districts proposed telemetry study to gain a better understanding of habitat use. Of particular interest is use of hardwood and hardwood/conifer forests, and of young forests.

Conduct surveys for spotted owls within and adjacent to habitat areas that are not known to be presently occupied, but may be occupied.

Surveys meeting established protocol are required prior to implementing projects that could impact spotted owls.

Monitor all known spotted owl nest sites to determine nesting status.

*Neotropical Migratory Birds*: Continue participation with the Monitoring Avian Productivity and Survivorship (MAPS) program. This national research program is studying dynamics of neotropical migrant bird populations.

*Snag/Down-Log Habitat*: These habitat types directly or indirectly support a great diversity of wildlife species. Past management practices by Federal and private forest managers in general have had a negative impact

on these habitats. Salvage logging has recently been an important forest management system, but salvage has the potential to be detrimental to the maintenance of snag/down-log habitat. State safety concerns also impact the ability to maintain snag/down-log habitat. Design monitoring to better evaluate existing levels of snag/down-log habitat and what remains after implementation of forest management activities.

*Great Gray Owl:* Conduct surveys for great gray owls as required in the ROD (beginning in January, 1995). The potential is high for this species to be found on the Beaver Creek watershed.

*Goshawk:* Conduct surveys for northern goshawk, a species of concern throughout their range. A nest site is known in Palmer Creek watershed and nest site(s) are suspected on the Beaver Creek watershed. No information is available for the other four watersheds.

Begin survey work for wildlife species identified in Appendix J2, that must be surveyed for prior to implementation of projects.

*Fish survey*: Continue monitoring fish distribution and age classes in the main stems. Monitor redd counts. Determine existance of fish in the China Gulch, Flumet, Billy's Gulch and McKee watersheds and the tributaries on the north side of Palmer Creek.

*Macroinvertebrates*: Most sites appeared to have hit bottom as far as habitat and biotic integrity and to be recovering. Trend monitoring will document this process. These streams will have differing potential for recovery, depending on; how rapidly sediment inputs can be brought under control, and the degree of damage to the overall habitat structure. Monitor Palmer Creek for baseline data.

**PHYSICAL/CHEMICAL**

*Channel Morphology*: Aggradation and degradation processes should be monitored by repeating cross-sectional surveys at fixed transect sites. These transects have been set perpendicular to the channel and have been permanently located with lag bolts set in cement at a distance set far enough away from the bank to prevent loss during flood events.

Continue monitoring other key morphological indicators including sinuosity, sediment size, channel slope and entrenchment.

*Water Quality*: Long-term monitoring of stream temperature, dissolved oxygen, pH, conductivity, suspended sediment and bedload.

*Soil Conditions:* Monitor the degree and spatial distribution of soil compaction. Use this data to assess the effects of past management activities, identifying restoration needs, and for designing new projects that will maintain or restore productive soil characteristics.

Monitor duff and litter thickness to assess the effects of past management activities, identifying restoration needs, and for designing new projects that will maintain or restore productive soil characteristics.

## V. LITERATURE CITED


Agee, James K., Fire Ecology of Pacific Northwest Forests, Island Press, Washington. D. C. 1993, page 141.

Atzet, Thomas and Dave Wheeler, Area Ecologists, Historical and Ecological Perspectives on Fire Activity in the Klamath Geological Province of the Rogue River and Siskiyou National Forests, USDA Forest Service, Pacific Northwest Region, Portland, Oregon, July 1982.

Atzet, Thomas, Personal discussion between Tom Atzet, Area Ecologist, and Bill Rose, Fire Specialist, May and June, 1994, concerning fire return interval for the forest/urban interface above Ashland, Oregon and the upper Applegate Valley.

Clark, Roger N., 1985. Influences of recreation. USDA, Forest Service General Technical Report PNW-178.

Dunne, Thomas and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Co. 818 pp.

Everest, F.H. 1993. USDA-Forest Service, Region Six, Columbia River Basins Forests, anadromous fish habitat desired future conditions, draft working copy.
Franklin, Jerry F. and C. T. Dryness. Natural Vegetation of Oregon & Washington . U.S.D.A. Forest Service Research Paper PNW-80. 1969 pg 98.

Frissell, Christopher A. 1986. Classification of stream habitat and watershed systems in south coastal Oregon and an assessment of land use impacts. Oregon Department of Fish and Wildlife.

Goldman, Charles R. and A.J. Horne. 1983. Limnology. McGraw-Hill book Co., New York. 464 pp.

Gordon, Nancy D., et al. 1992. Stream hydrology: an introduction for ecologists. J. Wiley and Sons. 526 pp.

Maser, Chris, et al., eds. 1988. From the Forest to the Seas: A Story of Fallen Trees. General Technical Report PNW-GTR-229. Portland, Oregon

Meehan, William R., editor. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland. 751 pp.

Moffatt, Robert L., et al. 1990. Statistical summaries of streamflow data in Oregon: volume I–monthly and annual streamflow, and flow duration values. USDI-U.S. Geological Survey, Open file report 90-118, prepared in cooperation with the Oregon Water Resources Department. 413 pp.

Morisawa, Marie. 1968. Streams: their dynamics and morphology. McGraw-Hill Book Co. 175 pp.

Morrison, Peter H. and Frederick J. Swanson. Fire History and Pattern in a Cascade Range Landscape. United States Department of Agriculture, Forest Service Pacific Northwest Research Station. General Technical Report PNW-GRT-254, May 1990, pg 68.

Nickelson, Thomas, et al. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, research and development section.

Oregon DEQ. 1992. Water quality status assessment report 305(b). April, 1992. Oregon Administrative Rules. Chapter 340, Division 41. Department of Environmental Quality, Portland, OR. pp. 24-28.

Platts, William. 1981. Effects of Livestock Grazing. USDA, Forest Service General Technical Report PNW-124.

Prchal, Mark. 1994. Geologic input to the Applegate AMA. unpublished report, Rogue River National Forest, Medford, Oregon.

Reid, Leslie M. and B.P. McCammon. 1993. A procedure for watershed analysis (review draft). Prepared for the Interagency Forest Ecosystem Management Assessment Team, USDA-Forest Service.

Reiser D.W. and T.C. Bjornn. 1979. Habitat Requirements of Anadromous Salmonids. USDA, Forest Service General Technical Report PNW-96.

Rosgen, Dave. 1994. Applied fluvial geomorphology. unpublished course manual. Wildland Hydrology Consultants, Pagosa Springs, Colorado.

Swanston D.N. 1980. Impacts of Natural Events. USDA, Forest Service Genral Technical Report PNW-104.

USDA, Forest Service. 1990. Beaver/Palmer stream survey. unpublished document, Rogue River N.F., Medford, Oregon.

USDA, Forest Service. 1994. Ecosystem Health Assessment Applegate Adaptive Management Area. Unpublished document, Rogue River N.F., Medford, Oregon

USDA, Forest Service. 1990. Stream survey project report, Applegate Ranger District. unpublished report, Rogue River National Forest.

USDA, Forest Service. 1993. Beaver/Palmer stream survey level II report. unpublished document, Rogue River National Forest, Applegate Ranger District.

USDA, Forest Service. 1993. Determining the risk of cumulative watershed effects resulting from multiple activities. Endangered species act, section 7. unpublished document, February, 1993.

USDA, Forest Service. 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the Northern spotted owl and Standards and Guidelines for management of habitat for late-successional and old-growth forest related species within the range of the Northern spotted owl. U.S. Government Printing Office: 1994 - 589-111/00003.

USDI, Bureau of Land Management. 1994. Ecosystem health assessment, Applegate Adaptive Management Area. unpublished draft report, August, 1994. BLM, Medford, Oregon District.

USDI, U.S. Geological Survey. Discharge notes. unpublished form 9-207.

USDI, U.S. Geological Survey. Flood frequency analysis data for water years 1983-1993. unpublished data.

U.S. Environmental Protection Agency. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. EPA/910/9-91-001.

U.S. Environmental Protection Agency. 1988. 1988 Oregon statewide assessment of non-point sources of water pollution. Department of Environmental Quality, Portland, Oregon.

Wellman, Roy E., et al. 1993. Statistical summaries of streamflow data in Oregon: volume 2–annual low and high flow, and instantaneous peak flow. USDI-U.S. Geological Survey, Open file report 93-63, prepared in cooperation with the Oregon Water Resources Department. 406 pp.

Wisseman, Bob. 1991. Benthic invertebrate biomonitoring, Rogue River N.F. unpublished synthesis report, Aquatic Biology Associates, Corvallis, OR.

Wolman, M. Gordon, 1954. A Method of Sampling Coarse River-Bed Material. Transactions, American Geophysical Union. volume 35, Number 6. 951 pp.

Yee, C.S. and T.D. Roelofs. 1980. Planning Forest Roads to Protect Salmonid Habitat. USDA, Forest Service General Technical Report PNW-109.

## GLOSSARY OF TERMS

**Accelerated erosion:** erosion at a rate greater than normal for a site on the land surface or in drainageways.

**Accretion:** the process , driven by plate tectonics, whereby the continental margin grows by addition of ocean crust and sediments at a subduction zone. (FEMAT)

**Aggradation:** the geologic process by which stream beds, floodplains and the bottoms of other water bodies are raised in elevation by the deposition of material eroded and transported by water from other areas.

**Airshed:** A Geographic area that shares the same air mass due to topography, meteorology, and climate.

**Aerial fuel:** All burnable material more than six feet above the ground. This includes the upper portions of trees, large shrubs, snags, and all the foliage and woody tissue on them.

**Alluvial:** originated through the transport by and deposition from running water.FEMAT

**Alluvial stream:** a stream whose boundary is composed of appreciable quantities of the sediments transported by the flow and which generally changes its bed forms as the rate of flow changes.

**Alluvium:** stream-deposited debris.

**Argillite:** a compact rock, derived either from mudstone (claystone or siltstone) or shale, that has undergone a somewhat higher degree of induration than mudstone or shale but less clearly laminated than shale and with out its fissility, and that lacks the cleavage of slate. It is a weakly metamorphosed argillaceous rock which is intermediate in character between a claystone and a meta-argillite.

**Armoring:** the formation of a resistant layer of relatively large particles by erosion of the finer particles.

**Arete:** a narrow serrate mountain crest or rocky sharp-edged ridge or spur, commonly present above the snowline in rugged mountains (as in Swiss Alps) sculptured by glaciers, and resulting from the continued backward growth of the walls of adjoining cirques.

**Bankfull stage:** the discharge which just fills a stream to its banks.

**Bedload:** material moving on or near the stream bed by rolling and sliding with brief excursions into the flow three or four diameters above the bed.

**Bed material:** the sediment mixture of which the stream bed is composed.

**Boulder:** fluvial sediment particles larger than 256 mm.

**Braided river:** a wide and shallow river channel where flow passes through a number of small interlaced channels separated by bars or shoals.

**Cenozoic:** the latest of the four eras into which geologic time is divided; it extends from the close of the Mesozoic Era, about 65 million years ago, to the present.

**Cirques:** a deep steep-walled half-bowl-like recess or hollow, variously described as horseshoe- or crescent-shaped or semi circular in plan, situated high on the side of a mountain and commonly at the head of a glacial valley.

**Channel:** a natural or artificial waterway that periodically or continuously contains moving water, or which forms a connecting link between two bodies of water.

**Climax:** The final stages of a vegetation succession through seral stages to the most stable, moisture and shade- loving association the site can support.

**Cobbles:** fluvial sediment particles 64 to 256 mm.

**Crown fire:** A fire that advances from top to top of trees or shrubs more or less independent of the surface fire.

**Degradation:** the geologic process by which streambeds, floodplains and the bottoms of other water bodies are lowered in elevation by the removal of material by water.

**Ecosystem:** a community of plants, animals, other living organisms, and the nonliving factors of their environment, whose interactions result in an exchange of materials and energy between the living and nonliving components of the system.

**Erodability:** the streambank erosion potential.

**Fire climax:** a plant association, forest type, or covertype held at a seral stage by periodic fires, therefore differing from the true climax community; e.g., a Douglas-fir forest in the western hemlock zone.

**Fire cycle:** The average stand age of a forest whose age distinction fits a mathematical distribution (negative exponential or Weibull).

**Fire danger:** Resultant of both constant and variable factors--weather, terrain, fuel, and risk--that affect the inception, spread, and difficulty of control.

**Fire environment:** The physical and biological conditions at the micro-site level that influences fire behavior and its affects.

**Fire event:** (fire occurrence, fire incident): a single fire or series of fires within an area at a particular time.

**Fire frequency:** a general term referring to the recurrence of fire in a given area over time.

**Fire hazard:** A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition.

**Fire hazard reduction:** Any vegetation treatment that reduces threat of ignition, spread of fire, and its resistance to control. This may involve removal, burning, rearranging, burying, or modification such as crushing or chipping.

**Fire interval:** (fire-free interval or fire-return interval): The number of years between two successive fire events in a given area.

**Fire risk:** The chance of various potential ignition sources causing a fire, threatening valuable resources, property and life.

**Fire rotation:** Fire rotation (natural fire rotation): the length of time necessary for an area the size of the study area to burn.

**Fish-bearing stream:** any stream that contains any type of anadromous or inland fish population.

**Floodplain:** the relatively flat valley floor formed by floods which extends to the valley walls.

**Fuel type:** An identifiable association of fuel elements of distinctive species, form size, arrangement, or other characteristics that will cause a predictable rate of fire spread and difficulty of control under specific weather.

**Geomorphology:** the science that treats the general configuration of the earth's surface; specific to the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features.

**Graded stream:** a stream in which a steady state has been reached such that, over a period of time the discharge and load entering the system are balanced by the discharge and load leaving the system.

**Granitic:** any light-colored, coarse-grained rock formed at considerable depth by crystallization of molten rock.FEMAT

**Gravel:** fluvial sediment particles between 2.0 and 64 mm in size.

**Ground fire:** Fire limited to the mantle of organic material, such as duff or peat, that accumulates on top of the mineral soil. Characterized by glowing combustion and little smoke.

**Ground fuel:** All combustible materials below the surface litter, including duff, tree roots, punky wood, peat, and sawdust, that normally support a glowing combustion without flame.

**Hydraulic geometry:** describes the way stream channel properties such as bankfull width, mean depth, mean velocity and cross sectional area change with streamflow.

**Hyporheic zone:** the interface forming the boundary between groundwater and channel water in streams, important in the storage of dissolved gases and nutrients.

**Intermittent stream:** a stream channel which shows channel scour or deposition in a definable channel.

**Jurassic:** the second period of the Mesozoic Era, thought to have covered the span of time between 190 and 135 million years ago; also, the corresponding system of rocks.

**Ladder fuels:** Provide verticle fuel continuity between strata as between surface fuels and crowns.

**Mass movement:** the downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, and creep. It does not, however include surface erosion by running water. It may be caused by natural erosional processes, or by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction).FEMAT

**Mean fire return interval:** arithmetic average of all fire intervals in a given area over a given time period.

**Meander:** one of a series of sinuous curves, bends or loops produced in the flood plain of a mature stream.

**Meta andesite:** a type of volcanic lava which is high in silica and shows evidence of having been subjected to metamorphism.

**Metasedimentary:** a sediment or sedimentary rock that shows evidence of having been subjected to metamorphism.

**Metavolcanics:** a term for volcanic rocks that show evidence of having been subjected to metamorphism.

**Melange:** a mappable body of rock that includes fragments and blocks of all sizes, both exotic and native,embedded in a fragmented and generally sheared matrix.

**Paleozoic:** an era of geologic time, from the end of the precambrian to the beginning of the Mesozoic, or from about 570 to about 225 million years ago.
Also, the sequence of rocks deposited during the Paleozoic.

**Perennial stream:** streams which essentially flow year-round.

**Physiographic province:** a geographic area having a similar set of biophysical characteristics and processes due to effects of climate and geology which result in patterns of soils and broad-scale plant communities. Habitat patterns, wildlife distributions, and historical land sue patterns may differ significantly from those of adjacent provinces. (FEMAT)

**Plate tectonics:** a theory of global tectonics in which the lithosphere is divided into a number of plates whose pattern of horizontal movement is that of torsionally rigid bodies that interact with one another at their boundaries, causing seismic and tectonic activity along these boundaries.

**Pluton:** a coarse grained igneous intrusion and composed of the granitic family of rocks.

**Plutonic rock:** a rock formed at considerable depth by crystallization of magma and/or by chemical alteration. It is characteristically medium- to coarse-grained, of granitoid texture.

**Porphyritic:** the texture of an igneous rock in which larger crystals (phenocrysts) are set in a finer-grained ground-mass, which may be crystalline or glassy or both.

**Range of natural variation:** Natural processes of succession as influenced by natural disturbance mechanisms. Considers the range of conditions environmentally that would naturally occur through succession. For the eastern portion of interior southwest Oregon, before effective organized fire suppression, a major disturbance mechanism influencing succession and vegetative conditions (live or dead) was fire.

**Residence time:** of fire passage: The time that the flaming front during fire passage occupies an area. Usually the greater the loading of dead and downed debris, the longer the residence time of fire propagation, combustion and waning, given relative moisture conditions.

**Riparian reserves:** designated riparian areas found outside Late-Successional Reserves.FEMAT

**Sand size:** fluvial sediment particles 0.062 to 2.0 mm in size.

**Sediment:** particles derived from rocks or biological materials that are or have been transported by water.

**Sediment discharge:** the mass or volume of sediment passing a stream cross section in a unit of time.

**Seral stages:** The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage.

**Sere:** A sequence of plant communities that successionally occupy and replace one another in a particular enviornment over time.

**Serpentinite/peridotite:** the association of dark colored, coarse-grained, iron and magnesium-rich igneous rock (peridotite) with the products of hydrothermal alteration and faulting of these rocks (serpentinite).FEMAT

**Shear stress:** force required to erode particles from a streambank.

**Sheet erosion:** the more or less uniform removal of soil from an area by raindrop splash and overland flow, without the development of water channels exceeding 300 mm in depth.

**Snag:** A standing dead tree or standing portion from which at least the leaves or foliage and smaller branches have fallen. Often a stub if less than 20 feet tall.

**Stand maintenance fire:** Fire because of the moisture conditions, atmospheric conditions vegetative type, density, arrangement and topographic conditions results in perpetuation of a certain type of plant community. Usually on a landscape basis. Vegetation can be categorized and described as evaders, resisters, avoiders, invaders, adapters in how vegetation will respond to fire. Determinants are mainly reproductive, physiological, and tolerance adaptations as how they respond to fire.

**Stand replacement fire:** A fire because of its intensity relative to the type of fuel (live or dead) that is burning; and the area that the fire covers and the type of overstory burned, results in the death of the dominant overstory. Replacement takes place consequently.

**Streambank erosion:** the removal of bank material by flowing water.

**Stream discharge:** the quantity of flow passing through a stream cross section in a unit of time.

**Subduction:** the process of one lithospheric plate descending beneath another.
**Subduction zone:** A long, narrow belt in which subduction takes place, eg along the Peru-Chile trench, where the Pacific plate descends beneath the South American plate.

**Succession:** The gradual supplanting of one community of plants by another, the sequence of communities being termed a sere and each stage seral or successional.

**Surface erosion:** a group of processes whereby soil materials are removed by running water, waves and currents, moving ice, or wind. (FEMAT)

**Surface fire:** Fire that burns surface fuels, such as litter, other loose debris of the forest floor, and small vegetation.

**Suspended sediment load:** the weight of suspended particles continuously supported by the water.

**Terrain:** a tract or region of the earth's surface considered as a physical feature, an ecological environment, or a site of some planned activity of man (e.g. an engineering location).

**Terrane:** a term applied to a rock or group of rocks and to the area in which they crop out.

**Thalweg:** the line connecting the lowest or deepest points along a stream bed, valley or reservoir, whether underwater or not.

**Ultramafic:** dark colored igneous rocks composed of minerals which are enriched in iron and magnesium. (see serpentinite/peridotite)FEMAT

**Uplift:** a structurally high area in the earth's crust, produced by positive movements that raise or upthrust the rocks.FEMAT

**Unconsolidated deposits:** sediments that are loosely arranged, with particles that are not cemented together. Includes alluvial, glacial, volcanic and landslide deposits.FEMAT

**Unstable and potentially unstable lands:** the unstable land component of the riparian reserves includes lands which are prone to mass failure under natural conditions(unroaded, unharvested), and where human activities such as road construction and timber harvest are likely to increase landslide distribution in time and space, to the point where this change is likely to modify natural geomorphic and hydrologic processes (such as the delivery of sediment and wood to channels), which will in turn effect aquatic ecosystems including streams, springs, seeps, wetlands, and marshes.

The following types of land are included: 1) active landslide and those which exhibit sound evidence of movement in the past 400 years; 2) inners gorges; 3) those lands identified as unstable by a geologic investigations, using the criteria stated above (includes lands already classified by the Forest Service as unsuited for programmed timber harvest due to irreversible soil loss, and by the BLM as unsuitable fragile lands). Highly erodible lands (i.e., lands prone to sheet and rill erosion) are not included in this definition.FEMAT

**Vegetation zone:** A land area with a single overstory dominant as the primary climax dominant. Occasionally zones are named after major seral species. Other associates exist in the zone.

**Watershed (catchment):** all lands enclosed by a continuous hydrologic- surface drainage divide and lying upslope from a specified point on a stream.

**Watershed analysis:** A systemic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis provides a basis for ecosystem management planning that is applied to watersheds of approximately 20 to 200 square miles.FEMAT

**Water table:** the static level of groundwater below which it is held in intergranular pores of soil or rock at pressures greater than atmospheric.

**Wetlands:** areas that are inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction(Executive Order 11990). Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar areas.FEMAT

## DEFINITIONS OF THE EIGHT MAJOR, INTERRELATED CHANNEL VARIABLES:

1. **width:** the distance across the wetted channel during high or low flows.

2. **depth:** the vertical distance between the water surface and a specified point on the streambed.

3. **velocity:** the speed at which water moves downstream.

4. **discharge:** the quantity of flow passing through a cross section in a unit of time.

5. **channel slope:** difference in water surface elevation per unit of stream length.

6. **roughness of channel materials:** a quantitative description of the variables in the stream channel that impede the flow of water.

7. **sediment load:** the mass of the sediment per a measured volume of water-sediment mix.

8. **sediment size:** the size of particles carried by the stream.

# APPENDIX A

DATE LAST REVISED 11-18-94 (sm)

ISSUES: BEAVER AND PALMER CREEK WATERSHEDS

The following issues have been developed by the core team for the Beaver and Palmer Watersheds. Sources for these issues include published studies, Environmental Assessments, and personal knowledge of Interdisciplinary Team members. Issues are presented under 2 main headings, Ecosystem Health, and Socio-Economic Stability. The following format is used:

1. Issue Statement- This is a brief statement describing the issue.

2. Preliminary Objectives- These conditions are described in terms of quantifiable parameters or attributes if possible. It is important to recognize that these are preliminary objectives which will evolve as the analysis progresses and more is learned about the issue. Their primary function is to focus the analysis on the most important elements of the issue. They are not to be confused with Desired Future Conditions which will be developed later in the process and are associated with discrete management areas. A few of the issues, such as "Climatic/Atmospheric Regime", do not have an associated description of desireable conditions associated with them. This is because they are part of the environment over which we have little control, but must understand in order to successfully manage complex ecosystems.

3. Key Questions- Key questions relevant to each issue are presented. These are questions which are addressed by the analysis. Some involve descriptions of existing conditions, while others may relate to processes and interactions which affect the issue.

## TERRESTRIAL AND AQUATIC ECOSYSTEM HEALTH

GENERAL ISSUE: Health of the aquatic and terrestrial ecosystem as measured by biological and physical processes, conditions, and functions. Those biological and physical elements of concern for this watershed include the following:

Physical Elements (P)
Geologic/Geomorphic Setting
Climatic/Atmospheric Regime
Hydrologic Regime
Fire Regime
Sediment Regime
Soil Processes and Productivity

Biological Elements (B)
Biodiversity
Insect and Disease
Connectivity
Population Viability

SUB-ISSUE: 1 Geologic and Geomorphic Setting: Unique Geologic Features

Issue Statement- Deciphering the geologic/geomorphic history of the Beaver and Palmer Watersheds is crucial to understanding the ecosystem; how it evolved, how it functions today, and how it is influenced by human activity. This requires identifying the geologic and geomorphic processes which shaped the modern landscape, and understanding the ways in which human activity affects these processes. Some unique geologic features have been identified in the watershed....

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Attributes that will be discussed include plate tectonic processes which brought a variety of different rock types to their present locations, intrusion of granitic rock, and episodes of mountain building and erosion which formed the mountains and valleys. Processes affecting the unique geologic areas will be identified, and the effects of human activities evaluated. Objectives for the unique geologic areas will be to maintain natural physical and biological processes which led to their formation.

Key Questions:

1. What is the origin of the broad variey of rock types in the project area, and how does rock type influence landform, soils, and vegetation? Where are the different rock types located?
2. How did modern landforms develop, and how does landform influence soil, vegetation, and sediment production? Where are these landforms located, and what proportion of the watershed do they comprise?

**SUB-ISSUE 2: Slope Stability**

Issue Statement - Understanding the natural processes affecting instability, rates of instability, distribution of landslides and what activities have affected slope instability and erosion are crutial in our knowledge of how and where stream channels and aquatic species habitats might be impacted over time. To understand how these processes and activities affect slope stability requires reviewing where and when landsliding occurred, what triggered the slides and how man's activities have influenced slope stability in each stratification unit.

Preliminary Objectives (parameters or attributes to be analyzed)

A. Attributes that will be discussed in the analysis include a description of where landslides occur, natural processes affecting stability, relative landslide rates, and sediment delivery potential.

B. Describe how climate, fires, aspect, vegetation, weather and floods affect slope stability.

C. Discuss how activities and peak flow events affect stability, stream channel and aquatic habitat.

D. Describe types of erosion and where it is occurring.

**Key Questions:**

1. Where are the unstable slopes, and how much sediment is being delivered?
2. What are the natural processes and the rates of instability?
3. What are the processes affecting instability for each geomorphological unit?
4. How do peak flow events affect the slope stability, stream channels, and habitats for aquatic species in the Beaver and Palmer watersheds.
5. What activities have affected slope stability? Where?
6. Where/what types of erosion are occuring?

SUB-ISSUE 3: Climatic/Atmospheric Regime

Issue Statement- Identification of the atmospheric/climatic regimes under which the ecosystem of the Beaver and Palmer Watersheds have developed. This includes identification of periods of flood, drought, storm patterns in winter and summer, occurrence of severe lightning and wind storms.

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Attributes that will be discussed in the analysis include wet/dry periods, current climatic regimes, period of intense storms, rain on snow events, etc.

Key Question:

1. What is the historical pattern of floods and droughts? (Disturbance regime and historical range of variability step)

SUB-ISSUE 4: Stream Flow Regimes

Restoration and/or maintenance of in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats including fish passage, and to retain patterns of sediment, nutrient, and wood routing (P1, P2, P5).

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Attributes that need to be analyzed are 1 to 2 year storm events (bank full storm event) and low flows. Bankful storm events have been determined to be the long term channel forming and maintenance event.

Function: Timing and distribution of flow in low flow, bankful and major storm events.

Key Questions:

1. What is the character, timing, and distribution of major storm events and low flow in the watersheds?
2. Have low flow, bankful or flood events affected habitat for aquatic species?

SUB-ISSUE 5: Water Chemistry

Restoration and/or maintenance of water quality necessary to beneficial uses and that support healthy riparian, aquatic, and wetland ecosystems.

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Keeping water quality within the range desired for the aquatic species.

B. Attribute that needs to be addressed, if possible, concerns bacteria levels in association with domestic uses.

Function: Nutrient Supply

Key Question:

1. What is the chemical composition of the water and what effect does it have on the aquatic species and domestic water use?

SUB-ISSUE 6: Sediment Regime

Restoration and/or maintenance of the sediment regime more consistent with the historical range of variability.

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Sediment regime attributes will be discussed in terms of landsliding, soil erosion, and channel erosion. The key attributes for these processes that will be addressed in the analysis are timing, volume, rate, character, and routing.

Function: Landslide, sruface erosion and channel erosion

Key Question:

1. How does sediment affect the channel morphology and aquatic habitat?

**SUB-ISSUE 7: Riparian Vegetation and Riparian Reserves**

Issue Statement- Riparian areas comprise unique communities of plants and animals which form an important element of the ecosystem. The President's plan identifies "Riparian Reserves" as part of the aquatic conservation strategy. Protection of these lands is essential for healthy aquatic habitat.

Preliminary Objectives (Parameters or Attributes to be Analyzed)-

Riparian function, FEMAT definitions, vegetative types, links to other resources.

Function: Canopy Cover/Shade

Key Question:

1. Does existing vegetation maintain an 80% canopy cover?

Function: Coarse Woody Debris Recruitment

Key Question:

2. What is the existing and potential supply for coarse woody debris (CWD) recruitment? Is this adequate for sustaining a diversity of species?

**SUB-ISSUES 8: Viabililty of Fish Populations**

Maintenance of viable populations of individuals of all life stages throughout the watershed for all anadromous and resident fish.

Restoration and protection of aquatic habitat for all anadromous and resident fish.

Restoration and/or maintenance of spacial and temporal connectivity within and between watersheds.

Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Maintain viable popluations of anadromous coho salmon and summer and winter steelhead, as well as resident rainbow and cutthroat trout.

B. Keeping water temperatures within the range desired for the aquatic species. Lower stream temperatures, short term: attain a summer seven day average of the maximum daily stream temperature less than 68 degrees F. throughout the basin. Long term: reduce maximum daily temperature to historic levels which pre-date European settlement.

C. Recreate and maintain an even distribution of age classes of of vegetation in the watershed, ultimately allowing no more than 25 percent of the basin in age classes than 30 years of age.

D. Recreate and maintain the mature age classes within the riparian zones. Mimic the "natural" climatic and ecological conditions of those sites.

E. Attain an average of 80 pieces of large and small wood per mile of stream channel on Federals lands. This may require the introduciton of LWM in the stream.

F. Recreate and maintain width/depth ratios of less than 10:1.

G. Create and/or maintain 25 pools per mile of stream channel and maintain a pool/riffle ratio approaching 40/60.

Function: Diverse Fish Species

Key Question:

1. Do the watersheds contain a diversity of fish species?
2. What importance do the Beaver and Palmer watersheds have on downstream fisheries, i.e., Applegate River, Rogue River?

Function: Diverse Habitat

Key Question:

3. What is the range of variability for the following attributes: coarse woody debris, pool/riffle ratio, width/depth ratio, canopy cover?

Function: Water Temperature

Key Question:

4. What is the optimal temperature conditions for salmonids?

Function: Embeddedness

Key Question:

5. Is the streambed substrate more than 35% embedded with fine sediment?

Function: Connectivity of Habitat

Key Question:

6. Is habitat connectivity needed to have a viable populations of fish?

Function: Macroivertebrates

Key Question:

7. Does an adequate and diverse population of macroinvertebrates (insects) exist?

**SUB-ISSUE 9: Soil Productivity**

Restoration and/or maintenance of soil conditions to assure long term productivity of the ecosystem.

**Preliminary Objectives (Parameters or Attributes to be Analyzed)**

A. Attributes to be addressed in the analysis are current soil conditions and a discussion of potential, in terms of productivity.

Key Questions:

1. What is the current status of woody material by site? what is the range of natural variation for woody material by site?
2. What activities affect soil biology and chemistry as measured by the loss of duff layers and compaction? Where do the activities occur?
3. What percent of the analysis area has been impacted by compaction? What % of the area has been impacted by the loss of duff layer.

## SUB-ISSUE 10: Terrestrial Vegetative Elements: Insects and Disease

Issue Statement- Vegetative elements comprise a primary part of the terrestrial ecosystem. Understanding of the nature, distribution, and processes of vegetative change are needed for ecosystem management. Insect infestations and plant disease form an important component of the ecosystem and influence vegetative patterns.

Preliminary Objectives (Parameters or Attributes to be Analyzed)-

Understanding of the composition and evolution of terrestrial vegetation as follows:

1. Matrix Vegetation: Douglas-fir, Mixed Conifer
2. Patches.
3. Corridors

Maintenance of plant disease and insect populations at levels more consistent with the historical range of variability.
Attributes to discuss in the analysis include vegetation characteristics conducive to disease and insect epidemics and identification of current problem areas: Insects and Diseases; Conifer mortality; Implications to the current situation.

Key Questions-

1. What are the terrestrial vegetative patterns in the Beaver and Palmer Watersheds? What vegetative groupings are useful in ecosystem analysis?
2. Where do mature forest/riparian corridors exist?
3. What are some the primary insects and diseases found within the watershed? (Flows step)
4. Are there some problem areas in terms of insect or disease epidemics within the watershed? (Flows and interaction step)
5. Are there some vegetative conditions that are promoting the increase of insect and disease problems? (Interaction step)
6. Are there any opportunities to control the spread of some of the problem areas and bring the landscape, as a whole, into an acceptable range of conditions? (objective step)
7. What is the distribution, character, and severity of plant diseases and insect infestations in the watershed? (Flows step)
8. Where have insect infestations and plant disease occurred? Is this a "normal occurrence"?.
9. What are the limiting factors on vegetative establishment, survival, and growth.
10. What are the mechanisms for vegetative disturbance in the Beaver and Palmer Watershed.
11. What kinds of vegetation can be established on various soil types? (Interaction step)
12. Where are areas that are not currently at site potential? (Element step) What measures can be taken to restore/rehabilitate these disturbed sites?
13. What is the current site productivity with the analysis area? (Element step)
14. What are the limiting factors for vegetation development on various soil types? (Interaction step)
15. What can be done to enhance or maintain certain vegetative elements within the analysis area? (Management opportunity step)

## SUB-ISSUE 11: Fire Regime

The analysis of the role of fire in the ecosystem is extremely important in southwest Oregon, considering the unique climate and vegetative conditions which influence fire management in this area. For a discussion of fire's influence on resources, fire risk is defined as the chance of various potential ignition sources (lightning, human caused, etc.) causing a fire, threatening valuable resources, property, and life. The chance of a fire starting is determined by hazards present. Fire hazard is a fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition, spread, and difficulty of suppression.

Meet air quality regulations for Class __ airshed.

**Preliminary Objectives (Parameters or Attributes to be Analyzed)**

A. Attributes that will be addressed and analyzed for fire processes, functions, and conditions will be fuel type and patterns, fire occurrence, fire intensities, fire sizes, fire timing, and fuel modeling (slope and aspect), resource values at risk, and fire risk.

B. The attributes that will need to be addressed for air quality within the analysis will be particulates and compliance with federal and state laws and regulations.

Key Questions:

1. What is the current fire regime? (Flows step)
2. What has been the effect of suppression on the identified attributes? What are the effects of dying vegetation on fire potential? (Disturbance regime and interaction step)
3. What is the historic fire occurrence and the timing of historic events? (Disturbance regime step)
4. How does air quality differ from historical regimes and current suppression regimes? (Disturbance regime and flows step)
5. What was the scope of stand replacing fires under the historical regime? (Disturbance regime step)
6. What is the current air quality condition? (Flows step)
7. How will achieving a more historic regime for fire affect particulate requirements? (Disturbance regime step)
8. What is the potential particulate emission with the current situation? (Trends step)
9. What is the current fire regimes effect on sediment and stream flow as compared to the historical fire regime? (Disturbance regime, historical range of variability, and general trends steps).

## SUB-ISSUE 12: Viability of Terrestrial Species

Maintenance of well-distributed, suitable habitat for fisher, marten, northern spotted owl, black tailed deer, Roosevelt elk, northern goshawk, Siskiyou mountain salamander, western pond turtles, red legged frog, bats, and large carnivores. Other species include neo-tropical migratory birds, resident birds (winter and summer), and small mammals.

Restoration and/or maintenance of spacial and temporal connectivity within and between watersheds.

## Preliminary Objectives (Parameters or Attributes to be Analyzed)

A. Older seral stage dependent species: The analysis will focus on habitat required for reproduction, foraging, and other life cycle functions of the previously identified late seral stage species. Habitat attributes that ultimately need to be addressed include: stand structure, dead and down material, snags, and canopy closure. The desired condition, amounts and arrangements of these attributes can be described, however, and that will be incorporated later in this document.

B. Species which use a variety of habitats: The analysis will focus on habitat required for reproduction, foraging, and other life cycle functions. Attributes that need to be addressed during the analysis for wide ranging species include: size of openings in forested areas, distance to cover from openings, cover/forage ratio, quality of foraging areas. The ability to assess the current condition for some of these attributes at the landscape level is limited. The desired condition, amounts, and arrangement of these attributes can be described, however, and that description will be incorporated later in this document (Step 5).

Key Questions

1. What is the current habitat situation for those species highlighted in the sub-issue statement? (Elements and interaction steps)
2. What is the desired habitat conditions for those species highlighted? What are the site capabilities for producing this habitat? (objective step)
3. What are the habitat use patterns for these species? (Flows and linkages step)
4. Are there any barriers to movement or is there adequate connectivity between habitat blocks? (Elements, flows, and forest plan landscape patterns and objective steps)
5. What dispersal habitat is available? (Elements, interaction, and objective steps)
6. Where do these species exist? Where are the protected species habitats located? What restrictions apply? (Flows step)
7. Is this the appropriate scale for addressing a range of viable population levels; i.e., defining a desired range of population levels. (If addressed, it will be in the forest plan landscape patterns and objective step)
8. What are some of the limiting factors to maintaining the highest quality habitat? (Interactions and disturbance regime steps)
9. What can be done to enhance or maintain certain habitat elements? (Management opportunities step)
10. What are conflicting uses connected to commodity extraction?

11. What are conflicts with managing for wildlife and cows? other wildlife? humans? (recreation, other comodoties)

## SOCIO - ECONOMIC ISSUES

## THE HUMAN ELEMENT

ISSUE: The human relationships and economic considerations need to be addressed for the Beaver and Palmer Watershed. These considerations have been put into two categories that need to be addressed:

1. Differing values by the wide range of public interests,
2. How these analysis areas contribute to the economic stability of the Rogue Valley.

SUB-ISSUES:

Provide for the diversity of human uses and values through appropriate laws, regulations, and land use allocations.

Identification of opportunities to manage human uses and activities that are consistent with ecosystem function and processes.

Identification of cultural resource sites, concerns, issues, and history.

### Preliminary Objectives (Parameters or Attributes to be Analyzed)

There are many human related attributes that need to be addressed in the analysis. Human use, expectations, and values can be broken down into categories of recreation, private, commodity, and contemporary native American.

A. Recreation attributes include fishing, dispersed use, developed camp grounds, visual quality, hunting, winter sports, ORV use, horse back riding, mountain biking, etc.
B. Private attributes include transportation systems, water uses, mining, urban interface, utility corridors, etc.
C. Commodity attributes include local employment, timber harvest, grazing, biomass production, rock quarrying, mining, watershed restoration activities, road systems, jobs, etc.
D. Contemporary native American attributes include subsistence collecting, spiritual areas, prehistoric sites, etc.
E. Other attributes that need to be considered include historic sites, law enforcement, poaching, unauthorized uses, etc.(illegal uses).

Key Questions:

1. What are historical uses? (Disturbance regime and historical range of variability step)
2. What are current uses? (Flows step)
3. Are current uses sustainable? (We weren't sure whether this could be answered in the analysis)
5. What is the current condition of current transportation system, roads and trails? (Element step)
6. Are there areas within the current transportation system which may be aggravating physical or biological conditions, processes, and functions? (Interaction step)
7. Identify conflicts arising from the intermixed human uses and values? (objective step)

8. What seasonally available foods and materials (special forest products) are available within the Watershed Analysis area? (Elements and flows steps)
9. What were the patterns of aboriginal burning in the Watershed Analysis area? What areas were burned, when and for what purposes? (Historical perspective step)

SUB-ISSUE: Potential for Wild and Scenic River Designation

Objective Statement: Potential for Wild and Scenic River designation must be completed for all streams on the Forest.

**Key Questions: Not incorporated into Analysis; the Applegate Ranger district has gone through a process on this subject (needs to become a part of this document).**

1. What is the potential for Wild and Scenic designation for Palmer Creek as measured by the presence of outstanding, remarkable values?
2. What is the potential for Wild and Scenic designation for Beaver Creek as measured by the presence of outstanding, remarkable values?

**It must be remembered that many of these issues overlap with each other. Even though specific issues were highlighted as addressing certain elements, one must remember that there are interactions occurring amongst all the elements. All of these issues will be tracked through the entire analysis and interactions, functions, processes, and conditions may be discussed beyond those highlighted in this issues package.**