# *West Bear Creek Watershed Analysis*

Version 1.1

Bureau of Land Management, Medford District
Ashland Resource Area

August 2001

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# EXECUTIVE SUMMARY

## Introduction

Watershed analysis is the primary tool for generating information to implement ecosystem management as directed in the Northwest Forest Plan and the Medford District Resource Management Plan. The West Bear Creek Watershed Analysis describes conditions and interrelationships of ecosystem components for the West Bear Creek Watershed Analysis Area. The analysis focuses on issues and key questions that are most relevant to the management questions, human values, and resource conditions within the analysis area. Management objectives and recommendations for Bureau of Land Management (BLM)-administered lands are prioritized based on conclusions reached through the analysis. The watershed analysis formulates an overall landscape plan for BLM-administered lands and recognizes the inventory, monitoring, and research needs for the analysis area.

The West Bear Creek Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the BLM Ashland Resource Area and Medford District Staff. The watershed analysis team followed the six-step process outlined in the *Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, version 2.2.* The six steps or sections included in the West Bear Creek Watershed Analysis are: 1) characterization, 2) issues and key questions, 3) current conditions, 4) reference conditions, 5) syntheses and interpretation of information, and 6) recommendations.

The West Bear Creek Watershed Analysis addresses the entire analysis area and is based on existing information and recent data collection. Where resource information is missing, a data gap is identified. The watershed analysis process is iterative and new information will be used to supplement future versions of the analysis.

Public participation for the West Bear Creek Watershed Analysis included a public meeting on March 14, 2001 and the opportunity to submit written and/or verbal comments. Approximately 400 notices regarding the open house were sent to residents within the analysis area, local agencies, local groups, and the Klamath Tribe, the Quartz Valley Indian Reservation, the Cow Creek Band of Umpqua Indians, the Shasta Nation, the Confederated Bands Shasta Upper Klamath Indians, the Confederated Tribes of Siletz and Grand Ronde, and the Confederated Tribes of the Rogue-Table Rock and Associated Tribes. The notice provided a map of the area, explained the watershed analysis process, and included a comment form for people to mail if they couldn't attend the open house. The open house was held at the Naval Reserve Center near Medford, Oregon. The purpose of the open house was to give the public the opportunity to share with the watershed analysis team their ideas, concerns, information regarding the historic or current conditions, and recommendations on how the analysis area should be managed. In addition to comments received at the open house, the BLM received 16 comment letters concerning the West Bear Creek Watershed Analysis Area. BLM staff were also available to answer questions on this watershed analysis at the South Rogue-Gold Hill watershed analysis meeting on March 13, 2001.

**Watershed Characterization**

The West Bear Creek Watershed Analysis Area covers approximately 93 square miles (59,566 acres) in the Klamath Mountains in southwestern Oregon. The analysis area includes lands west of Bear Creek from Wagner Butte to just north of Central Point. Major streams in the analysis area are Wagner, Anderson, Coleman, Griffin, Jackson and Willow Creeks.

Land ownership within the West Bear Creek Watershed Analysis Area includes: Bureau of Land Management (8,299 acres), U.S. Forest Service (2,821 acres), and private lands (47,946 acres). Federal land use allocations include: Matrix, Riparian Reserves, Late-Successional Reserve, Special Areas (Holton Creek Natural Resource Area), and a designated OHV area (John's Peak/Timber Mountain).

Regional public issues reflect the dominant uses of the analysis area and include: concerns with recreational activities, such as off-highway vehicle use; concerns with timber harvest on public lands; concerns over general degradation of the natural environment; and concerns about fish and water quality. Public concerns more specific to this analysis area include: urban interface issues, especially issues of wildfire, fire protection, and smoke; the spread of noxious weeds; and timber harvest.

The West Bear Creek Watershed Analysis Area is characterized by mild, wet winters and hot, dry summers. A majority (72 percent) of the analysis area is classified as having a low severity fire regime characterized by frequent, low intensity fires while the remainder has a moderate fire regime with less frequent fires of varying intensity.

The analysis area straddles the contact between the eastern edge of the Klamath Mountains (also called the Siskiyou Mountains) and the Western Oregon Interior Valley (physiographic) Province. The geology of the analysis area can be briefly described as eroding metamorphic and granitic uplands with minor amounts of sedimentary deposits draping the lower slopes.

Thirty percent of the analysis area is urban/agricultural mix with the largest urbanized areas in the northeast and southeast portions. The remainder of the watershed analysis area has forest matrix with patches of grassland and other non-forest vegetation types. The most common plant associations in the analysis area include Douglas-fir (PSME)/Poison Oak (RHDI); PSME/RHDI - Piper's Oregongrape (BEPI); PSME/Dwarf Oregongrape (BENE); Ponderosa Pine (PIPO) - California Black Oak (QUKE); PIPO - PSME; and a small area of white fir tree series within the southern tip of the analysis area. Tree species in the forest lands include ponderosa pine, incense cedar, Douglas-fir, and white fir. There are 31 populations (nine species) of special status vascular plants known to exist within the analysis area and seven sites (three species) of Survey and Manage plants. Noxious weed species known to occur within the analysis area include yellow starthistle, Canada thistle, spotted knapweed, St. Johnswort (Klamath weed), and medusahead. Other non-native species that have been seen in the analysis area are ripgut brome, softchess, cheatgrass, bulbous bluegrass, and orchard grass.

Northern spotted owls, listed as threatened under the Endangered Species Act (ESA) of 1973, are present in the analysis area. A portion of the analysis area is in a northern spotted owl critical habitat unit. Twenty-four special status species are known or suspected, based on known range and availability of suitable habitat, to be present in the analysis area.

Fishery resources in the West Bear Creek Watershed Analysis Area include anadromous (summer steelhead and fall chinook) and resident (rainbow trout and sculpin) species. Eleven known fish barriers limit fish movement within the streams.

Water quality limited streams identified by the Oregon Department of Environmental Quality in 1998 as not meeting the state temperature standard include the following streams within the West Bear Creek Watershed Analysis Area: Wagner, Coleman, Griffin and Jackson. Coleman, Griffin, and Jackson Creeks do not meet the state temperature standard for bacteria.

**Human Uses**

Two radically different patterns have characterized land use in the West Bear Creek Watershed Analysis Area. For thousands of years, indigenous people followed a hunting-fishing-gathering way of life, based on a small-scale, subsistence-oriented economy. Approximately 150 years ago, the advent of Euro-American settlement brought fundamentally different land use patterns based on complex technologies and an economic system connected to global markets.

The last 150 years have contributed to substantial changes in the landscape of the analysis area. In the nineteenth century, newcomers cleared land for ranches and for fuelwood; introduced a host of new plant (agricultural crops and weeds) and animal (farm and ranch animals) species; plowed under native meadows for farms; dammed, diverted, and channelized streams; and hunted unwanted predators (grizzly bears and wolves) and other species (antelope and bighorn sheep) to local extinction. In the twentieth century logging has expanded with the post-World War II explosion of roads and improvements in transportation; fire suppression has affected the local vegetation; and a host of state, federal, and local policies guide human operations on both public and private lands.

The effects of these actions are written on the land: the hydrology of the analysis area has been altered through irrigation, water withdrawals, dams, roads, channelization, and other actions; erosion is more severe in some places than in the past; soil productivity has been affected in some areas by compaction, hot fires, and changes in vegetation patterns; vegetation patterns have been altered through agriculture, fire suppression, grazing, and other actions; topography has changed in places through the construction of quarries and roads, and stream alterations; and native species (plants and animals) have disappeared or become reduced through a number of human actions or through competition with non-native species.

The twentieth century has witnessed the advent of federal land management policies that affect a portion of the analysis area's lands. The advent of ecosystem management suggests a shift from an extractive perspective to one combining economic concerns with stewardship practices. Fire suppression policies have operated with timber harvest to change the character of the forests in the analysis area, and numerous laws and regulations now guide human actions on these federal lands. Unauthorized uses, such as illegal dumping, have greatly increased in the analysis area.

**Terrestrial Ecosystem**

Fire suppression, plant succession, logging, road building, vegetation conversion for agricultural uses, livestock grazing, and the introduction of non-native plants are the main processes that have designed the landscape since the turn of the century. Results stemming from these processes include: increased forest stand density with a low level of growth or vigor; increased susceptibility of forest stands to bark beetle attacks and pathogens; a change in the species composition and structure of forest lands, grasslands, shrublands, and oak woodlands; and habitat alteration of shrublands, oak woodlands, and savannahs. These changes have caused an increase in fire hazard and a shift in the intensity and effects of wildfires when they occur. Current trends in silvicultural and prescribed fire practices are focusing on restoring and maintaining vegetative communities to a more fire resilient, native vegetation condition.

Vegetative conditions are the primary influence on terrestrial wildlife/animal populations and their distribution within the analysis area and across the greater landscape. Declines in mature/old-growth habitat and the quality of early and mid-seral conifer, oak woodland, shrubland, and grassland habitat have likely contributed to the decline of populations of wildlife species that prefer these habitats. The decrease in mature/old-growth habitat is likely to have resulted in lower populations of northern spotted owl and some special status species.

**Aquatic Ecosystem**
The streamflow regime reflects human influences that have occurred since Euro-Americans arrived. Road construction, timber harvest, land development, and water withdrawals are the major factors having the potential to adversely affect the timing and magnitude of both peak and low streamflows in the analysis area. Vegetation removal and soil compaction are the major causes of changes to hydrologic processes such as infiltration, interception, and evapotransporation.

Channel conditions, water quality, and riparian habitat in the West Bear Creek Watershed Analysis Area have changed considerably in the last 150 years primarily due to human activities such as logging, road building, removal of riparian vegetation, channelization, beaver removal, poorly managed livestock grazing, irrigation development, and land alteration for agriculture and residential developments. Some of the results are fragmented connectivity of riparian habitat; reduced quantity of snags and large woody material; reduced streambank stability; increased sediment production to streams; and reduced stream shading. Lack of riparian vegetation and water withdrawals have contributed to increased stream temperatures that can stress aquatic life and limit the long-term sustainability of fish and other aquatic species. Sediment is mainly transported to streams from landslides (natural and human-caused), road surfaces, fill slopes, and ditchlines. The combination of these factors have contributed to reduced stream channel complexity and stability resulting in poorer quality habitat for aquatic species and an increased susceptibility to streambank erosion.

Riparian Reserves along intermittent, perennial non-fish-bearing, and fish-bearing streams on BLM-administered lands will help to provide a future source of large woody material for streams, improve stream shading, and increase the potential for wildlife use. Overall, the interrelated aquatic and riparian habitats in the analysis area are in marginal to poor condition and are below their potential for fish production. Much of the habitat lacks quality pools and large woody material necessary for maintenance of pools, cover, spawning material, and bank stability. High degrees of sedimentation are also a problem, especially in areas with granitic soils. The over-allocation of water in the analysis area is a problem not likely to diminish.

# INTRODUCTION

## Objective of the Watershed Analysis

The West Bear Creek Watershed Analysis documents conditions and interrelationships of ecosystem components for the analysis area. It describes the dominant features and physical, biological, and social processes within the analysis area. The document compares prehistorical (before 1850) and historical (reference) conditions with current ecosystem conditions and discusses the development of current conditions and future trends. It also ranks management objectives and recommendations for Bureau of Land Management (BLM)-administered lands as high, medium, or low priority, and directs development of a landscape plan for BLM-administered lands. This document is intended to guide subsequent project planning and decision making in the West Bear Creek Watershed Analysis Area. This document is not a decision document under the National Environmental Policy Act (NEPA) and there is no action being implemented with this analysis. Site-specific analysis incorporating the NEPA process would occur prior to any project implementation on BLM-administered lands.

## How The Analysis Was Conducted

The West Bear Creek Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the BLM Ashland Resource Area and Medford District Staff (see List of Preparers). Group discussions identified linkages among resources and resulted in an integrated, synthesized report.

Guidelines used in the preparation of the West Bear Creek Watershed Analysis include: the *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* (USDA and USDI 1994a) (these two documents are combined into the Northwest Forest Plan), and *Ecosystem Analysis at the Watershed Scale:* Federal Guide for Watershed Analysis, Version 2.2 (USDA et al. 1995). The analysis also refers to the *Medford District Resource Management Plan* (USDI, BLM 1995).

The West Bear Creek Watershed Analysis is based on existing information and addresses the entire analysis area, although recommendations are only made for BLM-administered lands. Where resource information is missing, a data gap is identified. Data gaps are prioritized and listed in a separate section; missing information will be acquired as funding permits. The analysis process is dynamic and the document will be revised as new information is obtained. Types of new information may include resource data collected at the project level and monitoring data. An updated version of this document will be issued when new data and information collected indicate important changes in watershed conditions or trends.

## Document Organization

The organization of this document follows the format described in the *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis,* Version 2.2 (USDA et al. 1995). The Issues and Key Questions focus on the key ecosystem elements most relevant to the management questions and objectives, human values, or resource conditions within the analysis area.

The Characterization section identifies the dominant physical, biological, and human processes or features of the analysis area that affect ecosystem functions or conditions. The Current Conditions section details current conditions of the physical, biological, and human ecosystem elements. The Reference Conditions section describes how ecological conditions have changed over time as a result of human influences and natural disturbances in the West Bear Creek Watershed Analysis Area. The Synthesis and Interpretation section compares existing and reference conditions of specific ecosystem elements and explains significant differences, similarities, or trends and their causes. The Management Objectives and Recommendations section identifies management objectives for BLM-administered lands within the analysis area and prioritizes management activities to achieve the objectives. The Landscape Planning section synthesizes resource data to create landscape objectives and recommendations for BLM-administered lands. Prioritized data gaps and monitoring and research needs are included in separate sections.

Maps are grouped together and placed at the end of the document. All maps for the watershed analysis were generated using BLM Medford District geographic information systems (GIS).

**Public Involvement**

Public participation for the West Bear Creek Watershed Analysis included a public meeting on March 14, 2001 and the opportunity to submit written and/or verbal comments.

An open house was held on March 14, 2001 at the Naval Reserve Center near Medford, Oregon. The purpose of the open house was to give the public the opportunity to share with the watershed analysis team their ideas, concerns, information regarding the historic or current conditions, and recommendations on how the analysis area should be managed. In addition to comments received at the open house, the BLM received 16 comment letters concerning the West Bear Creek Watershed Analysis Area. BLM staff were also available to answer questions on this watershed analysis at the South Rogue-Gold Hill watershed analysis meeting on March 13, 2001.

Written comments received and verbal comments recorded at the open house meeting are summarized in Appendix A.

# ISSUES AND KEY QUESTIONS

The Issues and Key Questions focus the analysis on the ecosystem elements that are most relevant to the management questions and objectives, human values, or resource conditions within the analysis area.

## HUMAN USES

**Characterization**

1. What are the land ownership patterns and land allocations in the analysis area?
2. What are the major ways in which humans interact with the analysis area?
3. Where are the primary locations for human use of the analysis area?
4. What are the regional public concerns that are pertinent to the analysis area (e.g., air quality, environmental degradation, commodity production, etc.)?
5. What are the public concerns specific or unique to this analysis area?
6. Are there treaty or tribal rights in the analysis area?
7. Are there tribal issues and concerns in the analysis area?
8. What road types are in the analysis area and where are they located?

**Current Conditions**

1. Who are the people most closely associated with and potentially concerned about the analysis area?
2. What are the current human uses and trends of the analysis area (economic, recreational, other)?
3. What is the current and potential role of the analysis area in the local and regional economy?
4. What are the current conditions and trends of relevant human uses in the analysis area:
   a. government facilities, structures, and communication routes
   b. authorized and unauthorized uses
   c. transportation system
      i. What are the current road conditions?
      ii. What are the open and closed road densities (by road type) and where are high road densities located?
   d. logging
   e. special forest products
   f. grazing/agriculture
   g. minerals
   h. recreation
   i. cultural resources

**Reference Conditions**

1. How did native people interact with the environment?
2. What changes in human interactions have taken place since historic contact and how has this affected the native ecosystem?
3. What are the major historical human uses in the analysis area, including tribal and other cultural uses?
4. What is the history of road development and use in the analysis area?

***Human Uses continued***

**Synthesis and Interpretation**

1. What are the causes of change between historical and current human uses?
2. What are the influences and relationships between human uses and other ecosystem processes in the analysis area?
3. What human effects have fundamentally altered the ecosystem?
4. What are the anticipated social or demographic changes that could affect ecosystem management?
5. What human interactions have been and are currently beneficial to the ecosystem and can these be incorporated into current and future land management practices?
6. What are the influences and relationships between roads and other ecosystem processes?
7. How do road stream crossings affect water quality, instream habitat, and fish migration?

## CLIMATE

**Characterization**

1. What are the climatic patterns in the analysis area?

## GEOLOGY AND GEOMORPHOLOGY

**Characterization**

1. What is the origin of the broad variety of rock types in the analysis area and where are they located?
2. How did the rock types influence landforms, soils, and vegetation?

## EROSION PROCESSES

**Characterization**

1. What erosion processes are dominant within the analysis area?
2. Where have they occurred or are they likely to occur?

**Current Conditions**

1. What are the current conditions and trends of the dominant erosion processes prevalent in the analysis area?

**Reference Conditions**

1. What are the historical erosion processes within the analysis area?
2. Where have they occurred?

**Synthesis and Interpretation**

1. What are the natural and human causes of changes between historical and current erosion processes in the analysis area?
2. What are the influences and relationships between erosion processes and other ecosystem processes?

## SOIL PRODUCTIVITY

**Characterization**

1. How critical/vulnerable is soil productivity in the analysis area?

***Soil Productivity continued***

**Current Conditions**

1. What are the current conditions and trends of soil productivity?
2. What areas are most vulnerable to soil productivity loss by management actions?

**Reference Conditions**

1. What were the historical soil productivity characteristics?

**Synthesis and Interpretation**

1. What are the natural and human causes of change between historical and current soil productivity conditions?
2. How do natural disturbances affect long-term soil productivity?
3. What are the relationships between soil productivity and other ecosystem processes?

## LANDSCAPE VEGETATION PATTERN

**Characterization**

1. What is the array and landscape pattern of native and non-native plant communities and seral stages in the analysis area?
2. What is the percent composition of the vegetation condition classes over the landscape?
3. What processes caused these patterns?

**Reference Conditions**

1. What is the historical array and landscape pattern of plant communities and seral stages in the analysis area?
2. What processes caused these patterns?

**Synthesis and Interpretation**

1. Have non-native species and noxious weeds changed the landscape pattern of native vegetation?

## PLANT SPECIES AND HABITATS

**Characterization**

1. Non-native Species and Noxious Weeds
    a. What is the relative abundance and distribution of non-native plants and noxious weeds?
    b. What is the distribution and character of their habitats?
2. Special Status Plant Species and Habitats
    a. What is the relative abundance and distribution of special status vascular plant species?
    b. What is the distribution and character of their habitats?
3. Survey and Manage Species and Habitats
    a. What is the relative abundance and distribution of survey and manage plant species?
    b. What is the distribution and character of their habitats?
4. Special Areas with Botanical Resources
    a. What are the values of the Special Areas in the analysis area?

***Plant Species and Habitats continued***

**Current Conditions**

1. Non-native Species and Noxious Weeds
   a. What are the current habitat conditions and trends for non-native species and noxious weeds?
2. Special Status Plant Species and Habitats
   a. What are the current habitat conditions and trends for special status vascular species?
3. Survey and Manage Species and Habitats
   a. What are the current habitat conditions and trends for survey and manage species?
4. Special Areas with Botanical Resources
   a. What are the current conditions of the Special Areas in the analysis area?

**Reference Conditions**

1. Non-native Species and Noxious Weeds
   a. What was the historical relative abundance and distribution of non-native species and noxious weeds and the condition and distribution of their habitats in the analysis area?
2. Special Status Plant Species and Habitats
   a. What was the historical relative abundance and distribution of special status vascular species and the condition and distribution of their habitats in the analysis area?
3. Survey and Manage Species and Habitats
   a. What was the historical relative abundance and distribution of survey and manage species and the condition and distribution of their habitats in the analysis area?
4. Special Areas with Botanical Resources
   a. What was the historical condition of the Special Areas in the analysis area?

**Synthesis and Interpretation**

1. Non-native Species and Noxious Weeds
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for non-native species and noxious weeds in the analysis area?
   b. What are the influences and relationships of non-native species and noxious weeds and their habitats with other ecosystem processes in the analysis area?
2. Special Status Plant Species and Habitats
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for special status vascular species in the analysis area?
   b. What are the influences and relationships of special status vascular species and their habitats with other ecosystem processes in the analysis area?
3. Survey and Manage Species and Habitats
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for survey and manage species?
4. Special Areas with Botanical Resources
   a. What are the natural and human causes of change between historical and current conditions of the Special Areas?

## FOREST DENSITY AND VIGOR

### Current Conditions

1. What are the current conditions and trends of the prevalent plant communities and seral stages in the analysis area?
2. What is the site index of the soils and how does it relate to present tree growth?
3. What vegetation condition classes are not meeting their growth potential?
4. What are the major mechanisms for vegetation disturbance?
5. Are there some vegetation condition classes promoting insect and disease problems?
6. Where are the tree insect and disease problem areas?

### Reference Conditions

1. What was the historical tree vigor and growth pattern?
2. Were tree insects and disease a problem historically?

### Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current vegetative conditions?
2. What are the influences and relationships between vegetation and seral patterns and other ecosystem processes in the analysis area?
3. Which processes or casual mechanisms are most likely responsible for similarities, differences, and trends?
4. What are the implications of the changes and trends, including the capability of the analysis area to achieve objectives from existing plans?
5. What are the reasons for differences between current and reference tree growth patterns?

## FIRE AND AIR QUALITY

### Characterization

1. What are the fire regimes?

### Current Conditions

1. What role does fire currently have?
2. What vegetation conditions are contributing to high fire hazard and risk?
3. What are the current fire hazards and risks?
4. What are the high values at risk that could be impacted by a wildfire?
   a. What are the risks to public health and safety?
5. How is air quality impacted by prescribed fire and wildfires?

### Reference Conditions

1. What was the historic role of fire within the analysis area?

### Synthesis and Interpretation

1. How have fire suppression efforts over the past 80 years caused changes between the historical and current role of fire?
2. How has the fire role change caused changes between historical and current vegetative species distribution?

# TERRESTRIAL WILDLIFE SPECIES AND HABITATS

**Characterization**

1. Wildlife Habitat - General
    a. What is the relative number of species, distribution and character of the various habitat types found in the analysis area?
2. Threatened and Endangered Species
    a. What is the acreage, distribution and character of habitat in the analysis area?
    b. What is the role of the designated critical habitat in the analysis area?
3. Special Status/Sensitive Species
    a. What is the amount, distribution and character of habitat for those special status species that are of management concern in the analysis area?
4. Survey and Manage Species
    a. What is the amount, distribution and character of habitat for the survey and manage species found in the analysis area?

**Current Conditions**

1. Wildlife Habitat - General
    b. What are the current habitat conditions and trends for the various habitat types found in the analysis area?
2. Threatened and Endangered Species
    a. What are the current habitat conditions and trends for the threatened and endangered species found in the analysis area?
    b. What is the current role of habitat in the analysis area?
3. Special Status/Sensitive Species
    a. What are the current habitat conditions and trends for the special status/sensitive species found in the analysis area?
4. Survey and Manage Species
    a. What are the current habitat conditions and trends for the survey and manage species found in the analysis area?

**Reference Conditions**

1. Wildlife Habitat - General
    a. What was the historical relative abundance, condition and distribution of the various habitat types found in the analysis area?
2. Threatened and Endangered Species
    a. What was the historical acreage, condition and distribution of habitat for threatened and endangered species in the analysis area?
    b. What was the initial role of habitat for threatened and endangered species in the analysis area?
3. Special Status/Sensitive Species
    a. What was the historical amount, condition and distribution of habitat for the special status/sensitive species found in the analysis area?
4. Survey and Manage Species
    a. What was the historical amount, condition and distribution of habitat for the survey and manage species found in the analysis area?

***Terrestrial Wildlife Species and Habitats continued***

**Synthesis and Interpretation**

1. Wildlife Habitat - General
   b. What are the implications of natural and human caused change between historical and current relative abundance, condition and distribution of the various habitat types found in the analysis area?
2. Threatened and Endangered Species
   a. What are the implications of natural and human caused change between historical and current acreage, condition and distribution of northern spotted owl habitat in the analysis area?
   b. What are the implications of the change in role of the northern spotted owl critical habitat in the analysis area?
3. Special Status/Sensitive Species
   a. What are the implications of natural and human caused change between historical and current amounts, condition and distribution of habitat for the special status/sensitive species found in the analysis area?
4. Survey and Manage Species
   a. What are the implications of natural and human caused change between historical and current amounts, condition and distribution of habitat for the survey and manage species found in the analysis area?

## HYDROLOGY

**Characterization**

1. What are the dominant hydrologic characteristics and other notable hydrologic features and processes in the analysis area?

**Current Conditions**

1. What are the current conditions and trends of the dominant hydrologic characteristics and features prevalent in the analysis area?

**Reference Conditions**

1. What were the historical hydrologic characteristics and features in the analysis area?

**Synthesis and Interpretation**

1. What are the natural and human causes of change between historical and current hydrologic conditions?
2. What are the influences and relationships between hydrologic processes and other ecosystem processes?

## STREAM CHANNEL

**Characterization**

1. What are the basic morphological characteristics of stream valleys or segments and the general sediment transport and deposition processes in the analysis area?

***Stream Channel continued***

**Current Conditions**

1. What are the current conditions and trends of stream channel types and sediment transport and deposition processes prevalent in the analysis area?

**Reference Conditions**

1. What were the historical morphological characteristics of stream valleys and general sediment transport and deposition processes in the analysis area?

**Synthesis and Interpretation**

1. What are the natural and human causes of change between historical and current channel conditions?
2. What are the influences and relationships between channel conditions and other ecosystem processes in the analysis area?

## WATER QUALITY

**Characterization**

1. What beneficial uses dependent on aquatic resources occur in the analysis area?
2. Which water quality parameters are critical to these uses?

**Current Conditions**

1. What are the current conditions and trends of beneficial uses and associated water quality parameters?

**Reference Conditions**

1. What were the historical water quality characteristics of the analysis area?

**Synthesis and Interpretation**

1. What are the natural and human causes of change between historical and current water quality conditions?
2. What are the influences and relationships between water quality and other ecosystem processes in the analysis area?

## RIPARIAN AREAS

**Characterization**

1. What is the array and landscape pattern of plant communities in the riparian areas?
2. What processes caused these patterns?
3. What riparian-dependent species are present in the analysis area?
4. What are the general distribution and character of their habitats?

**Current Conditions**

1. What is the current species composition of riparian areas?
2. What are the current conditions and trends of riparian areas?
3. Where are sensitive areas and what are the reasons for sensitivity?
4. What are the current conditions and trends of riparian habitat for riparian-dependent species?

***Riparian Areas continued***

**Reference Conditions**

1. What was the historical condition of riparian areas?
2. What was the historical species composition of riparian areas?
3. What was the historical distribution and abundance of riparian-dependent wildlife species (community)?

**Synthesis and Interpretation**

1. What are the natural analysis area characteristics and human activities influencing riparian areas and riparian-dependent species?
2. How have these characteristics and activities influenced or changed riparian areas and habitat for riparian-dependent species?
3. What is the effect of riparian condition on instream habitat?
4. What are the influences and relationships between riparian areas and other ecosystem processes in the analysis area?

## AQUATIC WILDLIFE SPECIES AND HABITATS

**Characterization**

1. Habitat
   b. What is the distribution and character of aquatic habitat throughout the analysis area, especially for threatened and endangered, special status, and sensitive species?
2. Species
   a. What are the relative abundance and distribution of threatened and endangered aquatic wildlife species?
   b. What are the relative abundance and distribution of special status/sensitive aquatic wildlife species?
   c. What are the relative abundance and distribution of other aquatic wildlife species present in the analysis area?

**Current Conditions**

1. Habitat
   a. What are the current conditions and trends of instream habitat (e.g., quantity and quality) throughout the analysis area?
   b. What are the current conditions and trends for specific habitat needs of threatened and endangered, special status, and sensitive species?
2. Relationship of Subbasin Habitat with Rogue Basin
   a. How does instream habitat in the West Bear Creek Watershed Analysis Area fit into the "big habitat picture" for the Rogue Basin threatened and endangered fish stocks?
   b. How does instream habitat in the West Bear Creek Watershed Analysis Area fit into the "big habitat picture" for the Rogue Basin special status/sensitive fish stocks?

***Aquatic Wildlife Species and Habitats continued***

**Reference Conditions**

1. Habitat
   a. What was the historical condition and distribution of instream habitats throughout the analysis area?
   b. What was the historical condition and distribution of instream habitats specific to threatened and endangered and special status/sensitive species?
2. Species
   a. What was the historical relative abundance and distribution of threatened and endangered species in the analysis area?
   b. What was the historical relative abundance and distribution of special status/sensitive species in the analysis area?

**Synthesis and Interpretation**

1. Habitat
   a. What are the natural analysis area characteristics and human activities influencing species distribution and instream habitat condition?
   b. How have these characteristics and activities influenced or changed instream habitat condition, in general and specifically for threatened and endangered and special status/sensitive species?
2. Species
   a. How have changes in habitat condition influenced West Bear Creek threatened and endangered and special status/sensitive aquatic species?
   b. What are the limiting factors for long-term sustainability of threatened and endangered and special status/sensitive aquatic species?
3. Ecosystem Processes
   a. What are the influences and relationships of aquatic species and their habitats with other ecosystem processes in the analysis area?

# WATERSHED CHARACTERIZATION

The Characterization section identifies the dominant physical, biological, and human processes or features of the analysis area that affect ecosystem functions or conditions. The watershed analysis team identified the relevant land allocations and the most important plan objectives and regulatory constraints that influence resource management in this analysis area.

## INTRODUCTION

The West Bear Creek Watershed Analysis Area is located in the Klamath Mountains in southwestern Oregon. The western ridges form the divide between the Middle Rogue and Applegate River Subbasins. The analysis area is in the western reaches of the Bear Creek Watershed, located in the Middle Rogue River Subbasin (Map 1). The major streams in the analysis area are Wagner, Anderson, Coleman, Griffin, Jackson, and Willow Creeks.

The analysis area is within Jackson County and covers lands west of Bear Creek from Wagner Butte to just north of Central Point. Some of the peaks that define the western edge of the analysis area include Bald Mountain, Anderson Butte and Miller Mountain. The analysis area covers 93 square miles (59,566 acres) and includes small portions of Medford, Talent, Phoenix, Central Point, and all of Jacksonville. Elevation in the analysis area ranges from approximately 1,180 ft. at the mouth of Willow Creek to 7,140 feet at the top of Wagner Butte.

### Land Ownership

Land ownership is a mix of public and private (Table 1 and Map 2). The Bureau of Land Management (BLM) manages 8,799 acres within the analysis area. The United States Forest Service (USFS) manages 2,821 acres within the analysis area, including the J. Herbert Stone Nursery located on Jackson Creek. Private lands account for 47,946 acres in the analysis area.

Private lands make up the majority of the analysis area. BLM parcels are scattered throughout the foothills and along the crest of the mountains on the western boundary of the analysis area. The highest concentration of federal lands is in the southwestern portion of the watershed analysis area. The State of Oregon, Boise Cascade Corporation and Superior Lumber Company also own and manage large parcels of forested land in the analysis area. Bear Creek Corporation owns and manages orchards in the lower elevations of the analysis area.

**Table 1. Land Ownership**

| Ownership | Acres | Percent of Analysis area |
|---|---|---|
| Bureau of Land Management, Medford District Ashland Resource Area | 8,799 | 15 |
| United States Forest Service | 2,821 | 5 |
| Private | 47,946 | 80 |
| **Total** | 59,566 | 100 |

**Federal Land Allocations**
The majority of the BLM land in the analysis area is designated matrix (Table 2 and Map 3). Within the matrix lands, 100 acre cores are managed as late successional reserves to protect the analysis area's northern spotted owl population. Objectives and management actions/directions for these land use allocations are found in the *Medford District Resource Management Plan* (USDI, BLM 1995:24-40).

**Table 2. Federal Land Allocations**

| Federal Land Allocations | Acres[1] |
|---|---|
| Late-Successional Reserve | 3,300 |
| Riparian Reserves (estimated)[2] | 2,896 |
| Matrix | 7,577 |
| Special Areas<br>Holton Creek Research Natural Area | 423 |
| Special Recreation Management Area<br>John's Peak/Timber Mountain OHV Area | Unknown[3] |

1/ Late Successional Reserve and owl cores on BLM and Forest Service administered land.
2/ Riparian Reserves occur across all land allocations.
3/ The Timber Mountain Recreation Area Management Plan will determine the scope of this area.

## HUMAN USES
People use the West Bear Creek Watershed Analysis Area not only for habitation, but for a variety of recreational and economic purposes. Urban or agricultural developments account for thirty percent of the analysis area. Urban development is primarily concentrated around the cities of Medford, Central Point, Talent, Phoenix and Jacksonville. Rural-residential development is also prevalent in the foothills and mountains surrounding these population centers. Privately owned hobby farms, vineyards, orchards and ranches are found throughout the analysis area. The historic City of Jacksonville, which hosts the Britt Festival, is a regional destination for residents and tourists. Jacksonville is listed on the National Register of Historic Sites and the lands surrounding Jacksonville are popular for hiking, mountain biking and Off-Highway Vehicle (OHV) use. Logging and timber harvest occur on public and private lands in the higher elevations.

Regional public issues reflect the dominant uses of the analysis area. Recreational concerns include the loss of historically used trails due to encroaching woodland development and the widespread use of OHVs. Other issues include the loss of open areas due to development, the general degradation of the natural environment, poor water quality, and the lack of good fish habitat. In addition, there are a number of regional issues that are reflected in local concerns for this analysis area. Air quality, which has been a problem in the past, has improved in recent years. Urban interface issues include concerns about wildfire, fire protection, and smoke; concerns over low water flows in local streams due to irrigation withdrawals; the spread of noxious weeds; and timber harvest. Rapid population growth and the development associated with it has exacerbated many of these concerns.

**Native American Tribes**
The analysis area was formerly inhabited by the Takelma Indians, with the Shasta Indians and the Klamath Tribe also utilizing the area. Surviving Takelma and Shasta were removed from the analysis area at the end of the Rogue Indian Wars in 1856. The Takelma, and some Shasta, were taken to reservations in northern Oregon. The descendants of these reservations are members of two federally recognized tribes: the Confederated Tribes of Grand Ronde and the Confederated Tribes of Siletz. Shasta natives also managed to survive in northern California and descendants are part of the federally recognized Quartz Valley Rancheria.

There are no treaty reserved rights in the analysis area. However, descendants of the Takelma and the Shasta, and the tribal groups to which they belong today, are active in promoting the heritage and current welfare of their members. These groups take a strong interest in the management of their native lands. Traditional use areas, as well as archaeological sites reflecting these peoples' history, may occur within the analysis area. The Takelma and Shasta are likely to be concerned with the management of such locations anywhere in this analysis area.

**Transportation System**
Roads in the analysis area are owned or managed by the BLM, timber companies, Jackson County, and many private landowners. Major roads within the analysis area include Griffin Lane, Griffin Creek, Wagner Creek, Anderson Creek, Anderson Butte, Medford Provolt Highway (238), Old Stage, and Hanley Road (Map 4). Travel routes in the analysis area are used by cars, trucks, heavy equipment, motorcycles, bicycles, horses, pedestrians, and other modes of transportation. These routes are used for recreation, resource management, and private property access. The BLM's transportation system provides for many different recreation experiences and management opportunities.

Three road surface types are found on BLM roads: bituminous (asphalt), rocked, and natural (no surface protection). Main access roads usually have a bituminous surface, but may have a crushed rock surface. Roads off main access roads usually have a crushed rock surface, and dead end spurs generally have a natural surface. Adequately surfaced roads generally allow for year-round travel and reduce soil erosion, which helps to minimize stream sedimentation. There are developed quarries on private and federal land in the analysis area where rock may be obtained for surfacing roads and drainage protection. The BLM obtains water from developed water sources in the analysis area for road operations such as surfacing and dust abatement.

Road planning, location, design, construction, use, and maintenance are conducted with the goal of meeting transportation objectives while protecting resources. Best Management Practices from the *Medford District Resource Management Plan* (USDI, BLM 1995:149-177) provide guidance for resource protection.

## CLIMATE
Mild, wet winters and hot, dry summers characterize the West Bear Creek Watershed Analysis Area. During the winter months, the moist, westerly flow of air from the Pacific Ocean results in frequent storms of varied intensities. Average annual precipitation in the analysis area ranges from approximately 21 inches at the lower elevations to 48 inches at Wagner Butte (elevation 7,140 feet) (Map 5). Precipitation is distributed across three different zones (Table 3, Map 6). Winter precipitation in the higher elevations usually occurs as snow, which ordinarily melts

during the spring runoff season from April through June. Rain predominates in the lower elevations with the majority occurring in the late fall, winter, and early spring. A mixture of snow and rain occurs between approximately 3,500 feet and 5,000 feet and this area is referred to as either the rain-on-snow zone or transient snow zone. The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Rain-on-snow runoff events originate in the transient snow zone.

**Table 3. Precipitation Zone Distribution by Analysis Subwatershed**

| Analysis Subwatershed | Rainfall Zone (<3,500 ft.) (percent) | Rain-on-Snow Zone (3,500 - 5,000 ft.) (percent) | Snow Zone (>5,000 ft.) (percent) |
|---|---|---|---|
| Wagner Creek | 54.1 | 39.1 | 6.8 |
| Anderson Creek | 75.5 | 24.5 | 0 |
| Coleman Creek | 81.4 | 18.6 | 0 |
| Griffin Creek | 92.5 | 7.5 | 0 |
| Jackson Creek | 98.1 | 1.9 | 0 |
| Willow Creek | 100 | 0 | 0 |
| Totals for West Bear Creek Analysis Area | 82.1 | 16.2 | 1.7 |

Source: Medford BLM Geographical Information System (GIS)

There are two National Oceanic and Atmospheric Administration (NOAA) weather stations within or adjacent to the analysis area: one is the Medford Experiment Station (elevation 1,457 ft.), located within the north portion of the analysis area and the other is in the City of Ashland (elevation 1,724 ft.), located southeast of the analysis area. The majority of precipitation (62-66 percent) falls during November through March (Table 4). Annual precipitation can fluctuate widely from year-to-year. The 30-year average (normal) annual precipitation at the Medford Experiment Station is 21.22 inches and at the Ashland station it is 19.19 inches (Oregon Climate Service 2000).

**Table 4. Precipitation at NOAA Stations - Monthly Means for 1961-1990**

| NOAA Station | Precipitation (inches) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Medford Exp. | 2.87 | 2.05 | 2.09 | 1.38 | 1.11 | 0.77 | 0.29 | 0.61 | 1.03 | 1.68 | 3.34 | 3.64 |
| Ashland | 2.37 | 1.72 | 1.95 | 1.61 | 1.29 | 0.91 | 0.32 | 0.58 | 0.95 | 1.60 | 2.82 | 3.06 |

Source: Oregon Climate Service 2000

During the summer months, the area is dominated by the Pacific high pressure system, which results in hot, dry summers. Summer rainstorms occur occasionally and are usually of short duration and limited area coverage. The nearest NOAA weather stations with air temperature data are located at the Medford Experiment Station and at Ashland (Tables 5 and 6).

**Table 5. Average Monthly Max, Min, and Mean**
**Air Temperatures at Medford Experiment Station (NOAA) (1961-1990)**

| | Air Temperature (°F) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
| Max | 46.2 | 53.6 | 58.6 | 65.0 | 73.0 | 81.4 | 88.8 | 88.3 | 81.5 | 68.3 | 52.6 | 45.1 | 66.9 |
| Min | 30.1 | 32.0 | 34.3 | 36.5 | 41.3 | 47.7 | 50.6 | 50.7 | 44.2 | 37.7 | 34.6 | 30.9 | 39.3 |
| Mean | 38.2 | 42.8 | 46.4 | 50.8 | 57.1 | 64.5 | 69.7 | 69.5 | 62.9 | 53.0 | 43.6 | 38.0 | 53.1 |

Source: Oregon Climate Service 2000

**Table 6. Average Monthly Max, Min, and Mean**
**Air Temperatures at Ashland (NOAA) (1961-1990)**

| | Air Temperature (°F) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
| Max | 46.3 | 52.3 | 56.2 | 62.1 | 70.0 | 78.7 | 86.8 | 85.7 | 78.6 | 66.6 | 52.3 | 45.4 | 65.1 |
| Min | 29.6 | 31.9 | 33.7 | 36.2 | 41.6 | 48.0 | 51.7 | 51.6 | 45.7 | 39.1 | 34.1 | 30.0 | 39.4 |
| Mean | 37.9 | 42.1 | 45.0 | 49.1 | 55.8 | 63.4 | 69.3 | 68.7 | 62.1 | 52.8 | 43.2 | 37.7 | 52.3 |

Source: Oregon Climate Service 2000

Current climatic patterns need to be viewed with a long-term perspective. Based on tree-ring growth rates and recorded meteorological data, the past 200 to 300 years have been marked by cycles of hot, dry spells and temperate-to-cool weather that have lasted varying periods of time (LaLande 1995).

## GEOLOGY

The West Bear Creek Watershed Analysis Area straddles the contact between the eastern edge of the Klamath Mountains Geologic Province (also called the Siskiyou Mountains), and the Western Oregon Interior Valleys (physiographic) Province. The geology of the analysis area can be briefly described as eroding metamorphic and granitic uplands with minor amounts of sedimentary deposits draping the lower slopes (Map 7, Appendix B).

The Klamath Province consists of adjacent belts of rock that in a curved fashion, roughly parallel the coastline of northern California and southern Oregon. These belts are progressively younger as they approach the coast, ranging in age from 350 to 153 million years. They consist of a complex collection of collapsed, back-arc basins and accreted terrains, with the older of any two adjacent belts thrust faulted over the top of the younger (worldwide, younger rocks are generally on top of older rocks). Each of these belts was originally a section of ocean crust approximately 7 kilometers (+4 miles) in thickness. In the analysis area, only one of these belts is present. After attachment to North America, these plates were intruded by granite.

### Geologic History

*The Origin of Granite and Precious Metal Deposits in the Analysis Area*

Below all active volcanoes is a chamber that contains vast quantities (10 to 30 cubic miles) of molten rock derived from subducted ocean floors that have melted. Some of this magma rises to the surface to erupt from the volcano, but the vast majority will stay beneath the surface in the magma chamber. As time passes and the magma chamber cools, crystals form. The many different types of crystals form at different temperatures. Rock forming minerals rich in iron crystallize at temperatures as high as 1200°C. Lighter crystals such as quartz may not form until temperatures decrease to 700°C.

As these initial iron-rich minerals crystallize in this molten soup, they sink to the bottom of the magma chamber. This depletes the amount of heavy elements remaining as molten material. As this process continues, the characteristics of the molten rock within the magma chamber changes from a very fluid iron-rich, basalt-like magma to a thicker, lighter-colored andesite-like magma. Gases (water) and elements (gold, mercury, copper) not used by the initial crystals are concentrated in the remaining molten rock. When the magma chamber is almost completely solidified, the remaining liquid containing quartz, gold, mercury, and copper is squeezed out into the overlying and surrounding rock, depositing quartz veins that may contain precious minerals. All of the hard-rock precious-mineral deposits in the analysis area were formed in this way.

When the entire magma chamber solidifies and the overlying volcano erodes away, the remaining rockmass is a granite. This is how John's Peak and Wagner Butte in the analysis area were formed. Other examples of this outside the analysis area include Mount Ashland, the Sierra Nevada, and Castle Crags.

Throughout much of the last 150 million years, this area was relatively flat. Relief was gentle and was likely characterized by broad flood plains, with a few large meandering rivers, and rolling hills. Starting about 14 million years ago and continuing through the present, the area around the analysis area was uplifted. The uplift was centered under Condrey Mountain, to the south and west, on the Rogue and Klamath River Divide, and is referred to in geologic literature as the Condrey Mountain Dome (CMD). The CMD was uplifted a minimum of 7 km (+23,000 feet) in elevation. As this uplift progressed the surrounding area, including the analysis area, also rose and/or tilted, though to a much lesser degree.

With this great increase in relief, the 7-km thick belt of rock quickly eroded away. Erosion removed over 20,000 vertical feet of rock. This great volume of material resulted in sediment-choked braided streams in the Bear Creek, Williams and Illinois Valleys. Deposits left by these braided streams are referred to as Tertiary non-marine sandstones (Tn). Preserved braided stream deposits, like these, are rarely preserved in the geologic record. Due to decreased sediment inputs, Bear Creek is no longer a braided stream. Fish, wildlife and fauna evolved in this sediment-rich regime. Tertiary non-marine sandstone is the oldest stream sediment in the Bear Creek Valley, and may record the initiation of the Bear Creek drainage system.

The uplift of the Condrey Mountain Dome occurred in periodic events. This intermittent uplift is thought to continue today, though at a much slower rate. Raveling, earthflows, debris torrents and glaciers acted as the dominant forms of mass wasting and sculpted the present day watershed.

**Faults and Earthquakes**

Bear Creek is structurally controlled by a north-northwest oriented fault that generally runs the length of the Bear Creek Valley. Faults that define the Basin and Range Geologic Province (to the east) have the same orientation and some geologists consider the Bear Creek Valley to be a westward extension of the Basin and Range Province. The Bear Creek fault has moved several times since the mid-1800s. The most recent movement occurred in 1966 with the epicenter located between Medford and Phoenix. All recorded quakes on this system have been small, generally less than 3.5 in magnitude.

There are many other faults in the analysis area, but none are considered active. Though inactive, they helped carve the present landscape. When faults move, rock on either side of the fault is crushed. Drainage systems superimposed on the watershed preferentially follow faults due to the erodability of crushed rock. Many of the creeks in the valley are also structurally (fault) controlled including Daisy, Jackson, Murphy and Wagner Creeks.

Recent studies indicate that every 300 to 450 years an extremely large earthquake occurs near the Pacific Northwest coast that has the potential to affect the analysis area. Ocean floor is continuously sliding beneath the Pacific Northwest at a rate of 1.6 inches each year. It is also moving toward the coast at the same rate. However, near the coast the ocean floor does not move continuously, but sticks, causing stress to build up for long periods until it is released all at once in an earthquake as large as 9.2 in magnitude. A 9.2 magnitude quake would shake continuously for 3-to-5 minutes.

A worst-case quake of this size might not have a single center of shaking. It is thought that the entire Cascadia Subduction Zone along the coast from northern California to Canada would move, with strong shaking expected along the full 800-mile-length of the I-5 corridor from British Columbia to northern California. Evidence indicates the last great Pacific Northwest quake occurred in 1700 AD. Geologists predict that another will occur within the next several hundred years.

**Rock Types and Soils**

The geologic materials have been subject to weathering, mass wasting and erosion processes controlled by past and present climatic conditions. Landforms in the analysis area visible today are the result of continual interactions between climate and regional geology over eons of time. The various types of rock distributed throughout the watershed affect soils. Different mineralogy, structures, inherent strength of the bedrock, and resistance to erosion and mass wasting influence the landforms. Metamorphic and granitic rock and their associated soils are the predominant rock and soil types found in the analysis area (Maps 7 and 8).

*Metamorphic Rock and Associated Soils*

Metamorphic rocktypes make up over 55 percent of the watershed. Metasedimentary and metavolcanic rocks (**TrPzs** and **TrPv** on Map 7) found in the watershed are relatively resistant to erosion, and for this reason they are often found on steep slopes. Soils on these types of rock are shallow, composed of silts and clays with variable amounts of rock fragments. Generally, the upper fractured bedrock has only a thin weathering zone.

Metasedimentary and metavolcanic rock forms a very dense, tight formation as a result of interlocking crystals in the original sediments and lava flows, and low grade metamorphism. Unlike granitic intrusions that form miles below the earth's surface, lava flows and sediments are in a pressure and temperature environment much closer to that under which they formed (atmospheric). As a result, they are more resistant to weathering and erosion. This, coupled with their position in the lower precipitation zone of the watershed, leads to the rugged relief of the metavolcanics.

*Granitic Rocks and Associated Soils*
Granitic rocks (KJg) constitute 20 percent of the analysis area and are the most erosive and unstable rocktype found in the analysis area. Soils derived from granite are the Tallowbox and Shefflein soils (Appendix C). Soils formed from granitic rock are generally moderately deep over decomposed bedrock and are highly erosive because of low cohesive coarse textured particles. Rapid erosion on steep slopes keeps fresh granite near the surface, while transported decomposed granite (DG) increases embeddedness of streams by filling interstices (space between stream gravels) with coarse sand.

Granite is found as two disconnected pods in the extreme northwest (John's Peak) and extreme southwest (foothills of Wagner Butte) of the analysis area (Map 7). Each pod is approximately ten square miles in extent. The Johns Peak outlier of granite is part of the Grey Back belts, which was intruded into the overlying metamorphic and Cretaceous rocks during the Late Jurassic (153 million years ago), and are probably connected below the present surface of the Earth. The Wagner Butte granitic outlier is part of the Wooley Creek belt, which was intruded into the overlying metamorphic and Cretaceous rocks during the Late Jurassic (155 million years ago). Wagner Creek (in its upper reaches) flows along the western edge of this granitic body

**Soil Development**
The interactions, through time, of climate, living organisms, parent materials, and topographical relief resulted in soil development. Precipitation and temperature are the most important climatic factors affecting soil development. The Mediterranean-like climate of the analysis area is characterized by hot, dry summers and cool, moist winters. The soil temperature regime in the analysis area is mesic with mean annual soil temperatures averages $8^{o}$ C or more, but less than $15^{o}$ C. This moderate temperature range is conducive to an active biologic soil community.

By 10,000 years ago, glaciers had disappeared, and the warm dry climate of the Holocene Epoch began. Wet climatic periods caused the soil to move down the landscape resulting in discontinuity of depth. Most of the early soil that originally formed on hill slopes was moved by water to the valley floor. As the valley floor began to fill with soil, it created a base for soil to accumulate on the mountain toe slopes and side slope depressions. The soils and topography that formed in this analysis area were directly influenced by the weatherability of the parent material. The soils in areas that receive a greater amount of precipitation tend to be moderately deep and well developed due to the interacting influences of the basic mineralogy of the parent material and the accumulation of organic matter. Soils formed from granitic rock are generally moderately deep over decomposed bedrock and are highly erosive because of low cohesion.

## EROSION PROCESSES
There are three main erosion processes in the analysis area: mass wasting, surface erosion, and channel cutting. Though mass wasting and surface erosion are responsible for the majority of annual sediment transport to streams in the analysis area, these processes are of minor concern except in isolated areas. Areas of concern for erosion are those that are found on granitic rocktypes, i.e., Tallowbox-Shefflein soil types on John's Peak and Wagner Butte (Map 8).

**Mass Wasting**

Mass wasting is a term for describing a wide variety of processes that involve natural or human-caused downslope movement of masses of soil and rock material. The term "landslide" is commonly used as a blanket term that covers several modes of slope instability (Haneberg and Sims 1995). When these processes are active, as they were during the January 1997 storm, large adjustments in stream channels and hillslopes can occur (Haneburg and Sims 1995). Landslides can transport material rapidly as in the case of debris torrents, or occur slowly as with earthflows or creep movement. These mass wasting events often cause adverse impacts to fish habitat by depositing large volumes of sediment into the streams. Roads, bridges, and culverts are often damaged when major flood events, such as the 1964, 1974, and 1997 floods, trigger landslides. No landslides were reported in the analysis area following the1997 flood, but landslides have occurred on granitic terrane in the Wagner Creek drainage (T39S, R1W, section 23).

In the headwaters of intermittent streams erosion is continually moving sediment from hillsides into debris-filled draws. As this material is piled deeper and deeper, it eventually becomes unstable. During a heavy rain, like the 1997 event, the slug of material may move in any of the forms of a landslide (slump, rotational slump, etc.). If conditions are right (i.e., excess water and/or slope) the material often undergoes a “phase change.” Landslides, for example, become debris flows, which then become wood-charged debris torrents.

As the slug of debris starts moving, its speed and momentum increase rapidly. The disturbance cascades down the stream channel incorporating into itself all material in and adjacent to the channel, including full-grown trees and their roots. Debris flows can reach speeds of 60 km/h. This is a cyclical phenomenon, and given time channels heal, re-fill with debris and fail again. Virtually all mountain streams should be considered debris-flow paths.

**Surface Erosion**

Surface erosion is the detachment and transport of individual soil particles or small aggregates from the land surface (Satterlund and Adams 1992). It is caused by the action of rain-drops and surface runoff. Surface erosion can move soil particles a small distance or transport large volumes of sediment to streams every year. It may remove soil in more or less thin layers (sheet erosion), in rills, or in gullies. Rills and gullies occur most often when surface water runoff is concentrated and confined into narrow spaces, especially on coarse-grained soils. On steep, dry slopes, gravity alone may be sufficient to cause movement (ravel) (Satterlund and Adams 1992). Surface erosion generally occurs in areas where roads, fire, timber harvesting, grazing, or land development exposes bare soil. The largest volumes of sediment are moved during intense, long-duration storms. The main factors influencing surface erosion in the analysis area are high intensity storms and granitic soil types. Granite is found as two disconnected pods in the extreme northwest (John’s Peak) and extreme southwest (foothills of Wagner Butte) of the analysis area (Map 7).

**Channel Cutting**

Channel cutting is the detachment and movement of material from a stream channel. It may result from the movement of individual particles, as in shifting grains of sand in bars, or from mass movement, as when a large part of an undercut bank falls and is swept downstream (Satterlund and Adams 1992). The main factors influencing channel cutting in the analysis area are high intensity storms, rain-on-snow events and high water velocities.

## SOIL PRODUCTIVITY

Soil in the analysis area serves two important functions: it is the primary medium for most vegetative life, and it filters and stores water that is slowly released into the nearby stream courses.

Soil productivity is the capability of a soil to produce a specified plant or sequence of plants under specific management (USDA 1993). Soil productivity of forest lands is largely defined in terms of site quality, which is measured by the volume of timber the land can produce in a given time. Site quality within a given microclimate is associated with the soil's capacity to provide moisture and nutrients. The soil's ability to provide moisture is dependent on the texture, depth, and rock fragment content in the rooting zone. The soil's ability to provide nutrients necessary for plant growth is dependent on soil organisms and organic matter content. Beneficial soil organisms control many biological processes within the soil, such as organic matter decomposition, nitrogen fixation, and plant nutrient uptake (Amaranthus et al. 1989). A cool, moist environment with an abundance of suitable organic matter encourages the growth and productivity of these organisms. Surface duff and woody material insulate the soil layer and keep soil conditions cool and moist. Therefore, the depth of surface duff and the abundance of downed woody material is a good indication of site productivity.

The climate also affects duff thickness. The organic matter derived from deciduous trees and shrubs decomposes readily under the influence of warm temperatures in the valley. As a result, plant nutrients are more rapidly recycled. Thin duff thickness in conjunction with an ample source of deciduous material indicates the presence of an active and healthy biologic soil community which is converting plant litter into nutrients for plant uptake.

Precipitation and temperature are the most important climatic factors affecting soil development. The amount of precipitation is not high enough in this area to result in excessive leaching of bases out of the soil profile; consequently, nutrients are retained on site for plant uptake.

## LANDSCAPE VEGETATION PATTERN

The present day vegetation pattern across the analysis area landscape results from the dynamic processes of nature and human influences over time. As a consequence, the variation and scales of landscape components are innumerable.

Landscape ecological analysis and design are not new concepts, but have been brought to the forefront of natural resource management with the concept of ecosystem-based management. Landscapes are thought of as aggregates of similar patches of vegetation and landforms that originate through climatic influences, geomorphic processes, natural disturbances, human activities, and plant succession (Forman and Godron 1986). The relationships among species that compose the community can also influence the landscape. Diaz and Apostol (1992) describe landscapes as having three elements: matrix, patches, and corridors. Matrix is defined as the most contiguous vegetation type. Patches are areas of vegetation that are similar internally, but differ from the vegetation surrounding them. Corridors are landscape elements that connect similar patches through a dissimilar matrix or aggregation of patches. Ecological analysis of the landscape considers the processes that form the landscape patterns, the arrangement and extent of various vegetative types, and the three-dimensional shape of the land, along with causes and rates of change.

Studies of the landscape vegetation pattern from the Western Oregon Digital Image Project's satellite data (WODIP)(Pacer Infotec Inc. and USDI 1998) shows that 30 percent of the watershed analysis area has an urban agricultural matrix (Map 9, Table 7). The largest urbanized areas are found in the northeast and southeast portions of the analysis area. To the west of the urban area, the remainder of the watershed analysis area has a forest matrix with patches of grassland or other non-forest types of vegetation scattered throughout. The patches of non-forest vegetation indicate hot, dry areas with perhaps shallow soils not conducive for growing coniferous trees. The most contiguous forest matrix areas are found in the northwest and southern parts of the watershed analysis area. Across the landscape the forest matrix is extremely variable in size and species composition as influenced by topography, aspect changes, soil differences, plant succession, and the edge effect between the different vegetation types. Natural disturbances such as fire, windthrow, and bark beetles, along with human activity, have also contributed to the forest stand variability. The result of these factors is an extreme richness in the number of forest landscape elements.

The vegetation pattern becomes more complex when more structural components are included in the analysis. A variable vegetation pattern is the result of different vegetation diameter and height classes, topoedaphic influences and disturbances. The satellite imagery map (Map 9) categorizes the vegetation into various vegetation types, size classes, and levels of canopy closure.

**Table 7. Structural Components by Vegetation Classification**

| Vegetation Classification | Percent of Analysis area | Description | | | |
|---|---|---|---|---|---|
| Urban/Agriculture | 30 | Cities, Towns, Villages and Farm Lands, Cattle, & Llamas | | | |
| Grass/ Non-forest | 7 | Grasslands and Shrublands | | | |
| Hardwoods | 10 | Defined as all hardwoods regardless of size or canopy closure. | | | |
| | | **DBH[1]** | **Vegetation Type** | **Structure** | **% Canopy Closure** |
| Seedlings/Poles | 15 | <10" | conifer & mixed | all stories | all closures |
| Large Poles | 27 | 10-19" | conifer & mixed | all stories | all closures |
| Mature/Old-growth | 11 | >20" | conifer & mixed | all stories | <65 |
| | | >20" | conifer & mixed | 1 story | ≥ 65 |
| | | >20" | conifer & mixed | 2 story | ≥ 65 |
| | | >30" | conifer & mixed | 2 story | ≥ 65 |

1/ Diameter at Breast Height
Source: Western Oregon Digital Image Processing

**Vegetation Classification**

The vegetation of the West Bear Creek Watershed Analysis Area is extremely diverse. This diversity applies to the many plant communities that are present and the interactions of the organisms which compose these communities. Franklin and Dyrness (1973) classify the vegetation of the analysis area as being in the Interior Valley zone. The classification system is based on elevation, temperature, and moisture. At a lower level of dichotomy, Atzet and McCrimmon (1990) describe plant associations within the forest zones. East to west facing slopes typically have pine tree series plant associations, especially in the lower elevations. Northwest to northeast facing slopes have Douglas-fir tree series plant associations. The most common plant associations in the analysis area include Douglas-fir (PSME)/Poison Oak (RHDI); PSME/RHDI - Piper's Oregongrape (BEPI); PSME/Dwarf Oregongrape (BENE); Ponderosa Pine (PIPO) - California Black Oak (QUKE); PIPO - PSME; and a small area of white fir tree series within the southern tip of the analysis area.

The vegetation condition classes listed in Table 8 are defined in the Medford District Watershed Analysis Guidelines (USDI 1994). These classes describe the vegetation type or form, and the tree sizes are described by diameter classes. The map of these vegetation condition classes (Map 9) is derived from BLM Micro*Storms/GIS data. At this time data is only available for BLM administered lands and a data gap exists for private lands.

**Table 8. Vegetation Condition Classes for BLM - Administered Land**

| Vegetation Condition Classes | Percent of BLM Land |
|---|---|
| Grass, Forb, Herbaceous | 1 |
| Shrub, Non-forest Land | 1 |
| Hardwood/Woodland | 9 |
| Early (0 to 5 years) and Seedlings/Saplings (0 to 4.9 inches DBH) | 11 |
| Pole (5 to 11 inches DBH) | 22 |
| Mid (Large Poles, 11 to 21 inches DBH) | 39 |
| Mature/Old-Growth ($21^{+}$ inches DBH) | 17 |

**Major Processes Influencing the Landscape Pattern**

During the last decade, drought in combination with stand overstocking has contributed to low tree vigor across the entire forest landscape. As a result, bark beetles have killed thousands of trees across the landscape. The Douglas-fir bark beetle (*Dendroctonus pseudotsugae*) has killed Douglas-fir trees mostly along the edges of the drier oak woodlands, and the Western pine beetle (*Dendroctonus brevicomis*) has killed large diameter ponderosa pines across the landscape.

Other processes influencing the landscape pattern include Douglas-fir mistletoe tree mortality, wind, forest pathogens, and fire and fire suppression. Fire suppression has allowed plant communities to progress towards climax conditions, i.e. the last successional stage of a plant community. All of these processes are slowly shifting the forests from the stem exclusion stage to the understory reinitiation stage and old-growth stages of forest stand development. Timber harvesting has effected the landscape vegetation pattern mostly in the southwestern portion of the analysis area. Small clearcuts (20 to 40 acres in size) were scattered across the landscape after a blown down in the 1962 Columbus Day storm. These timber stands are now in the pole to large pole size classes.

# PLANT SPECIES AND HABITATS

**Introduced Plant Species and Noxious Weeds**
Only a portion of the analysis area has been formally inventoried for introduced plants and noxious weeds. These inventories and casual observation reveal that most introduced plants and noxious weeds occur on the valley floor and foothills. Not coincidentally, it is these areas that have experienced the greatest human disturbance. These plants occur less frequently in the upper reaches of the analysis area, but are still associated with human activities. The human activities that expose mineral soil produce the conditions most apt to be invaded by introduced plants and noxious weeds. Past human activities that produced favorable conditions for introduced plants and noxious weeds have been land clearing for agricultural or urban purposes, transportation system development, logging, mining, overgrazing, and off-highway vehicle use.

Noxious weeds, as defined by the Oregon State Weed Board, are plants that are injurious to public health, agriculture, recreation, wildlife, or any public or private property and as such have been declared a menace to public welfare. These plants are usually, but not necessarily, introduced species. Noxious weeds are classified as either 1) Target weeds, 2) "A" designated weeds, or 3) "B" designated weeds. Target weeds are priority weeds designated by the State Weed Board on which Oregon Department of Agriculture (ODA) will implement a statewide management plan. "A" designated weeds are species of known economic importance occurring in Oregon in small enough infestations to make eradication or containment possible. Economic importance is based on the plant's potential to cause detrimental effects to agricultural and/or horticultural industries, native flora and fauna, recreational areas, or is harmful to humans and animals.

Weeds on the "A" list also include those not known to occur in Oregon but their presence in neighboring states makes their future occurrence imminent. Infestations of "A" list weeds are subject to intensive control when found. "B" designated weeds are weeds of economic importance that are regionally abundant but with limited distribution in some counties. "B" list weeds are subject to intensive control at the state or county level as determined on a case-by-case basis.

Introduced plants and noxious weeds have the potential to affect ecological processes of a natural community. These influences will generally produce undesirable effects to the native plant communities by altering structure and composition. The natural biodiversity will be reduced and often is replaced by a monotypic weed community. These infestations can reduce the productivity of agrononmic, range, and forestry systems by utilizing resources such as water, light, and soil nutrients. A list of introduced plants and noxious weeds known to occur in the analysis area is in Appendix D.

The following laws, regulations, and policies guide the management of noxious weeds and introduced plant species:

- Federal Noxious Weed Act of 1974, as amended by Section 15-Management of Undesirable Plants on Federal Lands (1990).
- Federal Land Policy and Management Act of 1976
- Executive Order 13112 - Invasive Species (February 3, 1999)
- BLM Manual 517 - Use of Pesticides

- BLM Manual 609 - Control of Undesirable or Noxious Weeds
- BLM Manual 9011 - Chemical Pest Control
- BLM Manual 9014 - Use of Biological Control Agents of Pests on Public Lands
- BLM Manual 9015 - Management and Coordination of Noxious Weed Activities
- BLM Manual 9220 - Implementation of Integrated Pest Management
- Noxious Weed Strategy for Oregon/Washington BLM (August 1994)
- Final Northwest Area Noxious Weed Control Program EIS (December 1995) and Supplement (March 1997)
- Medford District Integrated Weed Management Plan and Environmental Assessment (April 1998)
- Public Rangelands Improvement Act of 1978
- Carlson Foley Act of 1968
- Final Environmental Impact Statement for Vegetation Treatment on BLM lands in 13 Western States (1991)

**Special Status Plant Species and Habitats**
Thirty-one populations (nine species) of special status vascular plant species are known to exist in the West Bear Creek watershed analysis area. Special status plants are those species whose survival is of concern due to their limited distribution, low number of individuals or populations, and potential threats to their habitat. Generally, it is BLM policy to manage for the conservation of special status plants and their associated habitats and ensure that actions authorized, funded, or carried out do not contribute to the need to list any species as threatened or endangered. Many of these populations occur in the upper reaches of the watershed where there has been less disturbance and more suitable habitat exists. Rules, guidelines and recommendations for managing these species are addressed in the Endangered Species Act of 1973, as amended, Oregon Administrative Rule 603-073, and BLM Manual Section 6840.

**Survey and Manage Plant Species and Habitats**
Seven sites (three species) of Survey and Manage plants are known to exist in the West Bear Creek watershed analysis area. Survey and Manage plant species include species of vascular plants, mosses, liverworts, hornworts, lichens, and fungi. Although fungi are included in the plant group, taxonomically they are considered a separate kingdom. All but one of these sites are also Special Status Plants. The standards and guidelines for these species are addressed in the *Northwest Forest Plan* (USDA and USDI 1994a) and the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (USDI and USDA 2001) and are designed to benefit these species and their habitats.

Management recommendations have been developed for 12 species of vascular plants (BLM Instruction Memorandum (IM) OR-99-27), five species of bryophytes (IM OR-99-039), 29 species of lichens (IM OR-2000-042), and 151 species of fungi (IM OR-98-003). Draft management recommendations are being reviewed for 19 species of bryophytes (IM OR-97-027). Species without management recommendations would use information in Appendix J2 of the 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 (USDA and USDI 1994b).

# FIRE AND AIR QUALITY

The Northwest Forest Plan recognizes fire as a key natural disturbance process throughout southwest Oregon (Atzet and Wheeler 1982). Human-caused and lightning fires have been a disturbance mechanism for thousands of years. Native Americans influenced vegetation patterns for over a thousand years by igniting fires to enhance values that were important to their culture (Pullen 1996). Early settlers to this area used fire to improve grazing and farming and to expose rock and soil for mining. Fire has played an important role in influencing successional processes. Large fires were a common occurrence in the area based on fire scars and vegetative patterns.

**Fire Regimes**

Climate and topography combine to create the two types of fire regime in the West Bear Creek Watershed Analysis Area. Fire regime is a broad term and is described as the frequency, severity and extent of fires occurring in an area (Agee, 1993). Vegetation types are helpful in delineating different fire regimes. Using vegetation types as a basis for historic fire regime delineation, a low-severity and moderate severity fire regime were identified within this watershed analysis area (Map 10). These regimes are based on the affects of fire on the dominant vegetation.

Approximately 72 percent of the analysis area has been identified as having a low-severity fire regime. A low-severity regime is characterized by nearly continual summer drought. Fires are frequent (every 1 to 25 years), burn with low intensity, and are widespread. Typical vegetation types favored by a low-severity regime are grasslands, shrub lands, hardwoods and mixed hardwood and pine. These plant communities are adapted to recover rapidly from fire and are directly or indirectly dependent on fire for their continued persistence. The dominant trees within this regime are adapted to resist fire due to the thick bark they develop at a young age.

Approximately 28 percent of the analysis area has been identified as having a moderate severity fire regime. This regime is associated with the mixed coniferous vegetation type. This regime is characterized by long summer dry periods with frequent fires (every 25 to 100 years). This regime is the most difficult to characterize and is often located in a transitional position between low and high elevation forests. Fires burn with different degrees of intensity within this regime. Stand replacement fires as well as low intensity fires will occur depending on burning conditions. The overall effect of fire on the landscape is a mosaic burn.

**Air Quality**

Air quality within the analysis area is influenced by weather conditions and emissions sources. Emission sources that are most likely to adversely affect the air quality at the watershed scale are fires within the region during the summer months. Prescribed burning operations may produce local impacts to air quality during the fall, winter, and spring months.

# TERRESTRIAL WILDLIFE SPECIES AND HABITATS

The West Bear Creek Watershed Analysis Area is comprised of the following natural plant communities as described by Brown (1985): grass-forb dry hillside, mountain shrubland and chaparral, deciduous hardwood, and mixed coniferous forest. Cropland and orchards are present on private lands in the lower elevations. These habitats support approximately 230 species of terrestrial vertebrate wildlife species that are known or suspected to be present in the analysis area. This total includes both resident and migrant species. Species that are representative of the above-mentioned habitats include the following:

**Grass-Forb Dry Hillside**
gopher snake, western meadowlark, California ground squirrel
**Mountain Shrubland and Chaparral**
western fence lizard, wrentit, dusky-footed woodrat
**Deciduous Hardwood Forest**
ringneck snake, acorn woodpecker, western gray squirrel
**Mixed Conifer Forest**
*Seedling/Sapling*
northwestern garter snake, mountain quail, pocket gopher
*Pole (5-11" Diameter at Breast Height (DBH))*
alligator lizard, golden-crowned kinglet, porcupine
*Mid Seral (11-21" DBH)*
ensatina, Steller's jay, cougar
*Mature/Old-Growth (21+" DBH)*
northern spotted owl, northern flying squirrel

Refer to the Landscape Vegetation Pattern section for the relative abundance of the habitats/vegetative condition classes, and a general description of their distribution on the landscape.

**Special Status Species**
There are three special status species of management concern in the analysis area: northern spotted owl, Lewis' woodpecker, and Townsend's big-eared bat. All are classified as BLM sensitive species.

The northern spotted owl is listed as threatened under the auspices of the Endangered Species Act of 1973, as amended. Approximately 3,215 acres of suitable spotted owl habitat support eight known owl sites on BLM managed land in the analysis area (Map 11). Suitable habitat data for private land is not available. Suitable spotted owl habitat generally provides for nesting, roosting or foraging and has the following attributes: a high degree of conifer canopy closure (approximately 60 percent or more), a multilayered canopy, large snags and coarse woody material.

Approximately 1,100 acres of the analysis area are in northern spotted owl critical habitat unit (CHU) OR-75. One of the known spotted owl sites is in the CHU. This CHU was established to provide nesting, roosting and foraging habitat, and to provide connectivity between CHU OR-74 and CHU OR-75 (USDI 1994).

Primary habitat for Lewis's woodpecker is oak woodland. Townsend's big-eared bats are known to use an abandoned mine in the analysis area.

**Survey and Manage Species**
The great gray owl, designated as Survey and Manage (Category C) in the *Record of Decision and Standards and Guidelines for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (SEIS ROD), is suspected to be present in the analysis area based on known sites in adjacent watersheds. Additional protection for six species of bats known or suspected to be present in the analysis area (Townsend's big-eared bat,

silver-haired bat, fringed myotis, long-eared myotis, long-legged myotis, and pallid bat) is also addressed in the SEIS ROD. Systematic surveys for these species and the habitat/sites they are commonly associated with have not been conducted in the analysis area.

# HYDROLOGY

For purposes of the hydrology discussion, the West Bear Creek Watershed Analysis Area is stratified into six analysis subwatersheds: Wagner, Anderson, Coleman, Griffin, Jackson, and Willow Creeks (Map 12).

**Hydrologic Features**

The most productive source of groundwater within the analysis area is found in the lower valley portions that consist of alluvium. The alluvium adjacent to the lower reaches of Griffin and Jackson Creeks usually have a saturated thickness of more than 10-15 feet and will yield 10-50 gallons per minute (gpm) to wells (Robison 1971). Areas above the valley floor are formed from the Hornbrook Formation, Granodiorite, or the Applegate Group. These areas generate small yields to wells, generally less than 5 gpm. Chemical quality of groundwater in the analysis area ranges from variable to good depending on the geologic unit (Robison 1971). Numerous wells exist in the area and they are primarily used for domestic or household use, irrigation, and agriculture (OWRD 2000). There are several wells that are used for municipal purposes.

Surface water in the West Bear Creek Watershed Analysis Area includes streams, springs, wetlands, reservoirs, canals, and ditches. There are approximately 478.6 stream miles in the analysis area. Major streams in the analysis area are Wagner, Anderson, Coleman, Griffin, Jackson, and Willow Creeks (Table 9). These streams are all tributaries to Bear Creek, a major Rogue River tributary. The mouth of Willow Creek is 1.6 miles upstream from the confluence of Bear Creek, Jackson Creek is 2.0 miles, Griffin Creek is 3.5 miles, Coleman Creek is 13.8 miles, Anderson Creek is 15.3 miles, and Wagner Creek is 17.3 miles upstream from the mouth of Bear Creek (Columbia Basin Inter-Agency Committee 1967). Wagner, Anderson, Coleman, Griffin, Jackson, and Willow Creeks are fifth order streams and Coleman Creek is a fourth order stream.

**Table 9. Stream Order and Major Tributaries**

| Stream Name | Stream Order at Mouth | Major Tributaries |
|---|---|---|
| Wagner Creek | 5 | Holton Creek, Yank Gulch, Arrastra Creek, Horn Gulch |
| Anderson Creek | 5 | North Fork Anderson Creek, South Fork Anderson Creek |
| Coleman Creek | 4 | none |
| Griffin Creek | 5 | North Fork Griffin Creek, Murphy Creek, Daisy Creek |
| Jackson Creek | 5 | Walker Creek, South Fork Jackson Creek, Miller Gulch, Cantrall Gulch, Norling Gulch, Dean Creek |
| Willow Creek | 5 | Lane Creek |

The analysis subwatersheds vary in acreage, ownership, stream miles and stream density (Table 10). The Jackson Creek, Wagner Creek and Griffin Creek analysis subwatersheds are the largest, accounting for slightly more than 75 percent of the analysis area. The Anderson Creek analysis subwatershed represents approximately 14 percent of the analysis area, while the Coleman Creek and Willow Creek analysis subwatersheds each account for approximately five percent of the analysis area. Ownership in each of these subwatersheds is predominately private. The Wagner Creek analysis subwatershed has the highest percentage of public ownership at 38 percent. Willow Creek Analysis Subwatershed has the highest stream density (8.2 mi./sq. mi.) followed by Jackson Creek Analysis Subwatershed (6.4 mi./sq. mi.). These two areas have high stream densities because of the highly dissected terrain with granitic soils in the headwaters.

**Table 10. Ownership and Stream Information**

| Analysis Subwatershed | Area (acres) | Area (sq. mi.) | Ownership (percent) | | | Total Stream Miles | Stream Density (mi./sq. mi.) |
|---|---|---|---|---|---|---|---|
| | | | BLM | USFS | Private | | |
| Wagner Creek | 14,933 | 23.3 | 21 | 17 | 62 | 103.5 | 4.4 |
| Anderson Creek | 8,242 | 12.9 | 20 | 0 | 80 | 58.4 | 4.5 |
| Coleman Creek | 3,068 | 4.8 | 14 | 0 | 86 | 23.3 | 4.9 |
| Griffin Creek | 13,912 | 21.7 | 12 | 0 | 88 | 90.7 | 4.2 |
| Jackson Creek | 16,191 | 25.3 | 8 | 2 | 90 | 161.6 | 6.4 |
| Willow Creek | 3,220 | 5.0 | 22 | 0 | 78 | 41.1 | 8.2 |
| Totals for West Bear Creek | 59,566 | 93.1 | 15 | 5 | 80 | 478.6 | 5.1 |

Source: Medford BLM Geographical Information System (GIS)

Three stream categories are defined in the Northwest Forest Plan for BLM and U.S. Forest Service (USFS)-administered lands: fish-bearing, permanently flowing nonfish-bearing, and intermittent streams (Table 11 and Map 13). None of the nonfish-bearing streams have been inventoried to determine whether they are permanently flowing or intermittent. However, an approximation obtained from aerial photos was made to estimate miles of nonfish-bearing perennial and intermittent streams. The majority (87 percent) of streams on BLM and USFS-administered lands are nonfish-bearing intermittent streams, followed by nonfish-bearing perennial streams (10 percent), and fish-bearing streams (3 percent).

### Table 11. Stream Miles by Stream Category for BLM and USFS-Administered Lands

| Analysis Subwatershed | Northwest Forest Plan Stream Category for Riparian Reserves | | | Total Stream Miles with Riparian Reserves |
|---|---|---|---|---|
| | Fish-bearing Streams Miles | Perennial Nonfish-bearing Streams[1] Miles | Intermittent Streams[1] Miles | |
| Wagner Creek | 2.3 | 3.4 | 24.6 | 30.3 |
| Anderson Creek | 0 | 1.6 | 6.4 | 8.0 |
| Coleman Creek | 0 | 0.1 | 2.0 | 2.1 |
| Griffin Creek | 0 | 0.8 | 10.1 | 10.9 |
| Jackson Creek | 0 | 0.5 | 12.4 | 12.9 |
| Willow Creek | 0 | 0.1 | 8.4 | 8.5 |
| Totals for West Bear Creek | 2.3 | 7.5 | 64.9 | 74.7 |

1/ Stream category estimated from aerial photos.
Source: Medford BLM GIS

Wetlands in the West Bear Creek Watershed Analysis Area are classified as palustrine (ponds) or riverine systems (Table 12, Map 14). The U.S. Fish and Wildlife Service identified 106.4 acres of Palustrine wetlands in the analysis area in a 1984 National Wetlands Inventory. No wetland data was available for the west portion of the Jackson and Willow Creek analysis subwatersheds. Only data for the eastern portions of the Jackson and Willow Creek analysis subwatersheds is included in the table. Many of the wetlands were created by excavations or dike construction. Additional wetlands may be located during site-specific project analysis. A wetland was recently constructed at the USFS J. Herbert Stone Nursery in the Jackson Creek analysis subwatershed.

### Table 12. Wetlands

| Analysis Subwatershed | Palustrine System | |
|---|---|---|
| | Acres | Number |
| Wagner Creek | 43.0 | 30 |
| Anderson Creek | 10.4 | 19 |
| Coleman Creek | 0.8 | 2 |
| Griffin Creek | 19.7 | 48 |
| Jackson Creek | 30.7 | 70 |
| Willow Creek | 1.8 | 6 |
| Totals for West Bear Creek | 106.4 | 175 |

Source: USFW National Wetlands Inventory (USDI, FWS 1984)

There are nine springs in the analysis area identified on 7.5 minute USGS topographic maps. They are located in the Wagner (three), Anderson (four), and Jackson Creek areas and all are unnamed except for Hope Spring in the Wagner Creek analysis subwatershed.

There are no lakes or major reservoirs in the analysis area, however there are numerous small privately constructed reservoirs, as well as a complex system of canals, ditches, diversions, and transfers throughout the lower elevations of the analysis area. Some streams in the analysis area, such as Jackson and Coleman Creeks, serve as a conveyance for delivering irrigation water (RVCOG 2001:36).

**Hydrologic Characteristics**

None of the Bear Creek tributaries in the analysis area have continuous recording streamflow gages. The two operational United States Geological Survey (USGS) gaging stations on Bear Creek are located in Medford (station no. 14357500) and in Ashland (station no. 14354200) (Table 13). The discharge above the two Bear Creek USGS gaging stations has been regulated since 1924 by Emigrant Lake. Water is diverted into Bear Creek from the Klamath River Basin and there are many diversions for irrigation and municipal use upstream from the gaging station. The water transport and storage activities affecting the flow in Bear Creek make it difficult to develop a streamflow relationship between Bear Creek and its tributaries.

**Table 13. USGS Gaging Stations**

| Station | Period of Record (water year) | Drainage Area (mi.$^2$) | Extreme Discharges | | Average Annual Discharge (cfs) | Average Annual Runoff (acre-feet/yr.) |
|---|---|---|---|---|---|---|
| | | | Maximum (cfs) | Minimum (cfs) | | |
| Bear Creek below Ashland Creek | 1990-1999 | 168 | 12,000 | 0.33 | 104 | 75,280 |
| Bear Creek at Medford | 1921-1999 | 289 | 17,600 | 0 | 115 | 83,570 |

Source: U.S. Geological Survey Water Resources Data (USDI, GS 1999).

The Bear Creek Flow Study by the Rogue Valley Council of Governments (RVCOG 1999a) examined the correlation between Bear Creek flows and 13 tributaries. Four of the tributaries evaluated are in the West Bear Creek Analysis Area: Wagner, Coleman, Griffin, and Jackson Creeks. The study concluded that during the non-irrigation season (November 1-May 30) the flows in the tributaries appear to be highly influenced by natural physical processes. However, the study found that during the irrigation season (April 1-October 31) the tributary flows do not follow a natural flow regime and therefore cannot be predicted from a relationship between the tributaries and Bear Creek.

The RVCOG study also determined the relative monthly water discharges separated by irrigation/non-irrigation seasons for the 13 Bear Creek tributaries. Jackson and Griffin Creeks were identified as being two of the top three influential creeks contributing flows to Bear Creek during the irrigation season.

During irrigation season, the Talent Irrigation District (TID) uses the McDonald ditch to divert water from McDonald Creek and several small, unnamed streams in the Applegate River Subbasin to Wagner Creek. Average monthly diversions during 1994-1998 ranged from 0.26 cfs in September to 6.15 cfs in June.

## STREAM CHANNEL

Level I Rosgen channel morphology classification (Rosgen 1996) has been done for streams in the analysis area (Map 15, Table 14). Stream classification is based on stream gradients, sinuosities, valley form, entrenchment, and confinement (Rosgen 1996). These stream characteristics were obtained from 7.5 minute USGS topographic maps and aerial photographs. Channel types are discussed in greater detail in Current Conditions (Appendix E provides descriptions of Rosgen morphological stream types).

**Table 14. Stream Channel Types**

| Subwatershed | Stream Types | | | | | | |
|---|---|---|---|---|---|---|---|
| | Aa+ (miles) | A (miles) | B (miles) | C (miles) | F (miles) | G (miles) | Total Stream miles |
| Wagner Creek | 86.1 | 11.4 | 3.5 | 0.0 | 1.8 | 0.7 | 103.5 |
| Anderson Creek | 42.7 | 9.7 | 2.0 | 0.0 | 0.0 | 4.0 | 58.4 |
| Coleman Creek | 16.7 | 5.7 | 0.0 | 0.0 | 0.0 | 0.9 | 23.3 |
| Griffin Creek | 53.6 | 13.8 | 5.2 | 0.0 | 12.7 | 5.4 | 90.7 |
| Jackson Creek | 103.5 | 24.5 | 9.3 | 0.0 | 19.5 | 4.8 | 161.6 |
| Willow Creek | 33.6 | 4.3 | 0.7 | 1.4 | 1.1 | 0.0 | 41.1 |
| Totals for West Bear Creek | 336.2 | 69.4 | 20.7 | 1.4 | 35.1 | 15.8 | 478.6 |

The streams in the analysis area cover a wide variety of channel characteristics, ranging from Rosgen type Aa+ to type G. Channels in the analysis area are predominantly (70 percent) type Aa+. These stream channels are located in the upper reaches and tend to be very steep (greater than 10 percent slope) with vertical steps. They are characterized by deeply entrenched V-shaped valleys that are confined by steep hillslopes. Transported material is quickly moved through these reaches. Substrate is mostly bedrock and cobble, except in the Jackson Creek and Willow Creek areas with granitic soils. These Aa+ streams have the highest potential for debris torrents.

Type A channels comprise 12 percent of the analysis area streams and are generally found downstream of the type Aa+ channels. These stream channels are steep (four to ten percent slope), entrenched, cascading, step/pool streams in V-shaped valleys confined by steep hillslopes.

Type B channel segments comprise four percent of the analysis area streams and are found in all the analysis subwatersheds except Coleman Creek. These channel reaches have moderate gradients (from 2 percent to 3.9 percent), are moderately entrenched, and riffle dominated.

Willow Creek is the only stream in the analysis area that exhibits type C channel characteristics. Starting approximately one mile upstream from the mouth it forms two C channels which are characterized by low gradient (less than two percent), meandering, riffle/pool, alluvial channels with broad, well-defined floodplains.

Type F channels are located in the lower reaches of all the analysis subwatersheds except Anderson Creek and Coleman Creek. They are especially extensive in the Jackson Creek and Griffin Creek analysis subwatersheds (12 and 14 percent of total stream miles respectively). The type F reaches are low gradient (less than two percent), entrenched, meandering, riffle/pool channels with high width/depth ratios.

Type G channels comprise three percent of the analysis area and are found in the lower portions of all the analysis subwatersheds except Willow Creek. Type G channels are entrenched gullies on moderate gradients (two to 3.9 percent) with low width/depth ratios. These channels tend to be deeply incised in alluvial or colluvial materials and are unstable with high bank erosion rates.

## WATER QUALITY

The Oregon Department of Environmental Quality's (ODEQ) water quality program is designed to protect designated beneficial uses of the State's waters. The designated beneficial uses for the West Bear Creek Watershed Analysis Area are domestic water supply (public and private), industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid fish rearing, salmonid fish spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetics quality, and hydro power (ODEQ 1992). The designation of beneficial uses is important because it determines the water quality criteria applied to a water body. Water quality standards are typically designed to protect the most sensitive beneficial uses within a water body. The most sensitive beneficial uses for the West Bear Creek Watershed Analysis Area are domestic water supply, anadromous fish passage, salmonid fish rearing, salmonid fish spawning, and resident fish and aquatic life (MacDonald et al. 1991:39). Flow modifications, temperature, dissolved oxygen, pH, bacteria/pathogens, turbidity, sedimentation, and habitat modifications are the key water quality indicators most critical to these sensitive beneficial uses.

The City of Talent, which is located near the mouth of Wagner Creek, obtains water from Wagner Creek for municipal use. Other cities in the analysis area obtain their water from the Medford water supply.

## RIPARIAN AREAS

The biggest influence on the condition and species composition of riparian corridors in the West Bear Creek Watershed analysis area is the developed condition of the land. The lower sections of all riparian corridors pass through developed areas of agriculture, rural-residential, urbanization, small farm use, and commercial land use. As a result, vegetation widths are 60 feet or less on perennial streams, with even less to none on intermittent and ephemeral draws (RVCOG 1999a, 1998). Where present, much of the native riparian vegetation has been replaced by non-native Himalayan blackberries and shrubs. These non-native species provide little shade or large woody debris, and there is no potential for future recruitment. Bank stability has been compromised and there is little sediment control.

Riparian corridors in the upper reaches of the streams in the analysis area are above most of the development and have wider, forested riparian corridors of mixed firs and hardwoods. Disturbance to the riparian corridor in these upper reaches is primarily from adjacent roads. Riparian vegetation is composed of second growth Douglas-fir, Ponderosa pine, and western red-cedar, as well as big leaf maple, black oak, madrone, cottonwood, alder, birch, and willow (RVCOG 1998, 1999).

Riparian areas provide habitat for riparian-dependant wildlife species, a transition zone between riparian and upslope habitat, and dispersal corridors for terrestrial wildlife. Some of the animals that depend on riparian areas in the analysis area include fish, mollusks, aquatic macroinvertebrates, amphibians, bats, beaver, western pond turtles, American dippers, great blue herons, and osprey.

The Northwest Forest Plan provides interim Riparian Reserve widths for streams (USDA and USDI 1994a:C-30). These widths are adopted for streams in the West Bear Creek Watershed Analysis Area (Map 16).

## AQUATIC WILDLIFE SPECIES AND HABITATS

**Fish Populations**
Summer steelhead were considered a candidate species for listing under the ESA of 1973. In April 2001, the National Marine Fisheries Services ruled that listing was not warranted. Summer steelhead use almost 24 miles of habitat in streams throughout the analysis area (ODFW 1999). Summer steelhead adults enter the tributaries as soon as winter flow levels are sufficient and spawn between January and March. Fry emerge in April and May, with most fry migrating out in May and June. Habitat available to summer steelhead is primarily located in the Wagner Creek (9.86 miles) and Jackson Creek (6.8 miles) subwatersheds, with additional habitat in the Griffin Creek (3.2 miles), and the Willow creek (2.5 miles) subwatersheds (Table 15, Map 17). It is unknown how much habitat is available in the Anderson subwatershed, and there is no habitat available in the Colemen Creek subwatershed.

Fall chinook (*Oncorhynchus tshawytscha*) spawn in Bear Creek during September and October, and utilize tributaries in the analysis area for additional habitat if there is adequate flow during this time period. An adult fall chinook was observed in Jackson Creek by ODFW staff in 1997, downstream from the Interstate 5 culvert. No chinook have been observed in any of the other tributaries in the analysis area.

Cuttthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*) and sculpin (*Cottus* sp.) also reside in streams within the analysis area. ODFW has determined upstream limits for rainbow and cutthroat trout, but not for sculpin, which are assumed to have a distribution similar to that of cutthroat. There are 35.5 miles of habitat available to rainbow trout in the analysis area, most of which is found in the Wagner Creek subwatershed (10.86 miles). Additional habitat is found in the Jackson Creek (7.0 miles), Anderson Creek (5.63 miles), and Willow Creek (3.5 miles) subwatersheds. Cutthroat trout are found almost exclusively in the Wagner Creek subwatershed (10.86 miles), with a very small section of stream available in the Anderson Creek subwatershed (0.06 miles) (Table 15).

**Table 15. Approximate Stream Miles of Salmonid Use**

| Analysis Subwatershed | Stream Name | Summer Steelhead | Rainbow Trout | Cutthroat Trout |
|---|---|---|---|---|
| **Wagner Creek** | Wagner Creek | 6.8 | 7.6 | 7.6 |
| | Arrastra Creek | 0 | 1.0 | 1.0 |
| | Trib C2 to Arrastra | 0 | 0.4 | 0.4 |
| | Holton Creek | 0.3 | 0.3 | 0.3 |
| | Yank Gulch | 0 | 0.6 | 0.6 |
| | Bear Gulch | 0 | 0.3 | 0.3 |
| | Horn Gulch | 2.7 | 0 | 0 |
| | Trib B to Wagner | 0 | 0.6 | 0.6 |
| | Rail Gulch | 0.06 | 0.06 | 0.06 |
| **Anderson Creek** | Anderson Creek | unknown | 5.5 | 0 |
| | Trib A to Anderson Ck. | 0 | 0.06 | 0.06 |
| | NF Anderson Ck. | 0 | 0.07 | 0 |
| **Coleman Creek** | No fish present | | | |
| **Griffin Creek** | **Griffin Creek** | **3.2** | **8.5** | **0** |
| **Jackson Creek** | Jackson Creek | 4.4 | 7.0 | 0 |
| | Trib A to Jackson Ck. | 1.4 | 0 | 0 |
| | Dean Creek | 2.0 | 0 | 0 |
| | Trib A to Dean Creek | 0.3 | 0 | 0 |
| | Trib C to Dean Creek | 0.1 | 0 | 0 |
| **Willow Creek** | Willow Creek | 2.5 | 3.5 | 0 |
| **TOTAL MILES** | | 23.76 | 35.49 | 10.92 |

*Other Species*
Crayfish and Pacific Giant Salamanders are also known to reside in the watershed analysis area, although little is known about their status.

The lower reaches of the tributaries in the analysis area are in a very developed valley of diverse land use including agriculture, small farms, rural residential, residential and commercial development, road crossings, railroad crossings, urban runoff drainage structures, and irrigation diversions. In many cases, this development is right in the riparian zone, resulting in channelized streams, changes in the natural flow regimes, inadequate shading of the stream, inadequate Large woody debris (LWD), no recruitment potential for additional LWD (see riparian section), and high sediment.

Throughout the analysis area, barriers to fish migrations such as dams, irrigation diversions, push up dams, and culverts block anadromous fish from additional spawning habitat. They also prevent resident fish from moving back up to repopulate an area if the original population is killed by an event such as drought, flood event, or chemical poisoning. There are eleven known fish barriers in the analysis area.

# CURRENT CONDITIONS

The Current Conditions section provides more detail than the Characterization section and documents the current conditions and trends of the analysis area.

## HUMAN USES

The West Bear Creek Watershed Analysis Area includes a mix of public and private lands, with the majority of the land in private ownership (see Characterization section, Human Uses). Private lands are primarily used for residence, ranching, timber, orchards, and an increasing number of vineyards. Public lands are used for timber harvest as well as recreation, which is a significant use in the analysis area.

The people most closely associated with the analysis area include local residents and landowners, as well as many groups and individuals that have an interest in the analysis area and use it for a variety of purposes including economic and recreational activities. The City of Jacksonville is entirely located in the analysis area, and portions of Medford, Central Point, Phoenix and Talent are in the analysis area. Other groups in the analysis area that are actively researching watershed health are the Bear Creek Watershed Council and the Jackson Creek Technical Advisory Team. These groups are comprised of local and federal officials, as well as interested community members. Interactions among private citizens, businesses, local groups, and government agencies are important avenues for education and information sharing and will contribute to efforts at ecosystem management in the analysis area.

**Current Human Uses and Trends**

Mining, farming, and ranching characterized the early communities of the analysis area (Wheeler 1971) and descendants of early immigrants still reside in the analysis area. Timber production and logging are human uses that occur on public and private lands in the analysis area. As elsewhere in the region, farming, ranching, and logging have declined in recent years. The service, trade, and manufacturing sectors of the economy are growing at a faster rate. These trends are likely to affect the analysis area.

Recreation on public lands has been important in the past and is likely to increase in the future. The Jacksonville Woodlands Association is currently working with BLM and private landowners to develop a trail system in the hills surrounding Jacksonville. John’s Peak and the surrounding area has historically been used by local and regional residents for off-highway vehicle (OHV) use. The Motorcycle Rider’s Association owns 220 acres near the headwaters of Jackson Creek and uses it as an OHV meeting and staging area. OHV use has increased in recent years, reflecting the growing popularity of OHVs throughout the west. Non-timber products and recreational uses on public lands will probably receive more emphasis in the future.

Population growth in the analysis area increased significantly in the past decade (Table 16). Growth in all of the cities located partially or fully in the analysis area outstripped the statewide average of 18 percent. As a whole, Jackson County increased by 22.31 percent, while Central Point and Talent grew by 62.81 percent and 57.61 percent respectively. The majority of this increase is due to migration. Population growth impacts the analysis area as there are more demands placed on natural resources, open space, transportation systems, and recreational systems, as well as city and county services such as schools, emergency services, health and human services, and water supply. The trend in growth is likely to continue in the coming decade.

**Table 16. Population Increases Affecting the West Bear Creek Analysis Area[1]**

| | 1990 Population | 2000 Population | Percent Increase |
|---|---|---|---|
| **Jackson County** | 146,389 | 179,050 | 22.31% |
| **Central Point** | 7,512 | 12,230 | 62.81% |
| **Jacksonville** | 1,896 | 2,270 | 19.73% |
| **Medford** | 47,021 | 62,030 | 31.92% |
| **Phoenix** | 3,239 | 4,145 | 27.97% |
| **Talent** | 3,274 | 5,160 | 57.61% |

[1] 2000 population estimates are from Center for Population Research and Census, Portland State University.

Elsewhere in the region there is a growing "commuter" class of residents in the rural areas (Preister 1994). These people reside in rural areas but commute from their homes and communities to jobs in the more urban areas. Within the analysis area, many people residing in and around Phoenix, Talent, Central Point and Jacksonville commute to work in Ashland and Medford. This trend is likely to continue in the analysis area.

**Facilities and Structures**

The West Bear Creek Watershed Analysis Area has only one known authorized "facility" within the analysis area boundaries as defined. This is a small communication site facility which is owned and operated by Southern Oregon Regional Communications (SORC), a provider of radio services for the Jackson County Sheriff's Department and the "911" emergency system. This facility was authorized to SORC in 1987 and continues to provide public service today. The facility is located on public land in the south portion of the analysis area. Previously, the State of Oregon owned and operated a fire lookout in the Anderson Butte vicinity, but now only some remnant foundation pieces can be found on the site.

**Authorized and Unauthorized Uses**

A number of other BLM authorizations have been granted for various uses within the analysis area. There are nine right-of-way grants for roads, six right-of-way grants for minor utility systems (electric and phone lines), and one right-of-way grant for a water line. These authorized uses are to private individuals or to utility companies providing service to private customers.

There are no known unauthorized uses of the types described above on public land within the analysis area. However, some of these unauthorized uses do exist. Examples of unauthorized activities that do occur on public land in the analysis area include illegal dumping, vandalism, and illegal drug manufacturing. The closure of a landfill near Jacksonville has resulted in an increase of illegal dumping on BLM-administered land, especially in the Anderson Butte area. Illegal dumping also occurs in the Wagner Creek area.

**Land Use Permits**
No BLM special land use permits have been issued in the analysis area under the Realty Program in recent years. This potential exists, but at this time no applications are on file and none are anticipated in the near future.

**Easements**
Over the years, BLM has acquired many easements within the analysis area. These easements were acquired mainly in support of the timber management program. The easements include both exclusive and non-exclusive types.

**Land Exchanges/Sales**
Currently, there is one land exchange proposal involving public land located in the analysis area. The BLM parcels identified for exchange are located in T. 37 S., R. 2 W., Willamette Meridian. They are under consideration for exchange of private lands located in another drainage of Jackson County. The Ashland Resource Area of the BLM has notified the proponent of the exchange that we are interested in the private parcels being offered, but are under no obligation to proceed with the action at this time. Additional work needs to be undertaken and completed before the exchange can go forward. This work is subject to availability of funding and work-months.

The 1995 Medford District Resource Management Plan (RMP) identified two BLM parcels that lack legal access and are isolated from other public lands as meeting the basic criteria for potential disposal through sale or exchange. To date the Medford District has not pursued this option and it is unlikely that this will become a District priority in the near future. One additional isolated parcel is currently included in a pending BLM Plan Amendment as being suitable for disposal. This Plan Amendment is subject to the completion of an Environmental Analysis (EA) which will be made available for public review and comment in the near future.

**Land Acquisitions**
The BLM recently purchased private land within the analysis area. This acquisition was made with money derived from the Land and Water Conservation Fund. The money in this Fund is generated by oil and gas receipts from the off-shore oil and gas drilling program. Twenty-seven acres of private land located southwest of the community of Jacksonville were purchased utilizing these funds. These twenty-seven acres connect with other public land in the area. A recreational trail system is now being developed through a partnership between the BLM and the Jacksonville Woodlands Association.

**Transportation System**
BLM's Geographical Information System (GIS) and Transportation Information Management System (TIMS) identifies approximately 580 total miles of road within the analysis area, of which 9 percent are controlled by the BLM and U.S. Forest Service. Roads in the analysis area vary from primitive four wheel drive roads to paved highways. BLM controls 22 miles of natural surface roads, 26 miles of rocked roads, and 4 miles of bituminous surfaced roads. Most county roads have a bituminous surface and the private roads either are usually rocked or are left unsurfaced.

BLM roads were constructed and are maintained for log hauling and administrative purposes. In recent years most road construction has occurred primarily on private lands. BLM inventories contain very little information about non-BLM controlled roads.

Road maintenance is conducted by the different owners and management agencies. Water, oil, or lignin are usually applied to road surfaces when hauling during dry periods for dust abatement and to keep roads from disintegrating. There are developed water sources in the analysis area where the BLM may obtain water. Water is used when placing surface rock and for road maintenance, which allows for proper processing and reduced segregation of the road surface rock.

Due to BLM's checkerboard land ownership, the Bureau has entered into numerous reciprocal right-of-way and road use agreements. These agreements do not include rights for the general public to use roads constructed under these reciprocal right-of-way agreements. These agreements enable the BLM to use private roads to access BLM lands and private landowners to access their lands over BLM roads. The agreements are an essential part of a complete transportation system and have resulted in significant cost savings to the public, environmental benefits, and fewer roads.

The BLM charges fees for commercial use of roads and then uses these fees to help pay for road maintenance. A reduction in timber harvest levels has resulted in a significant decrease in the primary funding source for maintaining the transportation system. Many roads previously maintained at a high level are not being maintained to that extent any longer. To reduce maintenance requirements and erosion potential, some unnecessary roads have been decommissioned. Other roads are closed until future access is needed and many others are maintained at the lowest possible levels. BLM roads have a maintenance level assigned to them. The roads are monitored and the maintenance levels are modified when needs and conditions change. Maintenance levels range from minimal standards on short roads to high standards on main roads. Sharing and maintaining roads with landowners has also reduced the amount of road necessary for access and maintenance costs. The goal is to maintain the entire transportation system in a safe and environmentally sound condition. The result is a transportation system that provides for various recreational activities, private access, logging, fire fighting access, and other land management uses.

Road maintenance includes removing safety hazards, reducing soil erosion potential and providing for fish passage at all potential fish bearing stream crossings. Safety hazards include hazard trees that have the potential to fall on houses, recreation areas, or roadways. Hazard trees are usually dead, but may be alive with roots under-cut or with significant physical damage to the trunk or root system. Proper maintenance of road drainage systems and stream crossing culverts is essential to avoid both erosion and fish passage problems. Most of the existing culverts were designed to withstand 50-year flood events. New drainage structures will be designed to withstand a 100-year flood event and when appropriate, provide for fish passage. Road protection measures include constructing drainage structures, grass seeding, blocking roads, placing road surface rock, and applying bituminous surfacing.

BLM roads are generally open for public use unless blocked by gates or other methods. Gates and other road barriers regulate vehicle access to reduce maintenance costs, soil erosion, transfer of noxious weeds, and wildlife disturbance. The BLM road inventory shows approximately 10 miles of BLM-controlled roads are located behind road blocks. In this watershed most of the highest road densities are located on private lands.

**Logging**
From 1986-1998, the BLM advertised seven different timber sales in the analysis area. A total of 4.9 million board feet (MMBF) of timber was removed from 1,781 acres (Appendix F). Three percent of the total acres (48 ac.) were tractor logged, seven percent (132 ac.) were cable logged, and 90 percent (1601 ac.) were helicopter logged. Partial cut harvest was conducted on 1,732 acres with a variety of different prescription, including a mortality salvage harvest on 1, 635 acres. Forty-nine acres were clearcut (these were sold in 1986 or 1989).

The most recent major advertised timber sale on BLM-managed lands within the analysis area was Go Anderson, a salvage sale. Approximately 2,100 thousand board feet (MBF) were removed from approximately 955 acres within the analysis area. Fifty-two of these acres were cable logged and the rest were helicopter logged. The sale was completed in 1992. Approximately 45 acres of the Isabelle timber sale, sold in FY99, are located in the watershed. These acres are located along the ridge top bordering the Middle Applegate Watershed. There are no timber sales planned in this analysis area through the fiscal year 2005.

Since 1950, approximately 6,000 acres of BLM-administered land have been entered for some type of timber harvest (Table 17). This accounts for 40 percent of BLM-administered land in the analysis area, but only 10 percent of entire analysis area. Approximately 1,048 of these acres were clearcut, with more than half of the clearcuts taking place in the 1980s.

**Table 17. Acres Harvested and Volume Removed on BLM-Managed Lands***

| Decade of Sale | Clearcut Acres | Select Cut Acres | Salvage Acres | Shelter-wood Acres | Overstory Removal Acres | Thinning Acres | Volume Removed (MMBF[1]) |
|---|---|---|---|---|---|---|---|
| **1950s** | 145 | 194 | 1 | 0 | 154 | 0 | 5.6 |
| **1960s** | 332 | 213 | 3 | 69 | 0 | 0 | 14.8 |
| **1970s** | 37 | 1624 | 17 | 250 | 30 | 0 | 16.3 |
| **1980s** | 533 | 15 | 9 | 252 | 375 | 0 | 12.9 |
| **1990s** | 1 | 4 | 1635 | 54 | 6 | 31 | 3.3 |

1/ MMBF = millions of board feet
* Figures reflect forest inventory data (Micro *Storms database) as of May 1, 2000. It is estimated that approximately 2,500 acres has been double counted meaning these acres have had more than one entry

Oregon Department of Forestry's (ODF) Notification of Operations database (1990-1999) was referenced in order to investigate logging and other operations conducted on private land within the analysis area. This database only contains the location, operator/land owner, year, activities, methods used, and acreage for proposed operations. The operator/landowner may deviate from the planned operation. Because of this potential deviation, only general information is available regarding operations within the analysis area.

Most of the notifications fell into one of the following categories: 1) herbicide, insecticide, rodenticide, fertilizer, and fungicide application; 2) road construction/reconstruction; and 3) harvesting. Herbicides, insecticides, rodenticides, fertilizers, and fungicides have been used by private landowners throughout the analysis area at different levels of application. Approximately 5.3 miles of new road have been planned by private landowners/operators since 1990 and approximately 33 miles of road have been planned for renovation.

Harvesting consists of two different harvest types: 1) commercial thinning and 2) removal of all or most of the merchantable conifers or large hardwoods from the unit during harvesting. From 1990-1999, 25,620 acres of commercial thins were either harvested or planned for harvest from private lands in the analysis area. During the same period, 1,335 acres of clearcuts were planned. The 26,955 acres planned for some type of timber removal on private land would have accounted for 45 percent of the entire analysis area in the 1990s. When combined with BLM-administered lands harvested in the 1990s, a total of 48 percent of the lands in the analysis area have been entered for timber harvest in the 1990s. No commercial harvesting has taken place on Forest Service managed lands within the analysis area.

**Special Forest Products**

The BLM is working with the Forest Service to develop regional and national strategies that recognize the importance of managing special forest products (SFPs). These strategies emphasize four themes: 1) to incorporate harvesting of SFPs into an ecosystem management framework with guidelines for sustainable harvest, species conservation, and protection of ecosystem functions; 2) to involve the public including industrial, Native American, and recreational users of these resources in making decisions about the future of SFPs on public lands; 3) to view the management of accessibility to SFPs as major factors in assisting rural economic diversification in formerly timber-dependent communities; and 4) to develop and implement inventory, monitoring, and research programs to ensure species protection and ecosystem health (Molina et al. 1997).

Special forest products have been extracted from the analysis area for at least 50 years. The primary SFPs in the analysis area are fuel wood, salvage saw timber, and cedar boughs. The level of fuel wood removal probably peaked in the late 1970s through the mid-1980s when logging activity and wood stove use were high. Since then, restrictions on wood burning in the Rogue Valley, combined with decreasing timber sale activity has resulted in a dramatic reduction in fuel wood cutting. The BLM-administered lands in the analysis area could continue to be a source for individual/family Christmas tree cutting due to its close proximity to the Rogue Valley. Currently, harvest levels are very low for other SFPs in the analysis area, such as floral greenery and mushrooms.

**Grazing/Agriculture**

Cattle operations are the number one agricultural commodity in Oregon, contributing 12.8 percent of the total gross value of agricultural products. Jackson County ranks $16^{th}$ in the state for gross farm and ranch sales (Andrews 1993). Within the analysis area, cattle operations are the largest non-forestry agricultural venture. Livestock grazing is currently concentrated in privately owned range lands consisting of flat and open terrain with adequate forage.

BLM-administered land within the West Bear Creek Watershed Analysis Area is designated as open range. There are portions of two allotments within the boundary of the watershed analysis area (Map 18) accounting for 7,251 acres (Appendix G). The total permitted use on these three allotments is 190 Animal Unit Months (AUMs). None of the allotments are currently in use. The Sardine and Galls Creek Allotment was canceled in 1980 by decision of the Medford District Manager. The Sterling Creek Allotment has been vacant since the early 1980s. The non-use status of these allotments can primarily be attributed to the poor quality of these areas for livestock grazing. The allotments are characterized by steep hills and brushy vegetation with little desirable forage. No one has applied to lease these allotments, and the declining agricultural base in the adjacent areas makes it unlikely that anyone would apply for a lease.

Other agriculture in the analysis area is varied and mostly consists of small acreage, domestic farms and gardens. There may be some orchards still in production, although most operations are found at lower elevations and outside of the analysis area. In general, agricultural lands and the open space they provide are in decline due to urbanization.

**Minerals**

There are a number of properly filed mining claims on public lands in the analysis area. At the time of research, there were fifteen recognized claims within the analysis area and an additional three which were “split” between this analysis area and the adjoining Rogue-Gold Hill Analysis Area. Eight of the fifteen claims are lode claims, and the other seven are placer claims. All lode and placer claims are 20 acres in size. Placer claims are typically located along a stream channel in which auriferous (gold bearing) gravels are processed for their mineral content. During the early days on mining in large operations, these gravels were often worked with a hydraulic “giant” or with a bucket dredge in order to move and process large quantities of material. This type of mining resulted in severe disturbance to the stream channel, the associated riparian vegetation, and the fishery resource. Evidence of this type of mining from the past can still be found in certain drainages of the analysis area.

Today, all mining claims on Federal lands are subject to Surface Management regulations under Title 43 of the Code of Federal Regulations (CFR), Subpart 3809, or the Use and Occupancy regulations, Subpart 3715. In addition, there are dredge size and season of use restrictions imposed by the State. In the analysis area suction dredging is only permitted between June 15 and September 15 of a given year in order to protect fish species.

**Recreation**

Recreational activities within the analysis area include hiking, fishing, dispersed camping, hunting, sightseeing, horseback riding, picnicking, driving for pleasure, mountain biking, target shooting, mushroom and berry picking, firewood gathering, and off-highway-vehicle (OHV) activities.

Developed facilities within the analysis area include an interpretive trail in the Wagner Creek area, a non-motorized trail system around Jacksonville, the Britt Grounds in Jacksonville, and an OHV staging area. The Wagner Creek interpretive trail is a loop trail approximately 1/4 mile long. The trail and the interpretive materials associated with it were developed and are maintained by the Talent Middle school.

The Jacksonville Woodlands trail system is a series of non-motorized trails in the hills surrounding Jacksonville. The area is cooperatively managed by the City of Jacksonville, the Jacksonville Woodlands Association, Jackson County Parks, and the Bureau of Land Management. Maintenance of the trail system is provided by the Jacksonville Woodlands Association. Most trails already exist, however new trails are planned for construction on three parcels of BLM land within the project area.

The Britt Grounds are managed by Jackson County Parks and are used for a number of activities throughout the year, including the Britt Music Festival.

The Motorcycle Riders Association (MRA), is a private group of OHV enthusiasts who own 220 acres in the analysis area near the headwaters of Jackson Creek. The area is used for both organized and unorganized OHV activities. Developed parking facilities exist on this property and the MRA has plans for additional facilities over time.

There are no developed facilities managed by BLM within this analysis area.

*Timber Mountain/ John's Peak Off-Highway Vehicle Designation*
The 1995 Medford District's Resource Management Plan (RMP) identified 16,250 acres as the John's Peak/Timber Mountain OHV area. The RMP specified that this area would be managed to provide for OHV use. A portion of this designated area is within the West Bear Creek Watershed Analysis Area. This area was designated to acknowledge 50 years of OHV use in this area, to manage the existing use, and to reduce adverse impacts to soils, water, wildlife, and residents by limiting the use to existing roads and designated trails.

Thousands of riders from the Rogue Valley use this and adjacent areas for OHV use. The MRA has over 400 families in its club. The existing trail system allows riders to travel the ridge system from Grants Pass to Jacksonville. The local chapter of the Motorcycle Riders Association sponsors three to four organized OHV events yearly, using a combination of private and public lands. These events draw riders from throughout the western United States and Canada. The area is extremely popular with the riders and use has been increasing for the past 50 years. Subsequent to the completion of this analysis, a management plan will be prepared for BLM-administered lands that include the John's Peak/Timber Mountain OHV area.

**Cultural Resources (Archaeological and Historic Sites)**
There are numerous known archaeological sites within the analysis area, representing both the history of the native peoples and that of the early settlers. A portion of the Applegate Trail route runs through the analysis area. There are several sites that are listed on the National Register of Historic Places within the analysis area, including the town of Jacksonville, Rich Gulch, and the Hanley Farm.

## EROSION PROCESSES

### Natural Processes Affecting Erosion Rates and Slope Stability

*Floods*

The primary natural event that affects erosional processes in the analysis area is flooding that takes place when thick snow packs in the transient snow zone are rapidly melted by warm rainstorms. The 1997 flood resulted in channel erosion and bridge damage along Wagner Creek and flooding in Bear Creek. No other drainages in the analysis area reported damage during this event.

*Wildfire*

Wildfire is a natural process capable of removing extensive soil cover in the analysis area. There can be substantial erosion from a fire-disturbed site when an intense rainfall event occurs within a year or two after a severe fire. Vegetative cover or litterfall is generally reestablished within the first two years after a disturbance, protecting soils from further rainfall impact. The erosion that occurs after a wildfire can result in significant topsoil loss and subsequent stream degradation. Topsoil loss due to wildfires has been reduced over the past 70 years since fire suppression has resulted in fewer natural fires exposing soils. The excessive vegetation resulting from 70 years of fire suppression has increased the risk that an intense wildfire of long duration will occur and cause severe soil erosion and landslide problems.

Areas most at risk for topsoil loss due to a severe wildfire are those lands found on granitic rock and the associated Tallowbox-Shefflein soils. This is due to the sandy nature of these non-cohesive rocktypes. This is due to the sandy nature of these non-cohesive rocktypes, and the hydrophobic (water repellant) nature of granitic soils when severely burned. Water repellancy causes precipitation to flow overland rather than soaking into the ground.

In January 2001, an approximately 100 acre wildfire occurred in the Wagner Creek Drainage on granitic rocktypes. The fire resulted from rekindling of timber cutting residue on private lands that were burned two weeks earlier.

*Slope Stability*

Landslides resulting from steep, unstable slopes are primarily located in the upper portion of the analysis area. These features on BLM and USFS-administered land are classified as unsuitable for management and are not treated. Currently, two granitic sites in the Wagner Creek Drainage (T39S, R1W, Sec. 23) are classified as landslide prone and unsuitable for treatment.

Debris slides, as described in the Characterization section, are likely to occur due to the non-cohesive sediment loads produced by granite. No debris slides were reported in the Analysis Area following the1997 flood, but as granitic terrane continues to add sediment to debris-filled draws, debris slides will eventually re-occur. Natural landslides provide a much needed benefit to aquatic systems by delivering gravels and large woody material with roots attached from the uplands to fish bearing streams.

For reproduction, many fish species as well as insects and microscopic aquatic life need well-sorted and poorly graded gravel (deficient in fines) for the incubation of eggs. The open texture of poorly graded gravel provides protection of eggs from predation and more importantly the upwelling of water through these gravels provides a continuously refreshed source of oxygen. Water cascading over and around landslide-delivered trees and boulders contributes to this process by creating upward moving eddies that lift fine sediment out of the gravels to be swept away by the current. Consequently, landslides are a natural and needed component of the ecosystem.

An exception to this would be a landslide originating in granitic rocktypes. Though granite landslides are a much-needed source of boulders and trees, there is very little cobble produced from this terrane and an excessive amount of sand-sized sediment.

Surface erosion due to natural processes is found where surface water is concentrated in drainages or draws. Sheet, rill, and ravel erosion occur most frequently on canyon sideslopes and valley floors. The largest amount of sediment transported to streams because of surface erosion comes from the steeper, stream-adjacent slopes.

**Human Activities Affecting Slope Stability**
Erosion processes are often most active near managed areas or areas managed in the recent past, such as roads and clearcuts. Slumps and/or tension cracks are often found in road prisms, cut slopes, and fill slopes. The following are the major human activities that have impacted erosion processes in analysis area. These activities are generally listed in order from largest to smallest impact potential.

*Road Development*
Road construction has been the largest human impact to the analysis area in terms of compaction, sediment delivered to streams and negative impacts to fishery habitats. Roads with inadequate drainage can result in rills, gullies, slumps, and debris-flow landslides during peak flow events (especially the 1964, 1974, and 1997 storms). Non-surfaced roads based on granitic rocktypes are especially prone to surface erosion. These at-risk roads are found in the headwaters of Wagner, Jackson and Willow Creeks.

Roads can intercept overland flows and concentrate the water into areas that can saturate weak soils and create conditions that are conducive for slope failures and surface erosion. Many roads in the analysis area have been constructed with culverts and ditches or drain dips as the drainage structures. However, some of these roads are unsurfaced and usually do not have armoring below water-bars or drain dips to protect against erosion and mass wasting. Use of natural surface roads left open during the rainy season has caused ruts which concentrate runoff. Intense rain storms and rain-on-snow events have produced heavy runoff from these unsurfaced roadways. As a result of the concentrated run-off, rills and/or ruts sometimes develop on the steep grades. During intense storms, high energy runoff is often concentrated into rills on steep road grades which transports sediment into streams, especially at stream crossings and where roads parallel streams.

High road densities, greater than 4.0 miles per square mile, are found in some sections of the analysis area (Map 21), most notably the John's Peak and Bald Mountain areas. The majority of areas with high road densities are on private timber lands. When these high road densities are combined with weak soils and are near riparian and/or unstable areas, effects to the environment are the most severe.

*Timber Harvesting*
Clearcut timber harvesting is second only to roads in causing adverse impacts to streams, soils, and fisheries. Clearcutting is not currently a major concern on BLM-administered land in the analysis area, as it is not permitted under the Medford District's Resource Management Plan (USDI, BLM 1995). No timber harvesting has occurred on any U.S. Forest Service lands in the analysis area, though a portion of T39S, R1W, Sec. 26 was clearcut before acquisition by the USFS.

Clearcut timber harvest is still being conducted on private lands. Clearcut units with slopes greater than 50 percent in canyon sideslopes have the highest risk for landslide activation and reactivation during peak flow events. Clearcut logging decreases rooting strength in the soil and can increase the groundwater available to unstable and potentially unstable terrain, increasing the likelihood of accelerating landslide movements. Surface erosion and landslides often start at the base or just below the clearcut units.

*Recreational Off-HighwayVehicles (OHVs)*
Off-road vehicle use is primarily concentrated in the northwest portion of the watershed. This off-road vehicle area centered around John's Peak is located on the most erosive soils in the watershed, the granitic rock-based Shefflein and Tallowbox Soils. Soils formed from granitic rock are generally moderately deep over decomposed bedrock and are highly erosive because of low cohesive coarse textured particles. Rapid erosion on steep slopes keeps fresh granite near the surface. Seemingly localized impacts can be far reaching as sediment delivery to aquatic habitat is increased. Though highly erosive, no known slope stability concerns have developed in this area.

*Agricultural Practices*
Historically, concentrations of cattle and sheep along streams, ponds, and other wetlands may have contributed to a loss of vegetative cover and subsequent erosion in the riparian areas. Erosion from grazing is generally most severe near streams and on steep slopes. In recent years, the use of lands within this analysis area for livestock grazing has diminished. The number of cattle on the land today is significantly less than the early days of the range. The BLM does not currently have any active allotments in the analysis area.

Plowing of fields and flood irrigation practices also impact riparian ecosystems as soil is loosened and fine sediments are introduced to streams.

**Conclusion**
Roads, clearcut timber harvest, prescribed burning, OHV use, and livestock grazing have accelerated the rate at which erosion and landslides can transport sediment and debris to streams. Of these human activities, roads have had the greatest effect on moving sediment into streams. More sediment has been mobilized and deposited in streams in a much shorter time frame than would have occurred naturally. These human impacts have adversely affected fish habitat and water quality.

**Future Trends**
The amount of sediment introduced to streams through erosion processes is slightly above natural rates. If timber harvest and road building intensifies, erosion rates could accelerate in the future.

The natural surface roads and trails will continue to be the main source of sediment to streams. As major storms occur in the analysis area, combined human uses will continue to be factors that contribute to accelerated mass wasting and surface erosion. Inadequately drained roads and unstable road cut and fill slopes will increase the likelihood that new failures will be initiated. In the steeper mountainous side slopes, sheet erosion and debris slides will move sediment into streams.

The impact of future storm events and the extent they may affect the analysis area are unknown. Natural landslide and erosion processes cannot be halted; however, stabilization measures could be implemented to mitigate adverse impacts on water quality.

## SOIL PRODUCTIVITY

Soils in the analysis area have been forming for thousands to millions of years. Environmental factors such as wildfires, vegetation, and climate have been the major influence on soil formation and productivity. Only in the last one hundred years have human activities significantly impacted soil productivity. Forest management activities such as timber harvesting, road building and wildfire suppression have interrupted the "natural" processes of soil development. Various agricultural activities also may have had an impact on the soils ability to produce vegetation and provide clean water to the streams.

Timber harvested areas have experienced a decline in soil productivity. This loss in soil productivity is directly related to an increase in soil erosion rates due to the yarding of material and the loss of vegetative cover. This is especially true for steep, mountainous sideslopes that have been clearcut and broadcast burned. The removal of organic material during logging operations that would otherwise be returned to the soil has had a negative affect on soil productivity.

Productivity losses can also be attributed to tractor logging as it can compact the soil and decrease pore space used to store oxygen and water in the soil. Since 1986, tractor logging has taken place on only 48 acres of BLM-administered lands; these lands were less than 35 percent in slope. However, on privately owned lands tractor logging has been used extensively, often on lands steeper than 35 percent slope. The amount of soil productivity lost is dependent on the amount of area compacted. Compacted skid roads usually experience a 50 percent reduction in site productivity.

On major skid trails and roads, increased compaction has resulted in some surface erosion and sediment accumulation in depressed areas. Soil recovery is slow and could take many decades. Recovery processes, while not well understood, probably depend on the type of vegetative succession that occurs, amount of existing site organic matter, and future disturbance regimes.

Road construction has taken land out of timber production in the analysis area. The soil productivity loss is directly proportional to the amount of roads built in the analysis area. Roads also have an indirect affect on soil productivity on steep mountain sideslopes. Inadequately built roads on unstable slopes and/or in headwall situations, often cause slope failure resulting in landslides or debris torrents.

Fire suppression activities over the last 70 years have changed the local fire regimes in the analysis area. Although wildfire frequency has decreased, fire intensity has increased, resulting in the consumption of more surface duff and large woody material. High intensity wildfires also heat the soil and greatly reduce soil organism populations. Although the forest usually experiences a short-term flush of nutrients from the oxidation of burned organic material, long-term nutrient cycling is interrupted.

## PLANT SPECIES AND HABITATS

### Introduced Plant Species and Noxious Weeds

Introduced plant species and noxious weeds are found throughout the analysis area and they maintain a continuous and increasing presence on lands in the analysis area. Some species may have been intentionally introduced after major ecological disturbances to reduce erosion and hold the soil until native species gradually re-establish. Other highly adaptive species may have been brought in to improve available forage for wildlife and livestock under past direction of public agencies and private individuals. Still others are plants which have escaped cultivation in lower elevation fields, lawns, and gardens. Finally, some introduced species have simply expanded their range along corridors created by regional transportation systems.

Any activity that creates disturbed soil and forms a corridor into an area, can act as a pathway for dispersal. Many introduced species in the analysis area are found along roadsides, quarries, areas of previous timber harvest, power and telephone line right-of-ways, and other areas of disturbance. Once established, they can rapidly spread to other areas, as many of these species out-compete native vegetation, even in the absence of a disturbance.

Many introduced species can potentially out-compete and displace native plants and thus alter the composition and relationships of the ecosystem. Successfully introduced species typically have superior survival and/or reproductive techniques. They can compete with native plants for water and nutrients, frequently develop and reproduce earlier at higher rates, and often have the ability to disperse over long distances using wind, water, animals, humans, and passing vehicles.

Some introduced plants cause extreme harm to the ecosystem and/or economic interests and have been designated as noxious weeds. Federal land managers cooperate with Oregon Department of Agriculture's (ODA) efforts to control and identify target species of noxious weeds by tracking their distribution on federal lands. Noxious weed populations must be located quickly to increase the effectiveness of control efforts. Integrated Weed Management (IWM) involves four general categories of management options including cultural, biological, physical, and chemical. IWM is a decision making process that uses site specific information to make decisions about treatment choices. IWM is based on the fact that combined strategies for weed management work more effectively than any single strategy. The current IWM practice method of choice for weed control is biological control. Not all noxious weeds, however, have current biological predators to control their populations and there are concerns that even under best management practices, populations of noxious weeds may continue to become established and/or expand.

As more people establish themselves in the valley, more land is disturbed and more travel into the mountains occurs. This trend coincides with the trend of increasing weeds in the analysis area. Some control efforts have occurred with varying results. Control efforts in the analysis area have included herbicide treatment, physical control, cultural adaptations, and biological control. Physical control of noxious weeds has included hand pulling Scotch broom and yellow starthistle. Biological control has been used in the area for approximately 25 years, primarily for yellow starthistle but also for purple loosestrife and leafy spurge. Recently, the Oregon State University Extension Service experimented with using goats to control Himalayan blackberry. Cultural adaptations to livestock grazing have been attempted for control of yellow starthistle and leafy spurge. Herbicides have been used to control yellow starthistle, Himalayan blackberry, leafy spurge, and puncturevine.

Inventories in the analysis area report two Target weed species, (yellow starthistle and leafy spurge) and 11 species of "B" designated weeds (Appendix D).

**Special Status Plant Species and Habitats**
Nine species of special status vascular plants are known to occur in the analysis area (Table 18). Much of this analysis area has not been surveyed for special status plants. Only small areas associated with management activities have been formally inventoried.

**Table 18. Special Status Plants**

| Scientific Name | Common Name | Status[1] | No. of Populations | Trend[2] |
|---|---|---|---|---|
| *Calochortus persistens* | Siskiyou mariposa lily | BSO | 1 | = |
| *Cimicifuga elata* | tall bugbane | BSO | 7 | /\ |
| *Cypripedium fasciculatum* | clustered lady's-slipper | BSO | 5 | \/ |
| *Cypripedium montanum* | mountain lady's-slipper | BTO | 1 | \/ |
| *Fritillaria gentneri* | Gentner's fritillary | FEO | 11 (8 non-Fed) | \/ |
| *Horkelia tridentata ssp. tridentata* | three-toothed horkelia | BAO | 1 (non-Fed) | \/ |
| *Lithophagma heterophyllum* | many-leaf prairie star | BTO | 2 | \/ |
| *Mimulus jepsonii* | Jepson's monkeyflower | BAO | 1 | \/ |
| *Sedum oblanceolatum* | Applegate stonecrop | BSO | 2 | = |

1/ Status
BAO = Bureau Assessment in Oregon
BTO = Bureau Tracking in Oregon
BSO = Bureau Sensitive in Oregon
FEO = Federal Endangered in Oregon
2/ Trend of species within the analysis area is based on population numbers, population health, and available habitat
= stable /\ increasing \/ decreasing

*Calochortus persistens* (Siskiyou mariposa lily) is a showy lily that was previously known only from one area near Yreka, California. This disjunct population consists of only five individuals that have not flowered in the last two years. The Siskiyou mariposa lily has been listed as rare with the state of California since 1982. In California, activities negatively affecting this species are road maintenance, off-highway vehicle use, nonnative plant species, grazing,, and recreational horseback riding. The recently discovered Oregon population has been unaffected by human activities.

*Cimicifuga elata* (tall bugbane) is a BLM Sensitive species in Oregon and a candidate for listing with the State of Oregon under the Oregon ESA. Found from Oregon to British Columbia, this plant is considered threatened with extinction throughout its range. The plants of southern Oregon differ morphologically and occur in somewhat different habitat than other populations studied. With taxonomic investigation, southern Oregon populations could be classified as a new variety or subspecies. Habitat for southern Oregon populations ranges from small openings in conifer forests to open conifer forests. Habitat for this plant has been negatively affected by timber harvest and fire suppression.

*Cypripedium fasciculatum* (clustered lady's-slipper) is a Bureau Sensitive species in Oregon, a Survey and Manage Category 1C species under the Final Supplemental Environmental Impact Statement for Amendment to the Survey & Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA and USDI 2001), and a candidate for listing with the State of Oregon under the Oregon Endangered Species Act. This plant is found east to the Rocky Mountains but is considered threatened with extinction in Oregon and rare throughout its range. Mid-to-late-successional forests with canopy closures greater than 60 percent appear to be the optimum habitat for this species. *Cypripedium fasciculatum* is a slow-growing, long-lived orchid with a mycorrhizal association and an arguable dependence on fire. Forest habitat for this plant has been negatively affected by timber harvest, wildfire, and fire suppression.

*Cypripedium montanum* (mountain lady's-slipper) is a Bureau Tracking species in Oregon and a Survey and Manage Category 1C species under the Final Supplemental Environmental Impact Statement for Amendment to the Survey & Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA and USDI 2001). The Mountain Lady's-slipper is found in Oregon, California, Washington, and Idaho. It is generally secure throughout its range but its persistence is a concern because of declining numbers or habitat. *Cypripedium montanum*, like *C. fasciculatum*, is found in mid-to-late-successional forests with canopy closures greater than 60 percent. Most populations of these two orchids are on the upper slopes of northerly aspects in the analysis area. These two orchids are frequently found together and, as such, are negatively affected by the same management actions, timber harvest, wildfire, and fire suppression.

*Fritillaria gentneri* (Gentner's fritillary) is listed as Endangered under the ESA of 1973, as amended. This large, red-flowered lily is found only in Jackson and Josephine Counties. Its usual habitat is oak woodland and conifer forest edges. The ESA prohibits anyone from maliciously damaging or destroying any endangered plant species on federal lands; or removing, cutting, digging up, or damaging or destroying any endangered plant from any location (public or private) in knowing violation of any law or regulation of a state, including during violation of criminal trespass laws (ESA Section 9(a)(2)(B)). Activities that have negatively affected this species are residential and agricultural development, logging, road and trail improvement, off-highway vehicle use, and collection.

*Horkelia tridentata* ssp. *tridentata* (three-toothed horkelia) is found in Oregon and California. It is considered rare in Oregon but more common in California. Habitat for this species is dry, open forest. The one population in the analysis area is found on private land in a small natural opening in the forest with past disturbance. Threats to this population are logging, fire suppression, off-highway vehicle use, and mining.

*Lithophragma heterophyllum* (many-leaf prairie star) is a Bureau Tracking species in Oregon. It is known from California and Oregon. In Oregon, it is considered rare while in California it is probably secure but with long-term persistence concerns. The habitat for the Many-leaf Prairie Star is shaded conifer forest. The one population in the analysis area is a single plant in an old timber harvest unit. The poor condition of this population is likely related to the overstory removal. The survey was performed only in the harvest unit; it is possible that the population extends into the neighboring forest. Habitat for this plant has been negatively affected by timber harvest.

*Mimulus jepsonii* (Jepson's monkeyflower) is a Bureau Assessment species in Oregon. Jepson's monkeyflower is known from central California to central Oregon. It is considered rare in Oregon and secure in California. Habitat for this species is conifer forest openings, generally with granitic soils. The single known site in the West Bear Creek analysis area is in a small opening in a white fir forest on Forest Service land. Threats to this population are logging, fire suppression, off-highway vehicle use, and mining.

*Sedum oblanceolatum* (Applegate stonecrop) is a current Candidate for listing with the state of Oregon, a former Candidate for Federal listing,, and a Bureau Sensitive species. This stonecrop is generally associated with rock outcrops and has an extremely limited range, found only in the Applegate River drainage and northwest Siskiyou County of California. Activities threatening this species include road building, quarry development, and collection.

**Survey and Manage Plant Species and Habitats**
Three species of Survey & Manage plants are known to occur in the analysis area (Table 19). The two vascular plant species are also special status plant species. No occurrences of Survey & Manage lichens or bryophytes were located in the analysis area.

**Table 19. Survey and Manage Plant Species and Habitats**

| Species | Category [1] | Habitat Requirement | Number of Sites | Trend[2] |
|---|---|---|---|---|
| *Tremiscus helvelloides* | 1B | moist, low elevation forest and woodlands | 1 | V |
| *Cypripedium fasciculatum* | 1C | conifer forest | 5 | V |
| *Cypripedium montanum* | 1C | conifer forest | 1 | V |

1/ Categories are from the Northwest Forest Plan (USDA and USDI 1994a) and are listed in the Characterization section. PB = Protection Buffer species.
2/ Trend of species within the analysis area is based on population numbers, population health, and available habitat
= stable /\ increasing \/ decreasing

*Cypripedium fasciculatum* and *C. montanum* are uncommon species where pre-disturbance surveys are practical. Concerns exist in regard to long-term survival and maintaining stable and well-distributed populations for both lady's-slippers because many of the populations consist of very few individuals.

*Tremiscus helvelloides* is a rare fungus whose population biology and ecological requirements are poorly known. Habitat for this fungus has been negatively affected by timber harvest, urban and rural development, and fire suppression. While there is a moderate level of uncertainty due to this lack of knowledge, the standards and guidelines would provide habitat sufficient to allow this fungus to stabilize in a pattern different from its reference distribution.

**Special Areas with Botanical Resources**
*Holton Creek Research Natural Area*
The 423 acre Holton Creek Research Natural Area (RNA) was established to preserve the natural features of a White fir-Douglas-fir forest with dwarf Oregon Grape would be preserved for scientific purposes and where natural processes are allowed to dominate. This site provides a baseline area against which effects of human activities can be measured, a site for study of natural processes in a relatively undisturbed ecosystem, and a gene pool preserve for all lifeforms, especially rare and endangered types. Low elevation forests in southwestern Oregon have been extensively logged. Holton Creek is unique in that it represents nearly an entire, intact subwatershed (Map 19). While this area is relatively pristine, it does exhibit effects of fire suppression, such as heavy mortality, understory development, and mistletoe infection. The Medford District RMP has designated this area unavailable for timber harvest, closed to off-highway vehicle use, closed to mineral entry, and mineral leasing subject to no surface occupancy. There are no current or past research projects occurring in the Holton Creek RNA.

## FOREST DENSITY AND VIGOR

Vegetation disturbance mechanisms (abiotic and biotic) that influence the analysis area's forest stand structure are logging, fire and fire suppression, bark beetles, pathogens, wind, and dwarf mistletoe species associated with Douglas-fir. In most cases, biotic factors influence the forest structure in response to low vigor and are therefore secondary. The primary concern with the shrublands, woodlands, and unmanaged forest stands is the excessively abundant vegetation which causes low vigor and/or poor growth. Much of the analysis area has thousands of stems per acre of shrubs and tree species. Stems of vegetation per acre should be in the hundreds or less depending upon the age of the plant community. Low tree vigor occurs when diameter growth falls below 1.5 inches over 10 years and results in trees that are more susceptible to bark beetle attack (Hall 1995).

**Vegetation Disturbance Mechanisms**
Biotic processes that influence the forest stand dynamics and structure in the analysis area include dwarf mistletoe, bark beetles, wind, and to a small extent forest pathogens. These biotic processes can cause tree and possibly stand mortality, shifting the forest stands to the understory reinitiation stage; the stage in which the tree canopy layer opens and allows regeneration to become established in the understory.

Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) is a problem in the southern half of the analysis area (south of Griffin Creek Road). Some small stands have a 100 percent infection rate and patches of trees have died. Mistletoe species and pathogens can reduce tree vigor which enables bark beetles to invade the stressed trees. Pathogens that are in the analysis area include: brown cubical butt rot (*Phaeolus schweinitzii*)and red ring rot (*Phellinus pini*). Windborne spores can infect new hosts through tiny dead branch stubs or tree stumps and remain dormant until the tree is stressed, usually by wounding. All of these processes create unhealthy trees that become safety hazards when located near houses or recreation areas, or roadways. Wind can cause infected trees to break or blow down. Wind-thrown timber is most common on the high ridges of the southwestern boundary of the analysis area when soils become saturated during the fall through spring months.

**Forest Productivity**

Forest productivity is generally defined in terms of site quality, which is a measure of tree growth over a given period of time. Site quality is determined by the physical characteristics of the soil, steepness of slope, aspect, microclimate, and species present. An indirect method of measuring site quality is to determine the site index of the soil. Site index is simply the height a tree will grow in a given time period. The Soil Survey of Jackson County Area, Oregon (1993) uses a reference age of 50 years for Douglas-fir. The soil survey indicates most of the soil series in the analysis area are capable of growing Douglas-fir trees to a height of 60 to 80 feet in 50 years. The best soils (Jayar, Rogue, Shefflein, and Vannoy series) will grow trees 80 feet tall in 50 years; the poorest soil (Tallowbox series) has a site index of 60 feet. These site potentials may not be met in overstocked forest stands.

For the majority of the large-pole and mature Douglas-fir stands in the analysis area, the average relative density index is approximately 0.70 (the ratio of the actual stand density to the maximum stand density attainable in a stand with the same mean tree volume) (Drew and Flewelling 1979). A relative density index of 0.55 is considered to be the point of imminent competition/mortality; and at this point, trees have a greater probability of dying from biotic factors, mainly bark beetles.

Individual tree vigor in the analysis area is low. Tree vigor is a measure of health and is defined as the ratio of annual stemwood growth to the area of leaves present to capture sunlight (Waring, et.al., 1980). Trees with vigor ratings below 30 will succumb to attack from bark beetles of relatively low intensity. Trees with vigor ratings between 30 and 70 can withstand progressively higher attacks but are still in danger of mortality from the insect attacks. Trees with a vigor rating of between 70 and 100 can generally survive one or more years of relatively heavy attacks and trees with ratings above 100 cannot be killed by bark beetles. A sample of 16 trees found in different parts of the analysis area had vigor ratings ranging from 3.32 to 89.02. Five of the sample trees had vigor ratings below 30. The sample trees were codominant and dominant size class trees with diameters ranging from 8 to 32 inches at breast height. Even though this is a small sample size scattered throughout the analysis area, this poor tree vigor trend is expected to be found in all forest stands with a relative density index of .7 and higher.

**Trends**

In general, the overstocked pole through mature size class forests in the analysis area have a low level of growth or vigor and are susceptible to bark beetle attack and pathogens. Bark beetle attacks could continue and increase in intensity. Tree mortality is expected to continue. Dense forest stands with ladder fuels are prone to intense forest fires. If fires occur, the forest area may be composed of more shrub and hardwood species in the future. Without fire, early seral, shade intolerant pine species and California black oak will continue to decline in abundance. Douglas-fir dwarf mistletoe can be expected to continue killing mature overstory trees and to spread to the Douglas-fir understory where present. Over time, the canopy closure of the older forest stands will become more open and the species composition of the forest stands will change.

## FIRE AND AIR QUALITY

**Suppression History**
In the early 1900s, uncontrolled fires were considered detrimental to forests. Suppression of all fires became a major goal of land management agencies. From the 1950s to present, fire suppression increased in efficiency due to additions in suppression forces. As a result of the absence of fire there has been a build-up of unnatural fuel loadings and a change in vegetative conditions.

Based on calculations using fire return intervals, five fire cycles have been eliminated in the southwest Oregon mixed conifer forests that occur at low elevations (Thomas and Agee 1986). Species, such as ponderosa pine and oaks, have decreased. Many once open stands are now heavily stocked with conifers changing their horizontal and vertical structures. As surface fuels and the laddering effect of fuels has increased, so has the threat of crown fires which were once historically rare (Lotan et al.1981). This absence of fire has changed historic fire regimes from low severity to moderate to high fire regimes.

Frequent low intensity fires serve as a thinning mechanism, thereby, naturally regulating the density of the forests by killing unsuited and small trees. In addition, ponderosa pine trees that thrive in fire prone environments quickly get shaded out by the more shade tolerant Douglas-fir species in the absence of fire. As a result, some late-successional forests have undergone a rapid transition from ponderosa pine stands to excessively dense true fir stands. Trees growing at lower densities tend to be more fire-resistant and vigorous.

After abrupt fire suppression became policy in the early 1900s, many forests developed high tree densities producing slow growing trees. Trees facing such intense competition often become weakened and are highly susceptible to insect epidemics and tree pathogens. Younger trees (mostly conifers) contribute to the stress and mortality of mature conifers and hardwoods. High density forests burn with increased intensity because of the unnaturally high fuel levels. High intensity fires can damage soils and destroy riparian vegetation. Historically, low intensity fires often spared riparian areas, reducing soil erosion.

The absence of fire has had negative effects on grasslands, shrublands and woodlands. Research in the last few decades has shown that many southern Oregon shrub and herbaceous plant species are either directly or indirectly fire-dependent. Several shrub species are directly dependent on the heat from fires for germination. Grass and forbs species may show increased seed production and/or germination associated with fire.

Indirectly fire-dependent herbaceous species are crowded out by larger-statured and longer-lived woody species. This is particularly so for grasses and forbs within stands of wedgeleaf ceanothus and whiteleaf manzanita with a high canopy closure. High shrub canopy closure prevents herbaceous species from completing their life-cycle and producing viable seed. Since many grass species have a short-lived seed-bank, these plants may drop out of high canopy shrub lands without fire.

Fire history recorded over the past 20 years in Southwest Oregon indicate a trend of more large fires burning at higher intensities in vegetation types associated with low-severity fire regimes and moderate-severity fire regimes. This trend is also seen throughout the western United States. Contributing factors are the increase of fuel loading due to the absence of fire, recent drought conditions and past management practices.

**Fire Risk**
Fire risk is defined as the chance of various ignition sources causing a fire that threatens valuable resources, property, and life. Historic lightning occurrence indicates there is the potential of lightning fires starting throughout all elevations within the analysis area. The highest fire risk areas are major ridge lines due to lightning strikes and lands adjacent to roads and private property because of the potential for human-caused fires.

Historical records show that lightning and human caused fires are common in this analysis area. Activities within this area such as camping, recreational use, and major travel corridors (Interstate 5) add to the risk component for the possibility of a fire occurring from human causes. The time frame most conducive for fires to occur is from July through September. Information from the Oregon Department of Forestry database shows a total of 285 fires occurred throughout the watershed analysis area from 1967 to 1999. Humans caused fires account for 72 percent of the total fires. The majority of fires (98%) were less than 1 acre in size. Fire data previous to 1967 is not available. Some of the values at risk from fire exclusion, high intensity wildfire, or fire suppression within this analysis area are private residential and agricultural property, water quality, forest resources (such as northern spotted owl core areas, mature/old growth stands, and plantations) and recreation sites (Table 20).

**Table 20. Values at Risk Due to Fire Exclusion,**
**High Intensity Wildfire, or Wildfire Suppression Activities**

| Resource | Values at Risk |
|---|---|
| **Recreation/ Social** | Aesthetic: Visual, spatial, and spiritual. |
| **Habitat** | Threatened and endangered species, and thermal cover. |
| **Improvements** | Private homes, natural gas pipeline, power transmission lines, farming and ranching facilities, managed timber stands. |
| **Archeological Sites** | Numerous sites (vulnerable to suppression activities). |
| **Soils/Geology** | Increased surface erosion, loss of litter layer, decrease in site productivity, change in soil structure, slope stability, and accelerated landslide activity. |
| **Economic** | Suppression costs and loss of products (recreation, timber, special products, livestock, range, and rural development). |
| **Botanical** | Numerous sites (vulnerable to suppression activities).<br>All areas are susceptible to encroachment by non-native species in the event of high intensity fire. Suppression activities such as fireline construction, placement of camp sites, and vehicle use can impact all botanical habitat; moist mountain meadows are particularly sensitive. |
| **Safety** | Firefighters, public, visibility, telephone and power lines. |
| **Air Quality** | Public health and visual quality. |

**Fire Hazard**
Fire hazard assesses vegetation by type, arrangement, volume, condition and location. These characteristics combine to determine the threat of fire ignition, the spread of a fire and difficulty of control of a fire. Fire hazard is a useful tool in the planning process because it helps in prioritizing watersheds and areas within a watershed in need of fuels management treatment. Hazard ratings were developed using vegetation (type, density, and vertical structure), aspect, elevation, and slope. Throughout the analysis area 28 percent of the landscape has high fire hazard, 46 percent has moderate fire hazard, and 26 percent has low fire hazard (Map 20).

In general, the existing fuel profile in the lower elevations of the analysis area represents a moderate to high resistance to suppression under average climatic conditions. Most of the timber stands have a dense overstory and a moderate amount of ground fuel and ladder fuels are present. This creates optimal conditions for the occurrence of crown fires that could result in large stand replacement fires. This type of fire also presents an extreme safety hazard to suppression crews and the public.

**Air Quality**
Levels of smoke or air pollutants have only been measured over the past three to four decades. The Clean Air Act directed the State of Oregon to meet the national ambient air quality standards by 1994. The Oregon Smoke Management Plan identifies strategies to minimize the impacts of smoke from prescribed burning on smoke sensitive areas within western Oregon. Particulate matter the size of 10 microns (PM10) or less is the specific pollutant addressed in this strategy. The goal of the Oregon Smoke Management Plan is to reduce particulate matter emissions from prescribed burning by 50 percent by the year 2000 for all of western Oregon. Particulate matter has been reduced by 42 percent since the baseline period (1991).

The population centers of Grants Pass and Medford/Ashland have been in violation of the national ambient air quality standards for PM10 and are classified as non-attainment areas for this pollutant. A small portion of the analysis area is within the non-attainment area. The non-attainment status of these areas is not attributable to prescribed burning. Major sources of particulate matter within the Medford/Ashland area are smoke from woodstoves (63 percent), dust, and industrial sources (18 percent).

Although still classified as non-attainment areas, the population centers of Grants Pass and Medford/Ashland have not been in violation of the national ambient air quality standards for PM10 for the past seven years.

*Wildfires and Prescribed Burning*
The wildfires that occurred in southern Oregon in 1987 emitted as much particulate matter as all other burning that occurred within the state that year. Emissions from wildfires are significantly higher than from prescribed burning. Prescribed burning under spring-like conditions consumes less of the larger fuels creating fewer emissions. Smoke dispersal is easier to achieve due to the general weather conditions that occur during the spring. The use of aerial ignition reduces the total emissions by accelerating the ignition period and reducing the total combustion process due to the reduction of the smoldering stage. Prescribed burning contributes less than four percent of the annual total of particulate matter within the Medford/Ashland area. To date, no prescribed burning has taken place within the analysis area.

# TERRESTRIAL WILDLIFE SPECIES AND HABITATS

**Current Habitat Conditions and Trends for Wildlife**
The quality of habitat provided by the various plant communities and structural classes in the analysis area varies considerably. In general, habitat conditions are declining across the analysis area, but some high quality habitat remains, such as in the Holton Creek Research Natural Area.

Introduced noxious species such as yellow starthistle are invading and replacing native grass-forb dry hillside habitat. Over time, some of this habitat has also been replaced by mountain shrubland communities. Mountain shrubland communities are also in decline due to the loss of wildfire from the ecosystem. Most mountain shrubland habitat depends on fire for regeneration, and with the advent of fire suppression, the trend has been toward senescence with little regeneration. The result is a lack of early seral habitat in this plant community. Oak-woodland/deciduous hardwood habitat has decreased in condition and abundance due to the encroachment of conifers and the overstocking of oaks. In some areas this encroachment comes as a result of fire suppression. Frequent low-intensity fires killed encroaching conifers and smaller oaks. Oak-woodland/deciduous hardwood habitat has also been removed for agriculture and development purposes.

In the conifer plant communities, snags and down woody material are probably inadequate in many of the early seral and pole stands due to their removal during timber harvest. Due to fire suppression some pole and mature conifer stands are more dense than they would be under natural fire regimes. There is little intrastand structure in these dense stands and as a result species richness is depauperate.

The abundance of mature/old-growth habitat has declined due to timber harvest, and much of the remaining mature/old-growth habitat is fragmented and less functional for species preferring interior mature/old-growth habitat. Mature/old-growth habitat is important to a number of wildlife species within the analysis area, including the northern spotted owl. The decline in the amount of this habitat resulted in the federal listing of the northern spotted owl as threatened and the subsequent development of the Northwest Forest Plan. There are approximately 6,552 acres of mature/old-growth habitat in the analysis area.

Although supportive data are unavailable, the general decline in habitat condition probably has not resulted in significant change in the diversity of wildlife species in the analysis area. However, considerable change in species abundance and distribution would be expected.

**Threatened/Endangered Species**
The northern spotted owl, federally listed as a threatened species under the auspices of the Endangered Species Act of 1973, as amended, is present in the analysis area. There are eight known spotted owl nest sites/activity centers present.

Approximately 3,215 acres of suitable northern spotted owl habitat are present on BLM managed land within the analysis area (Map 11). Suitable spotted owl habitat generally provides nesting or roosting/foraging functions, and generally has the following attributes: a high degree of conifer canopy closure (approximately 60 percent or greater), a multilayered canopy, and large snags and coarse woody material. In addition to the suitable habitat, there are approximately 2,250 acres of dispersal-only habitat on BLM managed land. Dispersal-only habitat provides limited foraging opportunity and a degree of protection from predators during dispersal. Canopy closure is generally 40-60 percent. Suitable and dispersal-only habitat data are not available for private lands within the analysis area, but it is likely that a limited amount of both suitable and dispersal-only habitat is present on private lands.

Most suitable and dispersal-only habitat on BLM-managed land in the analysis area is in the matrix land allocation. Under the Northwest Forest Plan (NFP), the bulk of the programmed timber harvest is scheduled to come from this allocation; therefore, suitable and dispersal-only habitat is likely to be degraded or removed in the future. The exceptions to this are 100 acre buffers around the known spotted owl sites and the Holton Creek RNA. These are protected areas and timber harvest is not likely to occur in them. Any suitable or dispersal-only habitat on private land is also likely to be harvested in the future.

**Northern Spotted Owl Critical Habitat**
Approximately 1,100 acres of BLM managed land in the analysis area are in northern spotted owl critical habitat unit (CHU) OR-75. Of this total, 390 acres are suitable habitat and 460 acres are dispersal-only habitat. The U.S. Fish and Wildlife Service designates critical habitat to preserve options for recovery of a species by identifying existing habitat and highlighting areas where management should be given high priority (USDI, FWS 1992). Critical habitat for the northern spotted owl was designated to protect clusters of reproductively-capable owls and to facilitate demographic and genetic interchange (USDI 1992). CHU OR-75 was designated to provide nesting, roosting and foraging habitat, and to provide connectivity between CHU OR-74 and CHU OR-75 (USDI 1994).

Critical habitat was designated prior to implementation of the NFP, and the biological opinion for the NFP acknowledges that the Late Successional Reserve (LSR) system established in the NFP is a reasonable approximation to critical habitat. The accepted current function of critical habitat outside of LSRs is for dispersal between LSRs.

**Special Status Species**
Special status species include those species listed by the U.S. Fish and Wildlife Service as threatened or endangered, proposed for listing as threatened or endangered, candidates for listing as threatened or endangered, or are listed by the BLM as sensitive, assessment, or tracking species. Oregon BLM tracking species are somewhat unique as a special status species because they are addressed in Oregon BLM special status species policy, but are not considered a special status species for management purposes. Twenty-four special status species are known or suspected, based on known range and availability of suitable habitat, to be present in the West Bear Creek Watershed Analysis Area (Table 21).

Ten of the special status species are associated with conifer or woodland forest habitat, and habitat for these species is expected to decline in the future due to timber harvest, special forest products removal, agricultural expansion and residential/rural residential development. The remaining species are considered special status species due to general rarity, lack of information, or population declines due to unknown reasons. Continuing regional and statewide studies and surveys may someday answer some of the concerns regarding these species.

## Table 21. Special Status Terrestrial Vertebrate Wildlife Species

| Species | Status[1] | Known/ Suspected | Reason for Status |
|---|---|---|---|
| Western Toad (*Bufo boreas*) | BT | Known | Declining population - reasons unknown [2] |
| Western Pond Turtle (*Clemmys marmorata*) | BS | Known | Declining population due to habitat loss and predation from introduced species [2] |
| Northern Spotted Owl (*Strix occidentalis caurina*) | FT | Known | Declining population due to habitat loss (mature/old-growth forest) [2] |
| Lewis' Woodpecker (*Asyndesmus lewis)* | BS | Known | Declining population due to habitat loss (oak-woodland) [2] |
| Acorn Woodpecker (*Melanerpes formicivorus*) | BT | Known | Declining population due to habitat loss (oak-woodland) [2] |
| Pileated Woodpecker (*Dryocopus pileatus*) | BT | Known | Declining population due to habitat loss (mature/old-growth forest) [2]. |
| Western Bluebird (*Sialia mexicana*) | BT | Known | Declining population due to habitat loss (snags) and competition for nest sites [2]. |
| Townsend's Big-eared Bat (*Corynorminus townsendii*) | BS | Known | General rarity; lack of information; disturbance at maternity, hibernacula & roost sites[2]. |
| Long-eared Myotis (*Myotis evotis*) | BT | Known | General rarity; lack of information; loss of forested habitat [2] |
| Western Gray Squirrel (*Sciurus griseus*) | BT | Known | Declining populations due to forested habitat loss and competition for food [2]. |
| Foothill Yellow-legged Frog (*Rana boylii*) | BT | Suspected | Declining population - reasons unknown [2] |
| Sharp-tailed Snake (*Contia tenuis*) | BT | Suspected | Isolated populations; habitat loss (decaying logs) [2] |
| California Mountain Kingsnake (*Lampropeltis zonata*) | BT | Suspected | General rarity; collecting [2] |
| Common Kingsnake (*Lampropeltis getultus*) | BT | Suspected | General rarity; collecting [2] |
| Northern Sagebrush Lizard (*Sceloporus graciosus graciosus*) | BT | Suspected | Unknown |
| White-tailed Kite (*Elanus leucurus*) | BT | Suspected | Unknown |

| Species | Status[1] | Known/ Suspected | Reason for Status |
|---|---|---|---|
| Northern Goshawk (*Accipiter gentilis*) | BS | Suspected | Declining population due to habitat loss (mature/old-growth forest) [2] |
| Great Gray Owl (*Strix nebulosa*) | BT | Suspected | Loss of mature/old-growth habitat [2] |
| Blue-gray Gnatcatcher (*Polioptila caeurlea*) | BT | Suspected | Unknown |
| Pacific Pallid Bat (*Antrozous pallidus)* | BT | Suspected | General rarity due to limited habitat (cliffs, caves, mines) and disturbance at these sites [2] |
| Silver-haired Bat (Lasionycteris noctivagans) | BT | Suspected | Declining population due to loss of habitat (snag and decadent trees in mature/old-growth forests) [2] |
| Fringed Myotis (*Myotis thysanodes*) | BT | Suspected | General rarity and susceptible to disturbance [2] |
| Long-legged Myotis (*Myotis volans*) | BT | Suspected | Lack of information and declining habitat (large snags and abandoned buildings) [2] |
| Yuma Myotis (*Myotis yumanensis*) | BT | Suspected | Unknown |

1/ Status:
FT = Listed as threatened under the ESA; BA = Bureau Assessment
BS = Bureau Sensitive; BT = Bureau Tracking

2/ Marshall 1996

## Survey and Manage Species and Bat Roost Sites

The great gray owl, designated as Survey and Manage (Category C) in the *Record of Decision and Standards and Guidelines for Amendment to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (SEIS ROD), is suspected to be present in the analysis area based on known sites in adjacent watersheds. Additional protection for six species of bats known or suspected to be present in the analysis area (Townsend's big-eared bat, silver-haired bat, fringed myotis, long-eared myotis, long-legged myotis, and pallid bat) is also addressed in the SEIS ROD. Systematic surveys for these species and the habitat/sites they are commonly associated with have not been conducted in the analysis area. The bat species known to be present have been identified during opportunistic surveys of several mines in the analysis area.

If located, great gray owl nest sites would be protected with 0.25 mile buffers, and bat roost sites, maternity sites and hibernacula would be protected with 250 foot buffers. In addition, meadows larger than 10 acres would receive 300 foot buffers. Other than these buffers, habitat for these species is available for harvest and would likely be harvested in the future.

# HYDROLOGY

For purposes of the hydrology discussion, the West Bear Creek Watershed Analysis Area is stratified into six analysis subwatersheds: Wagner Creek, Anderson Creek, Coleman Creek, Griffin Creek, Jackson Creek and Willow Creek (Map 12).

## Streamflow

The timing, magnitude, duration, and spatial distribution of streamflows are of importance to water users, riparian/floodplain landowners, aquatic life, and riparian and aquatic habitats. Sediment, nutrient, and wood routing are dependent upon streamflow regimes. Alterations to the natural hydrologic cycle have the potential to affect peak and low flows with subsequent changes to channel morphology, water quality, and aquatic ecosystems.

### *Peak Flow*

Based on historical records from U.S. Geological Survey gaging stations in the Rogue River Basin, maximum peak flows in the analysis area generally occur from December through March. In the higher elevation analysis subwatersheds (Wagner, Anderson, Coleman, and Griffin Creeks), these high flows are often a result of rain-on-snow storm events that occur when a substantial amount of rain falls on snow in the transient snow zone (elevation zone of approximately 3,500 to 5,000 feet). The combination of rain moving into the stream channels and the rapid snowmelt can result in flooding. A rain-on-snow event led to flooding in the Bear Creek Watershed on January 1, 1997. The transient snow zone occupies 9,664 acres (16 percent) of the analysis area (39 percent of Wagner Creek Analysis Subwatershed, 25 percent of Anderson Creek Analysis Subwatershed, 19 percent of Coleman Creek Analysis Subwatershed, 8 percent of Griffin Creek Analysis Subwatershed, and two percent of Jackson Creek Analysis Subwatershed). The runoff pattern in the lower elevation analysis subwatersheds (Jackson and Willow Creeks) is rain-dominated and produces peak flows that generally occur during the period of high rainfall after soils are saturated, from December through March.

Vegetation removal and soil compaction are the major causes of changes to hydrologic processes such as infiltration, interception, and evapotranspiration. The changes, both natural and human-caused, occurring individually or in combination, can result in increased magnitude and frequency of peak flows. Increases in size and frequency of peak flows may result in accelerated streambank erosion, scouring and deposition of stream beds, and increased sediment transport.

A severe, extensive wildfire is the natural-caused vegetation disturbance having the greatest potential to increase the size and frequency of peak flows. Loss of large areas of vegetation due to a wildfire would likely adversely affect the analysis area's hydrologic response. The primary human-caused vegetation disturbances that can potentially affect the timing and magnitude of peak flows in the analysis area are timber harvest, conversion of forested sites to agriculture use, and urban development.

Vegetation removal reduces interception and evapotranspiration rates and allows more precipitation to reach the soil surface and drain into streams or become groundwater. These hydrologic changes gradually diminish over time as vegetation returns. Until the new vegetation obtains the same crown closure as the previous unmanaged stand, it is considered to be hydrologically unrecovered. For the West Bear Creek analysis area, Douglas-fir stands are considered to be 100 percent hydrologically recovered when they reach 50 to 70 percent crown closure on north aspects and 30 to 50 percent crown closure on other aspects. Pine stands are estimated to reach 100 percent hydrologic recovery when the crown closure is 20 to 30 percent, regardless of aspect. These canopy closures reflect reference conditions when forest fires were more frequent and other biotic agents such as insects, disease, and windthrow were not controlled. The range of natural variability for vegetation in the analysis area includes canopy closures that would be greater than and less than full hydrologic recovery.

The estimated percent hydrologic recovery by analysis subwatershed (Table 22) was calculated by applying recovery factors to the vegetation information derived from Western Oregon Digital Image Processing satellite imagery data (Map 9, Table 7). Areas classified as water, rock, and grassland/shrubland are considered fully recovered. Urban/agricultural areas are treated as zero percent recovered. The satellite imagery data does not have the capability of distinguishing between tree series, thus the pine stands were treated the same as Douglas-fir in the hydrologic recovery analysis. A crown closure of 45 percent was used as an estimate of full hydrologic recovery of hardwood and forested areas for elevations less than 3,500 feet; 55 percent crown closure was used for elevations 3,500 to 5,000 feet; and 65 percent crown closure was used for elevations greater than 5,000 feet. Early seral stands had to be treated as recovered grass/shrublands instead of unrecovered openings as the satellite imagery data combines them.

Large areas of vegetation removal in the transient snow zone are of particular concern due to alterations of the streamflow regime and resultant increased peak flow magnitudes (Christner and Harr 1982). Peak flows resulting from vegetation removal in a rainfall-dominated zone are not known to cause the substantial impacts that rain-on-snow events can trigger (GWEB 1999). Wagner Creek, Anderson Creek, and Coleman Creek Analysis Subwatersheds are the areas within the analysis area that are most likely to experience peak flow increases due to vegetation removal in the transient snow zone (Table 22).

Vegetative cover in Wagner Creek Analysis Subwatershed is in the best condition hydrologically; vegetative cover in Jackson and Griffin Creek Analysis Subwatersheds are in poor condition hydrologically. The transient snow zone for Wagner, Anderson, and Coleman Creek Analysis Subwatersheds appear to have a fairly high amount of canopy closure and are in good condition with respect to vegetative cover.

**Table 22. Estimated Percent of Hydrologic Recovery**

| Analysis Subwatershed | Percent of Area Hydrologically Recovered[1] | |
|---|---|---|
| | All Lands | Transient Snow Zone |
| Wagner Creek | 85 | 97 |
| Anderson Creek | 72 | 96 |
| Coleman Creek | 80 | 94 |
| Griffin Creek | 59 | NA |
| Jackson Creek | 55 | NA |
| Willow Creek | 74 | NA |
| Totals | 68 | NA |

1/ Estimates for hydrologic recovery were obtained by using vegetation information from the 1993 satellite imagery data, which does not reflect the most current vegetative condition.

Human-caused activities that result in soil compaction within the analysis area include roads, yarding corridors, off-highway vehicle (OHV) trails, land development, agriculture, concentrated livestock grazing, and urban development. Soil compaction affects the hydrologic efficiency within a watershed by reducing the infiltration rate and causing more rainfall to quickly become surface runoff instead of moving slowly through the soil to stream channels (Brown 1983). The resultant changes in flow routing have the potential to affect the timing and magnitude of peak flows. The duration of these changes is permanent for areas that are permanently compacted.

Roads are the major source of soil compaction within the West Bear Creek Watershed Analysis Area. Roads quickly transport shallow subsurface flow intercepted by roadcuts and water from the road surface to streams (Wemple 1994). The road-altered hydrologic network may increase the magnitude of peak flows and alter the timing when runoff enters a stream. This effect is more pronounced in areas with high road densities, roads in close proximity to streams (Harr et al. 1979), and midslope roads (Jones 2000). The BLM GIS (Geographical Information System) transportation theme contains all roads on BLM-managed lands, but only a portion of roads on non-BLM lands (Map 4). Road density calculated from roads included in the GIS coverage is high in each analysis subwatershed (Table 23) and if all the roads could be included, the road density would likely be very high for each analysis subwatershed. Griffin Creek and Jackson Creek Analysis Subwatersheds have the highest road densities with 7.9 and 8.1 miles of road per square mile respectively. Sections with road densities greater than 4.0 miles/square mile are highlighted on Map 21 and listed in Appendix H. Jackson Creek Analysis Subwatershed has the greatest number of stream crossings per square mile (25.9) followed by Willow Creek (19.6) and Griffin Creek (19.4). Sections with road/stream intersections greater than 10 per square mile are included in Appendix H.

**Table 23. Road and Stream Crossing Densities**

| Analysis Subwatershed | Total Road Length (miles[1]) | BLM and USFS Roads[2] (percent) | Road Density (miles per sq. mile) | Stream Crossings (number per sq. mile) |
|---|---|---|---|---|
| Wagner Creek | 97.8 | 15.4 | 4.2 | 13.9 |
| Anderson Creek | 60.7 | 14.3 | 4.7 | 15.7 |
| Coleman Creek | 18.4 | 12.8 | 3.8 | 9.8 |
| Griffin Creek | 172.0 | 10.4 | 7.9 | 19.4 |
| Jackson Creek | 204.4 | 1.9 | 8.1 | 25.9 |
| Willow Creek | 26.3 | 1.6 | 5.2 | 19.6 |
| Totals | 579.6 | 8.3 | 6.2 | 18.8 |

1/ Roads shown on the BLM GIS transportation theme.
2/ Roads with BLM/USFS control or on BLM/USFS-administered land.

Areas compacted from yarding corridors and OHV trails are located throughout the forested portions of the analysis area while soil compaction due to land development, agriculture, concentrated livestock grazing, and urbanization occurs at the lower elevations, primarily within and adjacent to floodplains. Tractor logging in the upper portion of the Jackson Creek analysis subwatershed created a rather dense network of skid trails, many of which continue to be used by OHVs (RVCOG 2001:7).

*Low Flow*

Summer streamflows in the analysis area are highly influenced by human-caused factors such as water withdrawals, creeks used as conveyance channels, and irrigation return flows and do not follow a natural, predictable pattern (RVCOG 1999a:12). Low summer rainfall (Table 4, Characterization section) and sustained high evapotranspiration are the natural factors that affect summer streamflows in the analysis area.

Total quantities of water are not sufficient to satisfy all existing uses of water in the Bear Creek Watershed (OWRD 1989). No water right applications may be filed for waters in the Bear Creek Watershed except appropriations for beneficial uses involving stored water (OWRD 1989). Instream water rights are water rights held in trust by the Oregon Water Resources Department for the benefit of the people of the State of Oregon to maintain water instream for public use. Instream water rights in the analysis area are for fishery values (Tables 24 and 25).

**Table 24. Instream Water Rights - Priority Date and Purpose**

| Stream Name | Priority Date | Location | Purpose |
|---|---|---|---|
| Wagner Creek | 1/16/1991 | From Basin Creek to mouth | Resident fish rearing |
| Griffin Creek | 1/16/1991 | From Hartley Creek to mouth | Anadromous and resident fish rearing |
| Jackson Creek | 1/16/1991 | From Horn Creek to mouth | Anadromous and resident fish habitat |

Source: OWRD 2000

### Table 25. Instream Water Rights - Monthly Flows

| Stream Name | Instream Water Rights (cfs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Wagner Creek | 16.0 | 19.0 | 19.0 | 15.0 | 15.0 | 9.0 | 3.0 | 2.0 | 2.0 | 2.0 | 5.0 | 11.0 |
| Griffin Creek | 10.0 | 13.0 | 11.0 | 7.0 | 5.0 | 3.0 | 1.0 | 0.5 | 0.4 | 0.5 | 2.0 | 7.0 |
| Jackson Creek | 34.0 | 34.0 | 34.0 | 34.0 | 34.0/ 20.0 | 20.0 | 13.0 | 13.0 | 13.0 | 13.0/ 20.0 | 20.0 | 20.0/ 34.0 |

Source: OWRD 2000

Water diversions are mainly located in the lower stream reaches, with the highest density in Jackson Creek and Griffin Creek Analysis Subwatersheds (Map 22).

Table 26 presents water right information obtained from the Oregon Water Resources Department (OWRD 2000) for the analysis area. The majority (68 percent) of surface water right diversions in the analysis area are used for irrigation from April 1 to October 1. Water use is greatest in the Griffin Creek Analysis Subwatershed (38 percent of total use). The City of Talent appropriates 1 cfs from Wagner Creek for municipal use from November 1 to March 1.

### Table 26. Surface Water Rights

| Analysis Subwatershed | Water Use (cfs) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Irrigation | Fish/ Wildlife | Agriculture | Industrial | Municipal | Domestic | Recreation | Miscellaneous | Total |
| Wagner Creek | 15.28 | 0.00 | 0.00 | 5.24 | 1.00 | 0.03 | 0.21 | 0.01 | 21.77 |
| Anderson Creek | 14.78 | 0.39 | 5.42 | 6.00 | 0.00 | 0.10 | 0.00 | 0.00 | 26.69 |
| Coleman Creek | 10.77 | 0.00 | 0.53 | 5.25 | 0.00 | 0.02 | 0.00 | 0.00 | 16.57 |
| Griffin Creek | 53.55 | 0.03 | 10.50 | 1.00 | 0.00 | 0.08 | 0.00 | 0.00 | 65.16 |
| Jackson Creek | 20.07 | 0.00 | 6.72 | 1.02 | 0.00 | 0.12 | 0.00 | 0.00 | 27.93 |
| Willow Creek | 0.79 | 0.00 | 0.00 | 10.60 | 0.00 | 0.01 | 0.00 | 0.00 | 11.40 |
| Totals | 115.24 | 0.42 | 23.17 | 29.11 | 1.00 | 0.36 | 0.21 | 0.01 | 169.52 |

Source: OWRD 2000

Groundwater is mainly used for irrigation in the analysis area (Table 27) (OWRD 2000) with the greatest use occurring in Griffin Creek (44 percent) and Jackson Creek (36 percent) analysis subwatersheds. Groundwater uses exempt from water rights include: stock watering, lawn or non-commercial garden watering of no more than 0.5 acres, and single or group domestic purposes for no more than 15,000 gallons per day. No information is available regarding the amount of exempt uses.

**Table 27. Groundwater Rights**

| Analysis Subwatershed | Water Use (cfs) | | | | | |
|---|---|---|---|---|---|---|
| | Irrigation | Agriculture | Industrial | Municipal | Domestic | Total |
| Wagner Creek | 0.36 | 0.00 | 0.00 | 0.26 | 0.00 | 0.62 |
| Anderson Creek | 2.31 | 0.00 | 0.00 | 1.00 | 0.00 | 3.31 |
| Coleman Creek | 0.47 | 0.00 | 0.13 | 0.00 | 0.00 | 0.60 |
| Griffin Creek | 11.88 | 0.14 | 0.11 | 0.00 | 0.38 | 12.51 |
| Jackson Creek | 8.17 | 2.00 | 0.00 | 0.00 | 0.00 | 10.17 |
| Willow Creek | 1.04 | 0.00 | 0.00 | 0.00 | 0.00 | 1.04 |
| Totals | 24.23 | 2.14 | 0.24 | 1.26 | 0.38 | 28.25 |

Source: OWRD 2000

The Oregon Water Resources Department (OWRD) developed a regression analysis based on geography and precipitation patterns to estimate natural monthly streamflows at the 50 and 80 percent exceedance levels for streams without measured streamflows. The 50 and 80 percent flow exceedance values refer to discharges that occur at least 50 or 80 percent (respectively) of the time during a given month. The Water Availability Report System (WARS) uses these estimates to determine water availability after deducting estimated consumptive uses and instream flows from the predicted natural streamflows. Streams defined by OWRD as "over-appropriated" for surface water are those streams where the quantity of surface water available during a specified period is not sufficient to meet the expected demands from all water rights at least 80 percent of the time during that period (OWRD 1990). The 80 percent flow exceedance value is used to determine if water is available for issuing a new surface water right; 50 percent flow exceedance value is used for determining availability of surface water storage. Wagner, Griffin, and Jackson Creeks are fully appropriated at both the 50 and 80 percent exceedance levels (Tables 28 and 29). Information is not available for Anderson, Coleman, or Willow Creeks.

## Table 28. Estimated 50 Percent Streamflow Exceedance Levels and Water Availability

| Month | Wagner Creek | | Griffin Creek | | Jackson Creek | |
|---|---|---|---|---|---|---|
| | Natural Stream flow (cfs) | Water Availability (cfs) | Natural Stream flow (cfs) | Water Availability (cfs) | Natural Stream flow (cfs) | Water Availability (cfs) |
| Jan. | 15.60 | -1.40 | 10.20 | 0.20 | 13.80 | -0.70 |
| Feb. | 19.30 | -0.70 | 12.70 | -0.30 | 17.10 | -0.50 |
| March | 18.70 | -1.30 | 11.00 | 0.00 | 14.30 | -0.20 |
| April | 14.80 | -2.20 | 7.09 | -0.06 | 8.74 | -2.44 |
| May | 14.80 | -2.90 | 5.36 | 0.13 | 6.16 | -3.32 |
| June | 8.87 | -3.49 | 2.78 | -0.53 | 3.23 | -4.67 |
| July | 3.38 | -3.78 | 0.95 | -0.47 | 1.03 | -6.55 |
| August | 1.91 | -3.69 | 0.49 | -0.36 | 0.49 | -5.43 |
| Sept. | 1.71 | -2.99 | 0.41 | -0.22 | 0.36 | -3.58 |
| Oct. | 2.13 | -1.41 | 0.50 | -0.08 | 0.43 | -1.11 |
| Nov. | 5.32 | -0.69 | 1.89 | -0.13 | 2.01 | -0.09 |
| Dec. | 11.00 | -1.02 | 6.92 | -0.11 | 9.29 | -0.04 |

Source: OWRD 2000b

**Table 29. Estimated 80 Percent Streamflow Exceedance Levels and Water Availability**

| Month | Wagner Creek Natural Stream flow (cfs) | Wagner Creek Water Availability (cfs) | Griffin Creek Natural Stream flow (cfs) | Griffin Creek Water Availability (cfs) | Jackson Creek Natural Stream flow (cfs) | Jackson Creek Water Availability (cfs) |
|---|---|---|---|---|---|---|
| Jan. | 7.61 | -9.42 | 4.60 | -5.44 | 6.10 | -8.37 |
| Feb. | 9.59 | -10.50 | 5.79 | -7.25 | 7.60 | -9.98 |
| March | 9.85 | -10.20 | 5.43 | -5.61 | 7.03 | -7.45 |
| April | 8.33 | -8.71 | 3.64 | -3.51 | 4.54 | -6.64 |
| May | 7.03 | -10.60 | 2.38 | -2.85 | 2.86 | -6.62 |
| June | 5.43 | -6.93 | 1.56 | -1.75 | 1.65 | -6.25 |
| July | 2.33 | -4.83 | 0.60 | -0.82 | 0.57 | -7.01 |
| August | 1.47 | -4.13 | 0.37 | -0.48 | 0.33 | -5.59 |
| Sept. | 1.29 | -3.41 | 0.31 | -0.32 | 0.27 | -3.67 |
| Oct | 1.51 | -2.03 | 0.35 | -0.23 | 0.30 | -1.24 |
| Nov. | 2.75 | -3.26 | 0.75 | -1.27 | 0.71 | -1.39 |
| Dec. | 5.13 | -6.89 | 2.44 | -4.59 | 3.11 | -6.22 |

Source: OWRD 2000b

ODFW has identified Wagner, Anderson, Coleman, Jackson, and Willow Creeks as priorities for summer streamflow restoration (ODFW 2000). Wagner Creek has been also been designated by ODFW as a priority for fall and spring streamflow restoration.

### Trends

It is expected that peak flows in the Wagner, Anderson, and Coleman Creek subwatersheds could decrease slightly as the federal lands within the transient snow zone continue to recover hydrologically. Future vegetation changes are not likely to affect the magnitude or timing of peak flows in Griffin, Jackson, and Willow Creeks because there is a low potential risk of peak-flow enhancement in this rain-dominated portion of the analysis area. Although reduced harvest and restoration efforts under the Northwest Forest Plan (USDA and USDI 1994a) will accelerate the vegetation recovery process on federally-managed lands, forest harvest is likely to continue at the same levels on private timber lands.

The potential risk for peak-flow enhancement due to soil compaction is estimated to be high for the analysis area. Roads are the major source of soil compaction and will continue to affect peak flows, unless they are decommissioned or obliterated. Other sources of soil compaction include yarding trails/corridors and off-highway vehicle (OHV) trails (especially in the John's Peak area) in the steeper, forested portions of the analysis area and land development, agriculture, concentrated livestock grazing, and urban development at the lower elevations.

The low summer flow situation in the analysis area is not likely to change substantially in the future. Years with below normal precipitation will be especially critical for fish and other instream uses. No new water diversions are being approved; however, increased groundwater development in the analysis area will further reduce streamflow. Wagner, Anderson, Coleman, Jackson, and Willow Creeks have been identified by ODFW as high priorities for summer streamflow restoration so there may be some low flow increases in these streams.

## STREAM CHANNEL

In general, stream channels in the West Bear Creek Analysis Area have been straightened and channelized, stream elevations have dropped as banks were scoured out, and pools have filled in with sediment. In the upper reaches, stream channels are deeply entrenched in steep V-shaped valleys. There is a deficit of large wood in these steep gradient channels. This lack of sufficient in-stream structure to slow high stream energy results in floods that are more destructive.

In the lower reaches, stream channels are confined by roads and development, restricting the natural tendency of streams to move laterally. Some reaches have been channelized to prevent the loss of agricultural lands to flood damage. Low gradient streams in valley bottoms are entrenched and unable to access the adjacent floodplain except during major peak flow events.

In the following paragraphs, the West Bear Creek Watershed Analysis Area is stratified into six analysis subwatersheds: Wagner Creek, Anderson Creek, Coleman Creek, Griffin Creek, Jackson Creek and Willow Creek (Map 12).

*Wagner Creek*

The upper reaches of Wagner Creek flow along the western edge of an area with granitic soils (Map 7). Granitic rocks are the most erosive and unstable rock type found in the analysis area. Streams that flow through granitic areas are subject to increased sedimentation as granitic areas erode rapidly. This keeps fresh granite near the surface, and the transported decomposed granite results in a substrate with a high percentage of coarse sand and increases the embeddedness of streams.

From the confluence of Goose Creek up to the headwaters of Wagner Creek, the gradient averages 10 percent (ODFW 1997), although extreme segments reach 36 percent (RVCOG 1999b). The channel is constrained by hillslopes within a moderate V-shaped valley. The Rosgen channel morphology classification (Rosgen 1996) is Aa+ (Appendix E provides descriptions of Rosgen morphological stream types). Stream habitat is primarily cascades (71 percent), with substrate a mixture of fines (23 percent), cobble (22 percent), and bedrock (21 percent).

From Arrastra Creek to the confluence of Goose Creek the gradient averages six percent. The channel is constrained by hillslopes within a moderate V-shaped valley. The Rosgen channel morphology classification (Rosgen 1996) is Aa+ to A. Stream habitat is dominated by rapids (69 percent) and the substrate has a very high percentage of fines (35 percent).

Lower in the watershed, gradients lessen from 19 percent down to six percent as the streams flow down the footslopes onto the upper alluvial fan area. Valley widths increase but stream channels remain moderately constrained by steep sideslopes. Historically, landowners have worked to keep the stream course in place through bank stabilization and channelization. Wagner Creek Road also confines the channel where it parallels the stream (RVCOG 1999b).

The lowest reaches of the watershed flow through the alluvial fan and floodplain area with stream gradients at two percent to six percent. The stream channel is bounded by low terraces. Agricultural, urban and commercial development along both sides of the stream have left only a thin riparian strip, the channel is confined and entrenched, and channelization has been implemented in flood prone areas (RVCOG 1999b).

*Anderson Creek*
The upper reaches of Anderson Creek and its tributaries are very steep with entrenched channels confined by steep hillslopes. The lower reaches are entrenched gullies on moderate gradients with low width/depth ratios.

*Coleman Creek*
Like Anderson Creek, the upper reaches of Coleman Creek and its tributaries are very steep with entrenched channels confined by steep hillslopes. The lower mile of Coleman Creek is an entrenched gully with a moderate gradient and low width/depth ratio.

*Griffin Creek*
In Griffin Creek, channel straightening has taken place for agricultural, grazing and urban needs, and consequently, the stream is a mostly straight channel with restricted side-to-side movement. This has resulted in downward erosion, creating the high banks and narrow channel that typify this stream. In a 1998 survey, the average channel depth was 13 feet. Twenty-two percent of the reaches had depth estimations of 20 feet or greater, and there was a maximum depth of 30 feet (RVCOG 1998).

*Jackson Creek and Willow Creek*
In the analysis area, Jackson and Willow Creeks flow through areas with granitic soils, making them subject to rapid erosion and high levels of embeddedness.

Jackson Creek flows through the cities of Jacksonville and Central Point where past and present development continues to affect the stream channel. The stream is channelized and entrenched with little riparian vegetation remaining to protect streambanks. The result is streambank failure and erosion, which is exacerbated by the granitic soils.

Willow Creek is the only stream in the analysis area that exhibits type C channel characteristics. With a gradient of less than two percent, Willow Creek meanders and has both riffles and pools. Starting approximately one mile upstream it forms two C alluvial channels through broad, well defined floodplains. The substrate has a very high percentage of silt (45percent) (ODFW 1999).

## WATER QUALITY
Section 303(d) of the Clean Water Act requires each state to identify streams, rivers, and lakes that do not meet water quality standards even after the implementation of technology-based controls. These waters are referred to as "water quality limited" and states are required to submit lists of these water bodies to the Environmental Protection Agency every four years. Water quality limited waters require the application of total maximum daily loads (TMDLs), a strategy

for improving water quality to the point where recognized beneficial uses of the waters are fully supported. A TMDL addresses pollution by identifying problems, linking them to watershed characteristics and management practices, establishing objectives for water quality improvement, and identifying and implementing new or altered management measures designed to achieve those objectives (ODEQ 1997). A Bear Creek Water Quality Management Plan (WQMP) that will serve as a TMDL to address nonpoint sources is expected in 2001. The Oregon Department of Environmental Quality (ODEQ), Oregon Department of Agriculture (ODA), Oregon Department of Forestry (ODF), U.S. Forest Service, and the BLM are cooperating with the Bear Creek Watershed Council to develop the WQMP. The Oregon Department of Environmental Quality's 1998 list of water quality limited streams (also known as the 303(d) list) includes four streams in the analysis area (Table 30, Map 23).

**Table 30. Water Quality Limited Streams**

| Stream Name | Description | Parameter on 303(d) List |
|---|---|---|
| Wagner Creek | Horn Gulch to headwaters | Temperature (summer) |
| Coleman Creek | Mouth to headwaters | Bacteria (year-round)<br>Temperature (summer) |
| Griffin Creek | Mouth to headwaters | Bacteria (summer)<br>Temperature (summer) |
| Jackson Creek | Mouth to headwaters | Bacteria (year-round)<br>Temperature - summer |

Source: ODEQ 2000a

The ODEQ's 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution (NPS Assessment) identifies eight stream segments on five streams in the analysis area that are impacted by nonpoint source pollution (Tables 31-35). Not all these streams/parameters are included on Oregon's 1998 303(d) list due to a lack of supporting data, however, DEQ considers them Waterbodies of Potential Concern (ODEQ 1998:5). Sedimentation is a parameter of concern for all eight stream segments and elevated temperature and streambank erosion are concerns for all but two segments (Table 32). Changes in flow pattern and timing, elimination of thermal cover to stream, vegetation removal, channelization, animal waste, human waste, and irrigation return flows are identified as probable causes of nonpoint source pollution for five or more of the stream segments (Table 33). Floods and geologic hazards are identified as factors affecting nonpoint source pollution in all eight stream segments (Table 34). Cropland, pastureland, animal waste management, orchards, commercial/industrial construction, and road construction/location are land uses affecting the majority of the stream segments (Table 34).

## Table 31. Waterbodies Included in ODEQ's 1988 Nonpoint Source Assessment

| Stream Name | ODEQ Segment ID | Segment Location |
|---|---|---|
| Wagner Creek | 280 | Mouth to West Lateral Canal[1] |
| Wagner Creek | 281 | West Lateral Canal to Goose Creek[1] |
| Coleman Creek | 279 | Mouth to headwaters |
| Griffin Creek | 277 | Mouth to Phoenix Canal[1] |
| Griffin Creek | 278 | Phoenix Canal to Miller Gulch[1] |
| Jackson Creek | 275 | Mouth to Walker Creek |
| Walker Creek (Jackson Creek tributary) | 276 | Mouth to headwaters |
| Willow Creek | 274 | Mouth to headwaters |

1/ Segment locations estimated from ODEQ map. Source: ODEQ 1988

## Table 32. Parameters of Concern in ODEQ's 1988 Nonpoint Source Assessment

| Parameters of Concern | Wagner Creek | | Coleman Creek | Griffin Creek | | Jackson Creek | | Willow Creek |
|---|---|---|---|---|---|---|---|---|
| | 280 | 281 | 279 | 277 | 278 | 275 | 276 | 274 |
| Bacteria/viruses | X | X | X | X | X | | | |
| Excessive plant growth | X | | | X | | | | |
| Low dissolved oxygen | X | | | X | | | | |
| Low flow | X | X | | X | | | | |
| Nutrients | X | | | X | | X | | |
| Elevated temperature | X | X | X | X | X | X | | |
| Streambank erosion | X | X | X | X | X | X | | |
| Sedimentation | X | X | X | X | X | X | X | X |
| Turbidity | X | X | | X | X | X | | X |

Source: ODEQ 1988

## Table 33. Probable Causes of Nonpoint Source Pollution

| Probable Cause | Wagner Creek | | Coleman Creek | Griffin Creek | | Jackson Creek | | Willow Creek |
|---|---|---|---|---|---|---|---|---|
| | 280 | 281 | 279 | 277 | 278 | 275 | 276 | 274 |
| Surface erosion | X | X | | X | | | X | |
| Changes in flow pattern & timing | X | X | X | X | X | | | |
| Pollutants in road runoff | X | | | X | | | | |
| Pollutants in industrial/commercial site runoff | X | | | X | | | | |
| General riparian vegetation and bank disturbance | | | | | | X | | |
| Elimination of thermal cover to stream | X | X | X | X | X | | | |
| Vegetation removal | X | X | X | X | X | X | | X |
| Road location | | | | | | X | X | X |
| Flow alteration/modification | | | | | | X | | |
| Water withdrawal | X | X | | X | | | | |
| Channelization | X | X | X | X | X | X | | |
| Animal waste | X | X | X | X | X | | | |
| Human waste | X | X | X | X | X | | | |
| Irrigation return flows | X | X | X | X | X | X | | |
| Mining decomposed granite | | | | | | X | X | X |

Source: ODEQ 1988

**Table 34. Land Use Associated with Nonpoint Source Pollution**

| Associated Land Use | Wagner Creek | | Coleman Creek | Griffin Creek | | Jackson Creek | | Willow Creek |
|---|---|---|---|---|---|---|---|---|
| | 280 | 281 | 279 | 277 | 278 | 275 | 276 | 274 |
| Non-irrigated and irrigated cropland/pastureland | X | X | X | X | X | X | | |
| Animal waste management | X | X | X | X | X | X | | |
| Nurseries/orchards | | X | X | X | X | X | | |
| General range | | | | X | | X | | |
| Livestock grazing | X | X | | | | | | |
| Harvesting | | | | | | | X | X |
| Road construction/maintenance assoc. with agriculture, range & forestry | | | | | | | X | X |
| Timber management | | | | | | | X | X |
| Aggregate quarry mining | | | | | | | X | X |
| Urban | | | | | | X | | |
| Surface run off | X | | | | | | | |
| Residential construction | X | X | | X | | X | | |
| Commercial/industrial construction | X | X | X | X | X | X | | |
| Road construction/location | X | X | X | X | X | X | | |
| Storm/flood | X | X | X | X | X | X | X | X |
| Drought | | | | | | | X | |
| Geologic hazards | X | X | X | X | X | X | X | X |

Source: ODEQ 1988

Water quality parameters most critical to the beneficial uses (Characterization section, Water Quality) in the West Bear Creek Watershed Analysis Area are: flow modifications, temperature, dissolved oxygen, pH, bacteria/pathogens, turbidity, sedimentation and habitat modifications. Flow and habitat modifications are discussed in Hydrology and Aquatic Wildlife, respectively. The processes and disturbances affecting the other critical water quality parameters and current conditions are described below.

**Temperature**

Many factors contribute to elevated stream temperatures in the analysis area. Low summer streamflows, hot summer air temperatures, low gradient valley bottoms, lack of riparian vegetation, and high channel width-to-depth ratios result in stream temperatures that can stress aquatic life. Natural disturbances that can affect stream temperature are climate (high air temperatures), below normal annual precipitation and low summer rainfall (low flows), and wildfires and floods (loss of riparian vegetation). Human-caused disturbances in the West Bear Creek Analysis Area affecting stream temperatures include water withdrawals, irrigation return flows, channel alterations, and removal of riparian vegetation through road building, logging, grazing, agricultural clearing, mining, residential developments, and urbanization.

The ODEQ Bear Creek TMDL Assessment Report for Riparian Shade (ODEQ 2000b:11) assessed existing and potential stream shade for Bear Creek and some of its tributaries (Table 35). The reach weighted average for existing shade is well below the site potential shade for all stream systems assessed. (The reach weighted average takes into account the length of each stream reach for which a shade value was determined). Jackson and Griffin Creeks are in need of the most improvement.

**Table 35. Summary of Shade Assessment**

| Stream System | Existing Percent Shade: Reach Weighted Average | Site Potential Percent Shade: Reach Weighted Average |
|---|---|---|
| Wagner Creek | 70 | 91 |
| Anderson Creek | 58 | 90 |
| Coleman Creek | 67 | 89 |
| Griffin Creek | 47 | 85 |
| Jackson Creek | 46 | 88 |

Source: ODEQ 2000b

The State water quality criteria for temperature is established to protect resident fish and aquatic life, and salmonid fish spawning and rearing. The temperature standard for summer temperatures in the Rogue Basin states that the seven day moving average of the daily maximum shall not exceed 64ºF (ODEQ 1999:57). Wagner Creek, Coleman Creek, Griffin Creek, and Jackson Creek exceed the temperature standard and are listed as water quality limited (Table 30).

The BLM has monitored temperature in Wagner Creek, Horn Gulch (tributary to Wagner Creek), Coleman Creek, and Griffin Creek. Table 36 lists the temperature site locations, the seven day average maximum temperatures, and the number of times that the seven day average maximum temperature exceeded the State temperature standard. Wagner Creek is supplemented during the irrigation season by water diverted from McDonald Creek in the Little Applegate River Watershed. Water is transported via the McDonald Ditch to the headwaters of Wagner Creek. This 3.5 mile open ditch transport likely contributes to the warm water temperatures of Wagner Creek above Horn Gulch (Table 36). Stream temperatures in McDonald Creek above the ditch diversion average 6.7ºF cooler than the temperatures at Wagner Creek above Horn Gulch for the 1994 to 2000 monitoring seasons.

**Table 36. BLM Stream Temperature Monitoring Data**

| Year Monitored | Wagner Creek abv Horn Gl | | Wagner Creek abv Yank Gl | | Horn Gulch @ Wagner Crk | | Coleman Creek sec. 20 | | Griffin Creek sec. 26 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | °F[1] | No. >[2] | °F[1] | No. >[2] | °F[1] | No. >[2] | °F[1] | No. >[2] | °F[1] | No. >[2] |
| 1994 | 66.3 | 18 | --- | --- | 60.9 | 0 | --- | --- | --- | --- |
| 1995 | 59.8 | 0 | --- | --- | 58.1 | 0 | --- | --- | --- | --- |
| 1996 | 64.3 | 3 | --- | --- | 61.7 | 0 | --- | --- | --- | --- |
| 1997 | 67.4 | 31 | --- | --- | 60.3 | 0 | 64.9 | 19 | --- | --- |
| 1998 | 64.8 | 15 | 66.0 | 30 | 60.1 | 0 | 66.0 | 33 | --- | --- |
| 1999 | 65.5 | 17 | 66.4 | 21 | 58.3 | 0 | 64.9 | 13 | 55.6 | 0 |
| 2000 | 68.7 | 28 | 68.2 | 25 | 59.5 | 0 | 67.0 | 18 | --- | --- |

1/ 7 Day Ave. Max. Temp. (°F)
2/ # Times 7 Day Ave. Max. > 64°F
Source: USDI BLM 1994, 1995, 1996, 1997, 1998, 1999, 2000

**Dissolved Oxygen**

Dissolved oxygen concentration refers to the amount of oxygen dissolved in water. Dissolved oxygen is critical to the biological community in the stream and to the breakdown of organic material (MacDonald et al. 1991). Dissolved oxygen concentrations are primarily related to water temperature (MacDonald et al. 1991). When water temperatures increase, oxygen concentrations decrease. Oregon's dissolved oxygen standard describes the minimum amount of dissolved oxygen required for different water bodies (i.e., waters that support salmonid spawning until fry emergence from the gravels, waters providing cold water aquatic resources, waters providing cool-water aquatic resources, etc.). The 30-day mean minimum for cold water aquatic life is 8.0 mg/l (ODEQ 1999:Table 21)

The Rogue Valley Council of Governments (RVCOG) has been monitoring water quality on four streams within the analysis area once or twice a month since January 1992. The provisional dissolved oxygen monitoring data was summarized following the data assessment procedures in the Oregon Watershed Assessment Manual (GWEB 1999) (Table 37). Low dissolved oxygen levels generally occur during the summer months when water temperatures are high and streamflows are low. Low dissolved oxygen was identified as a parameter of concern for Wagner and Griffin Creeks in ODEQ’s 1988 Nonpoint Source Assessment (ODEQ 1988). This was based on perception with no supporting data. No streams within the analysis area have been listed as water quality limited for dissolved oxygen.

**Table 37. Provisional Dissolved Oxygen Data Summary**

| Statistic | Provisional Dissolved Oxygen Data Summary | | | |
|---|---|---|---|---|
| | Wagner Creek @ West Valley View Road | Coleman Creek @ Hwy 99 | Griffin Creek @ I-5 | Jackson Creek @Blackwell Rd |
| Number of samples | 74 | 66 | 69 | 65 |
| Minimum (mg/l) | 7.5 | 6.7 | 6.2 | 5.3 |
| Maximum (mg/l) | 12.1 | 12 | 18.7 | 14.4 |
| Median (mg/l) | 9.6 | 9.2 | 9.3 | 9.1 |

Source: RVCOG 2000

## pH

pH is defined as the logarithmic concentration of hydrogen ions in water in moles per liter. pH can have direct and indirect effects on stream water chemistry and the biota of aquatic ecosystems. pH varies inversely with water temperature and shows a weak inverse relationship to discharge. Forest management activities can indirectly increase pH through the introduction of large amounts of organic debris and by increasing light to streams (MacDonald et al. 1991). Increased light or nutrient loading can increase the diurnal variation in pH. State water quality criterion for pH in the Rogue Basin ranges from 6.5 to 8.5 (ODEQ 1999:57). No streams within the analysis area are on the 303(d) list for pH or have it identified as a parameter of concern.

Provisional pH data results from RVCOG's water quality monitoring in the analysis area from January 1992 through December 1999 have maximum pH values that exceed the state standard (Table 38). The RVCOG uses grab samples to measure pH, thus the data summarized in Table 38 does not depict the full range of pH values since pH can fluctuate throughout the day. The range of daily variability is unknown.

**Table 38. Provisional pH Data Summary**

| Statistic | Provisional pH Data Summary | | | | |
|---|---|---|---|---|---|
| | Wagner Creek @ West Valley View Road | Coleman Creek @ Hwy 99 | Griffin Creek @ I-5 | Jackson Creek | |
| | | | | @ Scenic Ave. | @ Blackwell Rd. |
| Number of samples | 113 | 105 | 110 | 87 | 71 |
| Minimum | 6.14 | 7.74 | 6.66 | 7.28 | 7.66 |
| Maximum | 9.30 | 9.10 | 11.00 | 8.89 | 9.90 |
| Median | 8.06 | 8.07 | 8.13 | 7.98 | 8.00 |

Source: RVCOG 2000

## Bacteria/Pathogens

Waterborne pathogens include bacteria, viruses, protozoa, and other microbes that can cause skin and respiratory ailments, gastroenteritis, and other illnesses. Most drinking and recreational waters are routinely tested for certain bacteria that have been correlated with human health risk.

If the average concentration of these bacteria falls below the designated standard, it is assumed that the water is safe for that use and that there are no other pathogenic bacteria that represent a significant hazard to human health (MacDonald et al. 1991). The four groups of bacteria most commonly monitored are total coliforms, fecal coliforms, fecal streptococci, and enterococci. Fecal coliform bacteria are mostly those coliform bacteria that are present in the gut and feces of warm-blooded animals. They can be directly linked to sanitary water quality and human health risks.

State water quality criteria for bacteria states that for a 30-day log mean of 126 *Escherichia (E.) coli* (a species of fecal coliform) organisms per 100 ml, based on a minimum of five samples, no single sample shall exceed 406 *E. coli* organisms per 100 ml (ODEQ 1999:58). The purpose of the bacterial water quality standard is to protect the most sensitive designated beneficial use, which has been identified as water contact recreation. Prior to the establishment of *E. coli* data as the basis for the State bacteria criteria in 1996, the standard was written in terms of fecal coliform. The fecal coliform standard was a log mean of 200 fecal coliform per 100 milliliters based on a minimum of five samples in a 30 day period with no more than ten percent of the samples in the 30 day period exceeding 400 per 100 ml (ODEQ 1998:11). Fecal coliform data was used to develop the Oregon 1998 303(d) list.

ODEQ's NPS Assessment (1988) identified bacteria as a parameter of concern in Wagner, Coleman, and Griffin Creeks. These streams were identified as having a moderate bacteria problem based on data available. RVCOG's provisional fecal coliform monitoring data from Wagner, Coleman, Griffin, and Jackson Creeks between January 1992 and December 1999 is summarized in Table 39 (RVCOG 2000).

**Table 39. Provisional Fecal Coliform Data Summary**

| Statistic | Provisional Fecal Coliform Data Summary | | | | |
|---|---|---|---|---|---|
| | Wagner Creek @ West Valley View Road | Coleman Creek @ Hwy 99 | Griffin Creek @ I-5 | Jackson Creek | |
| | | | | @ Scenic Ave. | @ Blackwell Rd. |
| Number of samples | 110 | 103 | 107 | 83 | 69 |
| Minimum (cfu[1]/100ml) | ND[2] | ND[2] | ND[2] | ND[2] | ND[2] |
| Maximum (cfu/100 ml) | 5000 | 5000 | 7250 | 8400 | 5000 |
| Median (cfu/100 ml) | 200 | 333 | 467 | 500 | 560 |

1/ cfu = colony forming units 2/ ND = not detectable
Source: RVCOG 2000

Sources of high bacterial levels in the analysis area include animal feces (wild and domestic, including livestock such as cattle), failing septic systems, runoff from urban areas, leaking or cross connected municipal sewer systems, and irrigation return flows.

### Sediment and Turbidity

Sedimentation is the natural process of sediment entering a stream channel. However, an excess of fine sediments (sand-size and smaller) can cause problems such as turbidity (the presence of suspended solids) or embeddedness (buried gravels and cobbles). Sedimentation is generally associated with storm runoff and is highest during fall and winter. Natural processes occurring in the analysis area such as landslides, surface erosion, wildfire, and flood events contribute to increased sedimentation.

Sediment sources in the analysis area resulting from human activities include roads; logging (tractor skid trails, yarding corridors, and landings); off-highway vehicle (OHV) trails; concentrated livestock grazing in riparian zones; urban, residential, and agricultural clearing of riparian zones; maintenance of irrigation diversions; irrigation return flows; irrigation ditch blowouts; and mining. The granitic soils in the headwaters of Wagner, Jackson, and Willow Creeks are prone to surface erosion, especially after the surface is disturbed.

Roads appear to be the primary human-caused sediment source in the forested headwaters of the analysis area. Roads with one or more of the following features have the greatest potential for contributing substantial amounts of sediment to nearby streams: stream-adjacent location, mid-slope location, natural surface, and inadequate drainage control and maintenance. Table 40 shows the following road information by analysis subwatershed: surface type, number of stream crossings, and proximity to streams. It is important to note that the information in Table 40 is not complete for roads on private lands. The BLM GIS transportation theme includes all BLM roads, but only a portion of roads on private lands. The surface type is unknown for 77 percent of the road miles. These “unknown” road miles are on private lands and they are mostly driveways to private residences and access roads for private timber companies. A high percentage of the road miles with unknown surface type are probably natural surfaced. Stream crossing densities are shown in Table 23. Roads are adjacent to a portion of all the major streams in the analysis area and have directly contributed sediment to the stream channel. The Jackson Creek Analysis Subwatershed has the greatest number of road miles within 150 feet of streams (76.7 miles), followed by Griffin and Wagner Creeks (47.6 and 33.4 miles respectively). The analysis subwatersheds with the highest percentage of federal roads within 150 feet of streams are Coleman Creek (12.2 percent), Wagner Creek (11.7 percent), and Griffin Creek (11.1 percent). Sections with road/stream intersections greater than 10 per square mile are included in Appendix H.

**Table 40. Road Surface Type, Stream Crossings, and Road Proximity to Streams**

| Analysis Subwatershed | Total Road Miles[1] | Road Surface Type (miles) | | | | Miles of Road Within 150 ft. of Streams (% on Federal Lands) | Miles of Road Within 300 ft. of Streams (% on Federal Lands) |
|---|---|---|---|---|---|---|---|
| | | Natural | Rock | Paved | Unknown | | |
| Wagner Creek | 97.8 | 5.9 | 15.6 | 8.4 | 67.9 | 33.4 (11.7) | 47.1 (12.1) |
| Anderson Creek | 60.7 | 9.9 | 2.9 | 4.6 | 43.3 | 23.0 (9.6) | 31.6 (11.4) |
| Coleman Creek | 18.4 | 1.7 | 3.0 | 1.5 | 12.2 | 5.8 (12.2) | 8.2 (12.2) |
| Griffin Creek | 172 | 2.8 | 18.8 | 17.0 | 133.4 | 47.6 (11.1) | 70.8 (11.7) |
| Jackson Creek | 204.4 | 15.5 | 1.4 | 20.2 | 167.3 | 76.7 (4.3) | 107.6 (4.3) |
| Willow Creek | 26.3 | 1.2 | 0.1 | 2.2 | 22.8 | 11.9 (3.4) | 16.6 (3.0) |
| Totals | 579.6 | 37.0 | 41.8 | 53.9 | 446.9 | 198.4 (8.0) | 281.9 (8.4) |

1/ Roads shown on the BLM GIS transportation theme.

Roads are adjacent to a portion of all the major streams in the analysis area and have directly contributed sediment to the stream channel. Several landslides have occurred below the Wagner Creek road where it closely parallels Wagner Creek between Arrastra Creek and Bear Gulch.

Skid roads, yarding corridors, landings, and OHV trails in the analysis area also contribute to accelerated surface erosion that is liable to enter waterways. The amount of soil disturbance due to these activities has not been calculated; however, from studying the aerial photos of the analysis area, it is apparent that extensive logging on private timber lands in the headwaters has resulted in a high level of ground disturbance. OHV use on existing roads, skid roads, and yarding corridors has increased the amount of sediment moving off site and into nearby streams. The creation of trails by OHV use has also resulted in sediment input to streams in the analysis area. Surface disturbance from OHV use is especially visible in the John's Peak OHV Area in the Jackson Creek and Willow Creek Analysis Subwatersheds.

Channelization, residential, urban, and agricultural clearing of riparian zones, and livestock grazing are the major sources of streambank destabilization and subsequent sediment input to the lower reaches of tributaries in the analysis area. Concentrated livestock grazing on streambanks results in erosion from trampling and streambank collapse. Additional sediment sources in the lower reaches of the analysis area include annual maintenance of diversion structures (especially push-up gravel dams), irrigation return flows, and irrigation ditch blowouts. The Upper West Lateral irrigation dam is a large source of sediment noted in the Wagner Creek Watershed Assessment (RVCOG 1999b). Sediment that is trapped behind the gates during the irrigation season is released into Wagner Creek when the gates are opened in the fall. Sediment deposited in irrigation ditches during the winter is re-mobilized during the irrigation season (RVCOG 2001).

Although more prevalent in the past, mining is still taking place within the analysis area. Currently, mining claims consist of both lode and placer type claims. It is not known how much sediment is produced by mining in the area.

The State water quality criterion for sedimentation states that the formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed (ODEQ 1999:58). Beneficial uses affected include resident fish and aquatic life, and salmonid fish spawning and rearing. The State water quality criterion for turbidity states no more than ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activities (ODEQ 1999: 57). Beneficial uses affected are resident fish and aquatic life, water supply and aesthetics.

ODEQ’s NPS Assessment (1988) identified sedimentation as a parameter of concern in Wagner, Coleman, Griffin, Jackson, Walker (tributary to Jackson Creek), and Willow Creeks and turbidity as a parameter of concern in Wagner, Griffin, Jackson, and Willow Creeks.

Provisional turbidity data results from RVCOG’s water quality monitoring in the analysis area during the period from January 1992 to December 1999 are summarized in Table 41 (RVCOG 2000). Comparing the low median values to the very high maximum turbidity values, it is apparent that turbidity is often an acute pollution problem, as opposed to chronic. These acute situations are most often due to storm events or short-term point-source pollution incidents such as construction site run-off (Quinby 2001).

**Table 41. Provisional Turbidity Data Summary**

| Statistic | Provisional Turbidity Data Summary | | | | |
|---|---|---|---|---|---|
| | Wagner Creek @ West Valley View Road | Coleman Creek @ Hwy 99 | Griffin Creek @ I-5 | Jackson Creek | |
| | | | | @ Scenic Ave. | @Blackwell Rd |
| Number of samples | 112 | 105 | 110 | 87 | 70 |
| Minimum (ntu[1]) | 0.5 | 0.6 | 0 | 1.5 | 1.9 |
| Maximum (ntu) | >1,000 | 369 | >1,000 | 144 | 500 |
| Median (ntu) | 4.1 | 4.7 | 10.6 | 13 | 15.2 |

1/ ntu = nephelometric turbidity unit
Source: RVCOG 2000

### Trend

Water temperatures in the headwaters may show some improvement in the long term as the Northwest Forest Plan is implemented on federal lands and riparian vegetation recovers along the tributary streams. However, high stream temperatures will likely persist on the lower reaches due to water withdrawals, high width-to-depth ratios, and lack of riparian cover. The dissolved oxygen, pH, and bacteria levels are not expected to change substantially in the future within the analysis area.

Sedimentation and turbidity will vary depending on the amount of soil disturbing activity in the analysis area. Timber harvest using tractors and road construction, especially in areas with granitic soils, will likely result in additional sediment delivery to nearby streams. New road construction will likely result in increased surface erosion while road decommissioning should decrease sediment and turbidity levels. OHV trail construction, OHV use on trails that cross stream channels, and the existing residential, urban, and agricultural development along the lower stream reaches will likely continue to contribute excessive sediment inputs.

## RIPARIAN AREAS

Riparian condition in the analysis area was primarily derived from fish habitat surveys done in some of the fish bearing streams. For purposes of the riparian area discussion, the West Bear Creek Watershed Analysis Area is stratified into six analysis subwatersheds: Wagner Creek, Anderson Creek, Coleman Creek, Griffin Creek, Jackson Creek and Willow Creek (Map 12).

*Wagner Creek*

In the Wagner Creek subwatershed, the Wagner Creek Assessment (RVCOG 1999b) described the riparian condition from the upper reaches of Wagner down to its mouth. The headwaters and upper reaches of Wagner Creek flow through a dense, second growth Douglas-fir, ponderosa pine, and western red-cedar forest which provides shade of 91percent. Other species found within the riparian area are hardwoods including black maple, black oak, madrone, cottonwood, alder, birch, and willow. Disturbance to the riparian corridor in these upper sections is mainly from the close proximity of Wagner Creek road and other road crossings.

Riparian conditions within the middle reaches of Wagner Creek, from Arrastra Creek down to Yank Gulch are quite different from the headwater sections. Land use along this section is a combination of rural residential, small farm use, and agriculture. Large fields, orchards and pastures border on the strip of riparian habitat that varies from less than 60 feet wide to several hundred feet wide. The vegetation is the same species as in the upper reaches, but in less abundance, so the riparian composition is sparse (RVCOG 1999b).

As the elevation drops down to the valley floor, the species composition changes from a primarily conifer forest to a primarily hardwood forest. Disturbances to the riparian corridor increase dramatically. Residences are built within the floodplain, access drives to residences and properties cross the creek, and many agricultural clearings are located adjacent to both sides of the creek (RVCOG 1999b).

Riparian conditions in the lower sections of Wagner Creek from Yank Gulch to the confluence with Bear Creek show the most disturbance from land use. Riparian widths are less than 60 feet wide, if present at all. Riparian vegetation is sparse and some stretches are denuded of all vegetation. Land use along this section is the most diverse and is composed of agriculture, small farm use, rural residential, and commercial.

*Anderson Creek*
Both forks of Anderson Creek and its tributaries are paralleled by roads, narrowing the riparian corridor. Some reaches are described as having good cover for fish, indicating larger diameter trees (ODFW 1999). The lower reaches go through developed areas of agriculture, small farm use, and rural residential areas leaving only a narrow to no riparian corridor.

*Coleman Creek*
The lower reaches of Coleman Creek flow through dense blackberry thickets and cow pastures. The upper reaches are paralleled by roads, leaving a narrow riparian corridor (ODFW 1999).

*Griffin Creek*
In Griffin Creek, land use is 56 percent agriculture, 21 percent urban, 11 percent grazing, 10 percent rural residential, and two percent is allocated to the Bear Creek Greenway. A lack of riparian vegetation creates a high erosion potential and active erosion is evident and frequent. The average riparian width is a scant 15-16 feet, and greater than 50 percent of this vegetation ribbon contains non-native Himalayan blackberries (RVCOG 1998).

*Jackson Creek*
Development along Jackson Creek and its tributaries has led to the removal of riparian vegetation that is important for shade, future habitat recruitment, and sediment control. Habitat above Hanley Road is described as providing cover for fish, indicating a wider riparian corridor with some larger diameter trees (ODFW 1999).

*Willow Creek*
Willow Creek also flows through urban and rural residential development leaving narrow riparian corridors. Riparian habitat is composed primarily of Himalayan blackberries (ODFW 1999).

## AQUATIC WILDLIFE SPECIES AND HABITATS

The West Bear Creek Analysis Area is home to summer steelhead, cutthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*) and sculpin (*Cottus* sp.). Summer steelhead were considered a candidate species for listing under the ESA of 1973. In April 2001, the National Marine Fisheries Services ruled that listing was not warranted. Fall chinook spawn in Bear Creek and may also utilize tributaries in the analysis area for habitat if there is adequate flow. Details of species distribution are found in the characterization section (Table 15).

The tributaries in the analysis area present some challenging conditions for the fish species that reside in them. During the months of minimal rain (June-September) water is removed for irrigation resulting in low flows and warmer than optimal stream temperatures (water quality section). Irrigation return flows exacerbate this problem by releasing water back into the streams that is above the $65^0$ F needed for healthy fish populations (RVCOG 1999a). These return flows also carry agricultural runoff that can contribute excess nutrients and pesticides to streams.

In May 1996, water injected with magnacide containing acrolein leaked into Bear Creek causing the mortality of an estimated 92,000 steelhead (RVCOG 1999a). Although this accident occurred outside of the analysis area, this impacted the population of steelhead throughout their range.

The lower reaches of the tributaries in the analysis area are in a very developed valley of diverse land use including agriculture, small farms, rural residential, residential and commercial development, road crossings, railroad crossings, urban runoff drainage structures, and irrigation diversions. In many cases, this development is directly in the riparian zone, resulting in channelized streams, changes in the natural flow regimes, inadequate shading of the stream, inadequate large woody debris (LWD), no recruitment potential for additional LWD (see riparian section), and high sediment.

Throughout the analysis area, barriers to fish migrations such as dams, irrigation diversions, push up dams, and culverts block anadromous fish from additional spawning habitat. They also prevent resident fish from accessing upstream spawning habitat or being able to move downstream for winter refuge. In addition, fish are prevented from repopulating the area above the barrier. There are eleven known fish barriers in the analysis area.

In the following paragraphs, the West Bear Creek Watershed Analysis Area is stratified into six analysis subwatersheds: Wagner Creek, Anderson Creek, Coleman Creek, Griffin Creek, Jackson Creek and Willow Creek (Map 12).

*Wagner Creek*

In Wagner Creek the gradient from Arrasta Creek to Goose Creek averaged six percent. Stream habitat is dominated by rapids (69 percent) and substrate has a very high percentage of fines (35 percent). The percentage of fines in riffles is even higher, at 50 percent. The riparian corridor is well shaded at 91 percent, however wood volume is low at 5.9 m3/100. Potential sources for the high level of fines are from new gravel and road crossings throughout this section and three active landslides visible from the stream near the Talent Middle School, one just above Horn Gulch Creek, and one 100M upstream from where Wagner Creek road crosses (ODFW 1997).

From the confluence of Goose Creek up, the gradient is a steep 10 percent. Stream habitat is primarily cascades (71 percent), with the substrate a mixture of fines (23 percent), cobble (22 percent), and bedrock (21 percent). Fish are blocked by a cascade over bedrock just above Reel Creek. Wood volume is low at 8.8 m3/100m. The stream is well shaded at 86 percent (ODFW 1997).

A 1994 BLM contracted macroinvertebrate survey was also done in this upper section of Wagner Creek, between Arrasta Creek and Horn Gulch Creek. Aquatic macroinvertebrates are good indicators of stream habitat quality as many are sensitive to changes in water quality or temperature. Because the life cycles and habitat needs of many aquatic insects are known, the presence or absence of particular taxa provides a good indication of the year-round stream condition. Long lived taxa richness was low, indicating a high disturbance to substrates, and that habitat complexity and retention mechanisms were not optimal. The survey found most crevice space, pools, pockets and alcoves were partially to totally filled with fine sediment. Pore space in the hyporheos was sealed, and silt entrained in the stream bottom sediments was high. Despite the massive amounts of fine sediment, bioassessment scores were surprisingly high. Dense shading, cool water temperatures, high detrital inputs and strong perennial flow appear to offset the impact of sediment clogging.

A Wagner Creek watershed assessment prepared by RVCOG in 1999 noted that wood levels are low especially in the lower sections, a reflection of sparse riparian vegetation and land use practices within the riparian zone.

Wagner Creek experiences high levels of turbidity and sediment during winter storm months. Steep slopes of highly erodible soils (see Soils section) contribute to the high sediment levels. One major source of sediments is from Wagner Creek road, especially the section between Arrastra Creek and Bear Gulch Wagner Creek Road (RVCOG 1999b).

*Anderson Creek*

In the North Fork of Anderson Creek fish are blocked by a culvert 300 feet downstream from the confluence of North and South Fork. However, the fish habitat above this is good with plenty of cover, suitable pools, gravel substrate, and gentle gradient. The South Fork of Anderson Creek has a gradient of five percent to 15 percent at the top, presenting a possible natural barrier.

*Coleman Creek*

Fish habitat in Coleman Creek is moderate to poor. It lacks good pools and riparian habitat. The stream flows through dense blackberry thickets and cow pastures.

*Griffin Creek*

In Griffin Creek, land use is 56 percent agriculture, 21 percent urban, 11 percent grazing, 10 percent rural residential, and two percent is allocated to the Bear Creek Greenway. The stream channel has been straightened to fit agricultural and urban needs and shows significant down cutting. A lack of riparian vegetation creates a high erosion potential and active erosion is evident and frequent. There are many diversions removing water, as well as return flows of warm water which increase stream temperatures (water quality section). The average riparian width is a scant 15-16 feet, and greater than 50 percent of this vegetation ribbon contains non-native Himalayan blackberries (RVCOG 1998). Fish use ends where Hopkins canal crosses

Griffin Creek, but habitat above this appears very good. There are abundant deep pools and riffles, good cover, and clean cobble and gravel substrate (ODFW 1999).

*Jackson Creek*
Although a recent detailed survey has not been done, general information indicates poor fish habitat. Development along Jackson Creek has led to the removal of riparian vegetation necessary for shade, future habitat recruitment, and sediment control. A 1973 survey found the stream was primarily composed of riffles with very few pools and two sections had been channeled, eliminating all pools (Jackson Creek Assessment, 2001). Fish are blocked at the Hanley road crossing. Habitat above this unnatural barrier is in better condition than below the barrier with abundant deep pools, riffles, clean substrate, and adequate cover (ODFW 1999). Dean Creek, a tributary to Jackson Creek lacks pools, cover, and riparian vegetation. The substrate consists of silt and the stream was highly channelized through pastures (ODFW 1999).

*Willow Creek*
Habitat in Willow Creek is poor from the mouth to the confluence of Lane and Willow Creeks. The substrate is 45 percent silt, there are very few pools and riparian habitat is composed primarily of Himalayan blackberries (ODFW 1999).

**Aquatic Wildlife Species and Habitats Trends**
Water temperatures in the headwaters may show some improvement in the long term as the Northwest Forest Plan is implemented on federal lands and riparian vegetation recovers along the tributary streams. However, high stream temperatures will likely persist on the lower reaches due to water withdrawals, high width-to-depth ratios, and lack of riparian cover. The amount of large woody debris may also increase in the headwaters on federal land, but little improvement is expected in the lower, heavily developed reaches. These improvements would primarily benefit resident fish such as cutthroat and sculpin.

Sedimentation and turbidity will probably continue to be a problem in the analysis area, especially in areas with granitic soils. In the lower reaches, OHV trail construction, OHV use on trails that cross stream channels, and the existing residential, urban, and agricultural development will likely continue to contribute excessive sediment inputs. Embeddedness reduces the habitat available for successful spawning, fills in the voids needed for fry to hide, and reduces the abundance of aquatic invertebrates (Meehan 1991). Excessive sediment inputs will continue to stress fish populations. Fish barriers from irrigation diversions, push up dams, and culverts will also continue to deter fish movement.

# REFERENCE CONDITIONS

The reference conditions section explains how ecological conditions have changed over time as a result of human influences and natural disturbances. This section provides a reference for comparison with current conditions.

## HUMAN USES

**Introduction**
This brief environmental history traces the major interactions of past human inhabitants with the land, and suggests some effects of these interactions upon the land. Historic information is always incomplete, often anecdotal, and rarely quantifiable. Yet the story presented here provides some glimpses into the past, and something of a road map to the conditions we now face.

**Native Inhabitants and the Land**
Archaeological evidence indicates that people have inhabited the region for about 10,000 years. During the first several thousand years of human occupation, until about 7,000 years ago, human populations were very low and very mobile. People lived in small bands, and hunted and gathered throughout the landscape.

After about 7,000 years ago populations began to increase, and regular camps appear in the archaeological record in the analysis area. For the next 5,000 years people living in this region followed a remarkably stable pattern of existence, though towards the end of this period changes began to take place. During this time, native peoples lived in small bands, moving themselves seasonally about the countryside in search of valued resources, in increasingly well-defined group territories. Hunting was important, as was gathering root and seed crops. Archaeological sites dating throughout this period attest to the use of the analysis area during this time. By the end of this period, however, significant changes appear in the archaeological record, signifying changes in the native way of life (Winthrop 1993).

This new way of life was well established after 2,000 years ago. It was characterized by larger populations, well-defined group territories, and a higher degree of sedentism than existed previously. Permanent villages, inhabited for at least part of the year, appear in the archaeological record. These villages were usually situated at lower elevations near major rivers and streams, reflecting a stronger emphasis on fish resources. Group interactions also intensified, evident in an increase in trade and warfare. Social hierarchies developed, with wealth items representing higher status among individuals or families. This way of life continued until the coming of Euro-Americans to this region.

The native people known as the Shasta and those known as the Upland Takelma inhabited the watershed analysis area. The boundary between the Shasta territory and the Takelma territory has been suggested as falling in the vicinity of the modern day town of Talent. (Olmo and Hannon 1989:4; Gray 1987:17-18)

Our knowledge of the Takelma familiarity with the analysis area's landscape comes from ethnographic work documenting their language. The Takelma had names for many of the places within the analysis area. The Takelma word for their village near the present day town of Jacksonville came from their name for a plant "k'alaw" that had a kind of sweet white root with a white flower (Gray 1987:75). In fact, the Takelma name for Bear Creek translates as "dirty water" (Gray 1987:78).

The Shasta and the Takelma, like other native peoples in the region, had developed a highly sophisticated understanding of the environment in which they lived and the resources on which they depended. As hunters/gatherers/fishers, they interacted with the environment to promote and enhance those foods and materials of most benefit to them. Roots and bulbs, such as camas and various forms of *perideridia* (e.g. ipos) provided starchy staples. Fish, especially anadromous fish such as salmon, and major ungulates (deer, elk) provided essential protein. Acorns from oak trees were another nutritious food. In addition, a wide variety of berries, nuts, seeds (e.g. tarweed seeds), fowl, and other game augmented the diet. Other plants and animals were used for a wide variety of necessary materials, for basketry, fiber, tools, clothing, and medicines.

The broad river valley, low surrounding hills and the southern aspect of higher elevations would have been principal source locations for acorns. The gathering of camas occurred in a number of localities, generally in flat well-watered areas adjacent to the Rogue River. The most favored fishing locations were at the falls and rapid of the Rogue and its tributaries (Gray 1987:32).

Native peoples throughout the region employed a number of techniques to manage their environment. Their most important tool was fire. Fire was probably used by the Shasta and the Takelma for thousands of years but became a major tool for resource management during the last two thousand years, coinciding with expanding human populations and the advent of a cooler and wetter climate.

Fire was used for a variety of purposes (LaLande and Pullen 1999). Fire was used in hunting to drive game animals to the kill, and for the longer-term goal of improving and maintaining wildlife habitat. Open, park-like forests were also a goal, because they made hunting easier. Fire assisted in promoting and maintaining staple crops, such as acorns from oak trees. Fire maintained open meadows and prairies, both in the uplands and valleys, which were crucial locations for subsistence resources including game, roots, bulbs, berry patches, and grass seeds.

Native peoples used fire for specific purposes and carefully regulated its use. For example, the Shasta and the Takelma used fire to destroy beaver lodges and to kill the animals (LaLande 1989:13). Also, the Takelma burned the hillsides of the Rogue Valley to make it easier to gather fallen acorns, and to maintain stands of grass (Pullen 1996:V-3). Burning took place at certain times (mainly spring and fall) and at specific intervals, and contributed to the development of the prairies and savannahs of the valleys, oak and oak/pine woodlands of the foothills, and the meadows of the uplands.

Archaeological and historic evidence documents a substantial native presence in the watershed analysis area. The use of fire by native inhabitants significantly affected the landscape in the valleys and in the uplands.

**Early Explorers**

Early explorers and traders began passing through the area in the nineteenth century. In general these people followed the course of Bear Creek. Beginning with Peter Skene Ogden in 1827, these explorers left occasional descriptions of the world through which they passed. These descriptions provide the earliest historic evidence we have of the environment.

Ogden was an employee of the British Hudson's Bay Company, which had a base along the Columbia River to the north. Sent out on a mission to discover and deplete the beaver of the southern Oregon country, Ogden followed the Klamath River, coming from the Klamath Basin into what is now northern California in 1827 (LaLande 1984:40-43).

Ogden continued on to the Shasta Valley, then turned north to cross the Siskiyous in the vicinity of present-day Interstate 5. He entered the Bear Creek Valley, following Hill Creek, and camped near today's Emigrant Lake. His descriptions of the landscape are glowing (LaLande 1984:52-55):

> "...all here looks like summer...green grass and four inches in length and from the size of the wood the Oaks here being nearly double the size of any I have seen this season induces me to suppose that the Climate is milder...Shortly after we were encamped an Indian came boldly to my tent and presented me with two fresh salmon".

According to historian Jeff LaLande, the oaks were probably California black oak, and Ogden had entered the oak savannah of the southern part of Bear Creek. The mention of fish is the earliest reference to salmon in this watershed, and probably indicates their presence in local streams at that time.

Ogden continued on through the area of present-day Ashland and Talent, where his descriptions of the environment grew even more appreciative:

> "..we encamped on a large Fork form'd by a number of small Streams which we crossed in our travels this day... and in many of them not long since there were beaver...this is certainly a fine Country and probably no Climate in any Country equal to it...from the singing of Birds of all kinds, grass green and at its full growth Flowers in Blossom...at present it is certainly a country well adapted from its Soil and timber (Oaks and Pine) for cultivation. The natives inform us that Deer are abundant in the hills and Mountains...from their being all well clad in Leather I can well believe them....Arrow quivers made of Beaver Skins also their Caps...Racoons are certainly numerous in this Country...The croaking of Frogs last night certainly surprised me...field mice are numerous all over the Plains.

He later described the Rogue River below the confluence of Bear Creek as being "well-wooded with Poplar Aspine and Willows." (Pullen 1996:VI-2).

These statements, taken from various passages of Ogden's journal (LaLande 1984:59-64), describe a few warm days in February, and give a brief view of the landscape through which he passed. Beaver were abundant in the streams, which followed meandering courses through the valley, hosting numerous frogs and providing good habitat for birds and raccoons. Oak and pine dotted the landscape, with lush native grasses carpeting the hills and valley. Field mice attest to an open, lightly wooded environment (LaLande 1984:64), and deer were plentiful in the hills.

Many others would follow in Ogden's footsteps over the next few decades (Dillon 1975). The trappers would deplete the beaver in the streams, following the Hudson's Bay Company policy of creating a "fur desert" to discourage competition from Americans; explorers and other travelers would also spread disease and engage in hostile actions with the local peoples. Some would also comment on the environmental conditions along the trail.

Lieutenant Emmons, a member of the U.S. Navy Exploring Expedition (the Wilkes Expedition) was one such commentator. Traveling south through the Rogue and Shasta valleys in late September and early October of 1841, he noted large prairies south of the Rogue River with deer, bear, camas roots, rabbits, antelope and coyotes, and a few frightened Indian women digging roots. He also noted an Indian woman setting fire to the prairie somewhere near today's Ashland (Dillon 1975:316), and complained frequently of the parched earth and smokey air. He noted ridges burning on the Rogue-Klamath divide to the south, and the barren plains of the Shasta valley to the south, blackened by recent grass fires (Dillon 1975:320).

Titian Ramsey Peale, another early explorer, described the area around 1841. After leaving the Rogue River near the mouth of Bear Creek and heading south, he described the landscape as "a rolling prairie which is bounded by low hills, resembling the scenery of the Willamette Valley." (Pullen 1996:VI-5)

In 1846, Lindsay Applegate, who was on an expedition to open a new road to the Willamette Valley, described the same area, when he wrote, "it seemed like a great meadow, interspersed with groves of oaks which appeared like vast orchards." (Pullen 1996:VI-5)

The floor of the Rogue Valley at the time of white contact appears to have been largely grassland with widely dispersed groves of oaks and pines, and with brush-filled ravines in some areas. Oaks and pines would have been fairly abundant in moist areas, and almost absent in dry places with a southern exposure. This pattern was most likely the result of annual burning of the valley floor by Indians procuring tarweed and insects (Pullen 1996:VI-6).

These early travelers, of whom Ogden and Peale were but a few, came through the watershed analysis area on their way to other places. None, before the discovery of gold in the early 1850s, came to stay. Yet these people brought a new way of interacting with the land, and their actions affected the landscapes through which they passed.

All of the travelers lived off the land as they passed through. Trappers also removed many beaver, with the intent of hunting them to extinction. Removal of these animals may have affected the watercourses within which they lived, as beaver dams decayed and stream courses became channelized.

Perhaps more importantly, these early travelers spread disease and pillaged the resources of the native peoples through whose lands they passed. The resulting ill-will culminated in a series of brutal battles during the period of pioneer settlement in the 1850s, known as the Rogue River Indian Wars. At the end of the wars in 1856, surviving native people from the Rogue Valley were removed to distant reservations, and the way of life of those Shasta left in the Shasta Valley was radically changed. The carefully maintained prairies, meadows, and woodlands of the native landscape began to disappear.

**Early Historic Period (1850 - 1900)**
All or portions of 5 major cities are within the watershed analysis area: Talent, Phoenix, Medford, Central Point, Jacksonville. The development of these cities and towns has affected land use in the analysis area. In addition, the change in the pre-eminence of resources is reflected in the change in population and political clout of these cities.

Before 1850 very few people had settled in the Rogue Valley. The Donation Land Claim of 1850 and the discovery of gold in 1851/1852 contributed to the settlement and development of the area.

The discovery of gold on Jackson Creek near the present day town of Jacksonville brought an overwhelming number of men to the area. By April 1851 there were a 1000 men seeking their fortune and the town of Jacksonville grew up overnight in response to this influx of men and their money. Jacksonville soon became the population center and county seat of the newly created Jackson County. Jacksonville remained the county seat for 43 years.

Besides increasing the population within the watershed analysis area, mining also had a tremendous impact on the resources and the landscape. The majority of the mines within the watershed analysis area were gold placer mines. The amount of water available is a prime factor in determining methods of mining and the length of the annual operating season for these mines (Brooks and Ramp 1968:36). The simplest methods of mining are the miner's pan, the sluice box, and the rocker and cradle (Brooks and Ramp 1968:36). "The common method used by solitary prospectors involved panning the gold from the gravels using water from the river. A slightly more advanced system used rockers, cradles, and long toms. Gravels were shoveled into a wooden box, buckets of water were added, and the box was shaken to release the gold. The 'shoveling-in' and transport of water required considerable effort and much of the fine gold was lost. The invention of the sluice was a great energy saver. Gravels were shoveled into the sluice boxes, a stream of water was diverted from the river into the sluice, and the gold was collected in riffles located in the bottom of the sluice box" (Rinehart 1962 quoted in Budy 2001:36).

The great advantage of the sluice was in the manipulation of water. Instead of hauling buckets, water was diverted to the sluice where the gravels were washed. Furthermore, more of the fine gold could be recovered by coating the riffles in the bottom of the sluice with mercury (quicksilver) which served to amalgamate for higher recovery. (Budy 2001:36)

None of these early methods required much investment, and the nearby forests provided wood needed for sluices and troughs to divert the water, as well as simple shelters and cabins. For simple sluicing methods, water to wash the gravels was diverted directly from the river via wooden troughs. Often, these were built directly along the river bank and required only sufficient slope to keep the water moving. Even using such simple methods, two or three men often worked together on a claim. (Budy 2001:39)

The majority of the mining operations took place during the winter and spring months when there was water in the creeks. Chronic water shortages occurred in the summer months. In 1854, government deputy field surveyor George Hyde came to Jackson County. Surveyor Hyde, while working in Township 37, Range 1W wrote that with the exception of Steward (Bear) Creek, all the streams dried up in the summer (Atwood 1993:29). Another early writer commented that "In the winter of 1858-1859, miners prepared to work diggings near Willow Springs" (Gilmore 1952:83). This same author also comments that "The miners on Jackson creek near the end of March (1859), had finished sluicing and were busily engaged in washing out the gold; . . . Success continued as late as June, at least in the areas where water was available, and good wages were made on the flats adjoining the various creeks in the Rogue Valley" (Gilmore 1952:83-84).

During the early days of mining in the Ashland area, placers operated on Bear and Anderson Creeks; on Wagner Creek and its tributaries, Yankee Gulch, Arrastra Creek and Horn Gulch (Brooks and Ramp 1968:271). By the summer of 1861 all the surface placers and creek beds had been worked extensively. Now miners had to dig deeper and employ new and more expensive methods of securing gold (Gilmore 1952:93-94).

Hydraulic mining technology began in California in the 1850s and spread rapidly to the miners in Oregon (LaLande 1985:31 in Budy 2001:39). Hydraulic mining necessitates significant investment in the development of necessary water supply systems as this technology required a steady stream of water and sufficient volume to develop pressure. The system involved diverting water from a source located above the placer deposits and confining it in progressively smaller pipe to a control point where it produced a powerful spray. The earliest methods used a flexible hose fitted to a nozzle that could be directed to the gravels to be pressure washed (Evans 1883). An improvement was the monitor, invented around 1865, which could generate much higher pressure and was employed by industrial hydraulic operations beginning in the 1870s (Budy 2001:39). By 1857, hydraulic mining was being developed in the Jacksonville area (Gilmore 1952:79).

The Forty-nine diggings group, near Phoenix, operated regularly for a few months during the wet season from about 1860 to about 1900 (Brooks and Ramp 1968:271). In 1872 or 1873 the remains of an elephant were found buried 8 to 13 feet below the surface (Diller 1914:91). Hydraulic mining was employed at this mine (Diller 1914:93).

In addition to the placer mines there were a number of gold lode mines. Other minerals besides gold were also mined in the area. There were many mines operating in the Wagner Creek watershed: the Black Diamond mine on Arrastra Creek (quartz lode), the Shorty Hope mine on Wagner Creek (gold, ultimately producing over $30,000 worth), the Skyline mine on Horn Glen (gold and tungsten), the Double Jack on Arrastra Creek, the Bratcher Mine above and east of Wagner Creek (gold), the Burdic, Ruth, and Little Pittsburg mine (called the "Burdic group" and yielding gold) all situated on Wagner Creek (Cohen et. al. 1999:6).

Another famous lode mine, the Ashland Mine, is located just outside the watershed analysis area. However, some of the tunnels and shafts associated with this mine are located in the watershed analysis area. Discovered on July 12, 1886 by J. Israel and William S. Patton, this mine was in operation from 1886 to WWII (Smith 1960:3).

The Donation Land Claim of 1850 allowed white settlers in Oregon after December 1, 1850 to claim 160 acres of land if they were white male citizens; a married couple could claim 320 acres (Schwantes 1989:121). Recipients were required to reside on and cultivate the land for four consecutive years in order to ensure a patent from the government for their claim (Gilmore

1952:302). Besides farmers, many miners took up land claims in conjunction with their mining activities, to have land to return to if their mining pursuits failed (Gilmore 1952:307).

There were a number of direct impacts from this law. First, it encouraged long term residents rather than migrants. Secondly, as the law required cultivation of the land, there was an immediate and radical change in land use.

In addition, the donation land act ignored the claims of the Native Americans to the land. John Beeson, who settled at the confluence of Bear Creek and Wagner Creek (Pullen 1996:VI-3), complained that his fellow settlers had taken all of the bottom land, from which the Indians had been accustomed to derive a large amount of their subsistence, in seeds, roots, and berries (Pullen 1996:IV-16). The Donation Land Claims were supposed to be square or oblong in shape. This requirement superimposed a recognizable pattern on the landscape (Schwantes 1989:121). These claims also brought fences, which not only delineated the borders of the various claims, but also prevented the Native Americans from accessing their traditional food sources. Both Phoenix and Talent, two of the towns in the watershed analysis area, resulted from donation land claims.

Some of these early settlers of the Donation Land Claims described the vegetation in the area that they settled. S. H. Taylor, an early settler along Bear Creak, wrote in 1853 that "the poplar and poorer species of elm flourish along streams." (Taylor, 1921, OHQ). John Beeson, who settled at the confluence of Bear Creek and Wagner Creek in 1853, also wrote about the thick brush that fringed the creek (Beeson 1857 quoted in Pullen 1996:VI-3). In 1853, E. Steele described pursuing an Indian band along Bear Creek and having "an open plain to cross before passing into a thicket (Steele 1873 quoted in Pullen 1996:VI-5)."

Because of the clash of cultures and lifestyles, the U. S. Military was brought into the area. Several structures associated with the military are located within or immediately adjacent to the watershed analysis area. Many of the first homes in the area were used as temporary forts. To transform a home into a fort, a deep trench was dug around the entire area and logs stood on end in the trench with fourteen feet rising into the air. Dirt was shoveled into the trench so that the walls were solid. The logs were about two feet thick, and holes were cut into them to shoot through (Birdseye 1984:32). In 1862 Camp Baker was established half a mile west of Phoenix and used as late as 1865. At its maximum Camp Baker consisted of 24 log buildings (Tucker 1930:141). Coleman Creek ran between the mess hall and the stables. Fort Lane lies just outside the analysis area.

*Transportation and Communication*

Most of the main routes through the area have a long history, and all were well established by the end of the nineteenth century (Fagan 1994; LaLande 1980; Klamath National Forest map archives). Early constructed roads were usually built on the flatter ground along streams and rivers where construction was easier and access more important for homesteading, ranching, and mining. The Applegate Trail used from 1846 to 1868 follows the route of Highway 99 and then turns west to follow Old Stage Road. Early travelers on this road passed through the analysis area on their way to settle in the Willamette Valley.

Until 1853 no recognized roads existed within the limits of Jackson county. The first roads were established by the county court in 1853, between Jacksonville and Applegate, California, and

Douglas County (Tucker 1931:154). By 1860 there were wagon roads into the Rogue Valley from northern California, from the Umpqua Valley, and from the coastal seaport of Crescent City (Gilmore 1952:234).

The north/south railroad connecting the Rogue valley to other major urban centers was completed in 1887. This development brought a huge boost to the region's economy, providing access to markets for timber, cattle, and agricultural produce (Jones 1980:247-251). The railroad followed the easy route offered by Bear Creek, bypassing the town of Jacksonville. Even the construction of the Rogue River Valley Line linking Medford and Jacksonville was not sufficient to maintain the economy of Jacksonville.

The town of Medford came about as a result of the railroad. Passenger service to Medford started in February 1884 (Richardson 1993:44). Communication developments were also critical. Local newspapers and regional road networks all appeared during this period, as did the telegraph in the 1880s. Telephone service was inaugurated in 1896 (Tucker 1931:159). As part of the process of incorporating the landscape into the new society, the federal government sent surveyors to map and record the newly acquired lands. These maps provide some brief descriptions of the land at the beginning of significant Euro-American use, and after the demise of the native way of life.

*Agriculture*

During the 1850s and into the 1860s, the market for the Rogue River valley farmers was strictly limited to local consumption; only a limited amount of goods were transported over hard, difficult transportation routes. One of the early commercial crops was wheat. With the coming of the railroad which provided outside markets, fruit orchards became a more important agricultural commodity (Gilmore 1952:323-324). The first commercial orchard (peach, prune and apple) was planted in 1883, and the first commercial nursery started in 1892 (Tucker 1931:167). Agriculture also demands water. Just as the miners built ditches to transport water, the farmers built irrigation ditches to water the crops. Jacob Wagner settled on Wagner creek in 1852 and obtained what is now the oldest water right in the state of Oregon. Jacob Wagner built the first irrigation ditch in Talent at the mouth of Wagner Creek (Cohen et. al. 1999:8).

In the 1870s the growth of the orchard industry in the Rogue Valley had several significant impacts on the valley (LaLande 1980). Major irrigation works expanded, although this expansion did not affect the analysis area until the twentieth century. The orchard boom also led to a high demand for wood for fruit crates, fueling the growing timber industry in the region. Both the orchard and logging industries increased the demand for beef, with local ranchers provisioning loggers in the region (Hessig 1978).

*Timber*

Logging in the analysis area was a minor enterprise from 1850 through the 1880s, spurred by the local needs of miners and settlers. In the first days of settlement (1852) water-powered sawmills were practically the only form of power driven industrial machinery within the county (Tucker 1931:157). Logging took place mainly at lower elevations. Sugar pine was a major target, and milling was done at small, local mills (LaLande 1980:135). Development of the railroad in the 1880s increased access to markets and timberlands.

*Hunting and Recreation*
Throughout the nineteenth century intensive hunting and trapping continued in the analysis area. There was an active market for deer hides and pelts (beaver and other types) (LaLande 1980:132; Hessig 1978:22). Hunting for sport continued, and ranchers sought to eliminate predators, especially cougars and grizzly bears, dangerous to their stock.

*Effects Upon the Land*
By the turn of the 20th century, the new way of life introduced by Euro-American settlers was well entrenched and had brought significant changes to the land. The native peoples had been removed, and the caretaking philosophy that motivated their interactions with the landscape was also gone. Interestingly, the changes brought by the new way of life were not specifically linked to major changes in population; there were probably about as many people actually living within the analysis area before and after the shift from a native to a Euro-American way of life. The major changes were due in part to radical differences in economy and technology. These differences were reflected in early development of infrastructure--roads and communication networks--which facilitated a market economy and the ranching, logging, and agricultural industries which depended upon it.

The Euro-American way of life brought rapid change to certain elements of the local environment. Major predators were hunted down or removed, as were major game animals. The absence of native burning began to change the character of the vegetation, especially of the meadows, prairies and grasslands, and oak and pine woodlands. Grazing, especially the unregulated grazing of the nineteenth century, affected native bunchgrasses. Ranchers burned to promote forage for their stock, but their burning was less discriminate than that of their native predecessors, and often escaped into major fires in the timberlands. Logging began to deplete accessible timber reserves, especially sugar pine (LaLande 1980). Agriculture introduced new species to the land, and roads and trails increased traffic of all kinds throughout the area.

**Early Twentieth Century (c. 1900 - World War II)**
Medford was incorporated as a town in 1885 and as a city in 1905. By 1906 Medford was the commercial center of the Valley (Tucker 1931:144). In 1927 Medford became the county seat ending the 43 year reign of Jacksonville as the county seat. This change in county seat reflects the change in importance of resources and resulting population centers.

Another important development was the introduction of electricity to the area. The local rivers were used to generate electricity. Gold Ray Dam on Rogue River provided electricity for the watershed analysis area. In 1904 power lines were extended from Gold Ray to Medford and Jacksonville was connected in January 1905 (Tucker 1931:158).

*Transportation*
As late as 1910, the outlying roads of the county were not in good condition (Tucker 1931:156). In 1913, the western Better Roads Movement initiated construction of the Pacific Highway over the Siskiyous (Atwood 1995:7). With the advent of the auto in the early twentieth century, the route was improved again as Highway 99.

Highway 99 basically follows Bear Creek through the watershed analysis area. Historically, Bear Creek's course was extremely variable and over time the stream had migrated over large portions of the valley (Olmo and Hannon 1989:12). The Oregon State Highway Department relocated Bear Creek's channel so that Highway 99 could have fewer bridges (Olmo and Hannon 1989:13-14). A further improvement in roads came about as a result of the automobile and the desire of people to travel year round. In 1913 and 1914 the Pacific Highway from Central Point to Phoenix became the first paved highway in the state. By 1931 the full extent of the Pacific Highway was paved (Tucker 1931:156).

*Ranching, Agriculture, Timber*
Agricultural activities continued to play a significant role in the region, as indicated by the development of major irrigation networks. The Talent Irrigation District (TID) was formed in 1916. TID has had a water right on Wagner Creek since 1909 (Cohen et. al. 1999:8) and TID reservoirs were built in the 1920s (Cohen et. al. 1999:8). Ranching was primarily affected by the development of government regulations, instituted in response to the excesses of the late 19th century and the continuous conflict among range users (Brown n.d.:41; LaLande 1980:140).

By 1905 the orchard boom was increasing demands for water. The Medford Irrigation District was founded in the 1920s (Noah 1993:70). Orchards changed the development of the valley by bringing unprecedented growth to Medford (Noah 1993:70).

In February 1922, radio broadcasting station, KFAY, was established in Medford (Tucker 1931:161). The economy was so focused on the orchards that a historian in the 1930s saw greatest economic benefit of the radio station as the transmission of weather reports for the benefit of the orchardists (Tucker 1931:163).

Between 1920 and 1940, business interests shifted from orchards to lumber, and by the end of WWII, Medford had 76 sawmills running.

*New Players in the Watersheds*
The early decades of this century also witnessed the arrival of another significant force to the region: the federal government, in the form of land management agencies.

Partly in response to growing national concern over environmental degradation caused by land use practices of the nineteenth century, and partly out of concern over the loss of economic resources, the federal government instituted a system of federal reserves around the turn of the twentieth century. In Oregon, the Cascade Forest Reserve stretched almost to the California border, encompassing lands within the analysis area. These lands soon became part of the Crater National Forest, precursor to the Rogue River National Forest. Eventually, management of the lands within the analysis area came under BLM's jurisdiction. In the early part of the century, the failure of the O & C Railroad to comply with terms and conditions of their land grant resulted in the return of unsold sections of their land to the government. Most of the BLM-managed lands within the analysis area returned to government management through this process.

Government management in the early days emphasized the regulation of hunting and grazing, and regeneration of the range. Fire suppression and timber management were also high priority issues. Fire suppression especially became a priority, particularly for the Forest Service, with long-term consequences to the land. The Forest Service perspective on fire suppression is documented in the following quotes from a 1936 Klamath National Forest brochure:

> "The fire-protection policy of the Forest Service seeks to prevent fires from starting and to suppress quickly those that may start. This established policy is criticized by those who hold that the deliberate and repeated burning of forest lands offers the best method of protecting those lands from the devastation of summer fires. Because prior to the inauguration of systematic protection California timberlands were repeatedly burned over without the complete destruction of the forest, many people have reached the untenable conclusion that the methods of Indian days are the best that can be devised for the present...
>
> The stock argument of those who advocate the 'light burning' of forests is that fire exclusion ultimately leads to the building up of supplies of inflammable material to such an extent that the uncontrollable and completely destroying fire is certain to occur. The experience of the Forest Service in California, after 15 years or more of fire fighting, does not lead to any such conclusion...
>
> Fire exclusion is the only practical principle on which our forests can be handled, if we are to protect what we have and to insure new and more fully stocked forests for the future.."

*Effects Upon the Land*
Land use practices in the first half of this century continued to foster changes begun in the nineteenth century, although government regulations served to improve some situations. Hunting regulations led to some regeneration of game species, and grazing regulations assisted in slowing the degeneration of the range and in regenerating some lands. However, native grasslands and meadows continued to be transformed. Among the factors affecting this transformation was the introduction of invasive weeds. Fire suppression policies began to affect the composition of local forests and to further the demise of the more fire resistant oak and pine woodlands. Water and fish resources were affected by the development of major irrigation and hydroelectric facilities.

**Late 20th Century**
During the second half of the twentieth century, developments in transportation and logging technology, as well as increased demand and substantial increases in prices (from $2.00 to $22.50/thousand board feet in 1951; Lawrence 1972:23) made logging possible and profitable throughout the analysis area.

World War II spurred the economy and the lumber business worked at full production after 1942. During the labor shortage of WWII, Mexican workers were recruited to harvest valley crops. Phoenix became the major center for the Hispanic population (O'Hara 1993:147).

The need for water for agricultural purposes continued to grow. To help meet this demand, the Talent Project was constructed in 1959. The Talent Project was a system of networking irrigation canals which would supply irrigation water to the majority of the Bear Creek Basin (Cohen et. al. 1999:8).

Demand for recreation grew as local populations and visitors increased, stimulated in part by access made easy by more roads. Interstate 5 opened to traffic in 1966 and follows an ancient trail used by the Native Americans and early explorers to cross the Siskiyous and travel through the Bear Creek valley (Dillon 1975). Federal land use priorities are reflected in the land use policies of the government, which continues to manage significant portions of the analysis area.

## EROSION PROCESSES

Prehistoric erosion rates were much higher than present-day erosion rates. To the south, the Condrey Mountain dome (Klamath/Applegate River divide) lost 23,000 feet in elevation due to erosion during the previous 14 million years. To the north, the area around Table Rocks has eroded several thousand feet over the previous 9 million years (Orr 1992). Erosion processes that affected both of these areas were similar to erosion processes in the analysis area and have continued for several million years.

Historic erosion processes were predominately surface and channel erosion. Types of surface erosion included sheet, ravel and minor gully erosion. A large volume of sediment was likely transported to area streams via sheet erosion and raveling of materials over long periods of time. Steep and incised mountainous sideslopes and areas with Tallowbox soils (Map 8) were the most erodible terrain of the analysis area.

Historically, wildfires and floods were the main natural agents that affected rates of erosion by removing extensive soil cover. Throughout the late nineteenth and early twentieth centuries, large wildfires occurred periodically in the analysis area (see Human Uses). Large wildfires were likely detrimental to water quality and fisheries as they removed ground cover and exposed soil to subsequent surface erosion. The highest erosion rates would have occurred when an intense storm event immediately followed severe wildfires on erosive soils. Due to fire suppression over the past 70 years, topsoil loss has been reduced as fewer natural fires have exposed soils.

Stream channels can downcut during high-flow flood events and form highly incised stream channels. Streambank failures adjacent to steep slopes were likely common. Active channel erosion was also a common feature during past large floods and resulted in increased sedimentation.

Native Americans had little impact on erosional processes. Though fires were used to maintain oak groves and increase visibility around hunting and living areas, these controlled burns were of low intensity. During the latter half of the 1800s miners set fires with the intent of consuming all vegetation, so as to more easily find gold bearing strata. Compared to the fires set by Native Americans, these were of higher intensity and led to accelerated erosion (Bonnicksen 2000).

## SOIL PRODUCTIVITY

In areas with minimal human disturbance, historic soil productivity conditions were much the same as they are today. Nutrient availability may have increased in some areas due to the unnaturally thick duff and litter layers resulting from fire prevention. Productivity in the analysis area varies by elevation, aspect, topography, and bedrock.

Tallowbox and Caris-Offenbacher soils are found along ridges and upper slopes. These soils are shallow and rocky. Site productivity, though good, is lower than on midslopes where Shefflein and Vannoy soils are found (Table 31). Midslope soils are older and more developed.

**Table 42. Soil Productivity as Shown by the Height of a 100-year old Douglas-fir**

| Soil Type | Slope Position | North-facing slopes | South-facing slopes |
|---|---|---|---|
| **Tallowbox** | Upper slopes and ridges | 100 feet tall | 90 feet tall |
| **Caris-Offenbacher** | Upper slopes and ridges | 110 feet tall | 100 feet tall |
| **Shefflein** | Mid-slopes | 115 feet tall | 100 feet tall |
| **Vannoy** | Mid-slopes | 110 feet tall | 105 feet tall |

The primary reason for the lower productivity of ridge-top soils is the natural lack of adequate soil moisture and soil development, especially the development of very thick topsoil. Drying winds and exposure to extreme cold temperatures is another reason for the low site productivity. The lack of thick soils is due to the steepness of the slope that these soils are found on, resulting in erosion of soils before soils are truly developed; Caris-Offenbacher soils have a maximum slope angle of 80 percent, whereas on the more erosive Tallowbox soils, it is only 70 percent.

## LANDSCAPE VEGETATION PATTERN

The vegetation native to the West Bear Creek Watershed Analysis Area is a result of time and the unique geology of the area. Over the last 60 million years, vegetation has migrated into this area from six different directions: the Oregon and California coast ranges via the Siskiyou Mountains (red alder, Pacific madrone and bigleaf maple); the Sierras and Cascades (baneberry, sugar pine, manzanita spp. and California black oak); the Klamath River corridor, and lowland chaparral area (mountain mahogany) (Atzet 1994).

Natural change in landscape pattern is inherent; natural succession is continuously changing the vegetation and there is no single stage of a forest that can be considered to be the only natural stage. Leiberg (1900) wrote that prior to 1855, the Native Americans were responsible for frequent, small circumscribed fires which resulted in forest stands with diverse age classes. Leiberg also notes that T.39S., R.1W. burned and was logged throughout.

After Euro-Americans arrived, the forest stands became more open (fewer vegetation stems on a unit of size basis) and the forest patch size decreased because of logging and the more frequent use of fire for various reasons. Because of the frequent disturbance, there was more vegetation in the larger size classes. Mature and old-growth fire resistant trees species, such as pine species, Douglas-fir, and incense-cedar with thick bark survived the fires.

Historic vegetation patterns are difficult to confirm because only government lands were mapped. According to the 1958 forest type maps created by the BLM (USDI 1958), the forests within the analysis area were predominantly composed of Douglas-fir, pine and hardwood mixtures. The historic vegetation matrix was forest lands in the uplands, but with forests in a more open condition with a small, individual stand size. The northern half was composed of more mixed stands of hardwoods and conifers with scattered large diameter Douglas-fir and ponderosa pine. Most of these forests stands were under 100 years of age. Only small sized stands of Douglas-fir were older. The grasslands and shrublands were slightly larger in size.

Moving south the number of hardwoods decreased and the conifer stands increased in size. The number of conifer trees per acre also increased with gains in elevation. Again most of the stands were less than 100 years of age, with only a few being older.

Fire and logging were the primary processes influencing the vegetation landscape pattern. Wind damage may have been a factor in the open forests during the winter months when soils became saturated. Bark beetles and pathogens were probably least noticeable because of the lower tree stocking levels and the diversity of species making up the forest stands.

## PLANT SPECIES AND HABITATS

**Introduced Plant Species and Noxious Weeds**
Prior to exploration and settlement by Euro-Americans, introduced plants would have had little opportunity to arrive in this area. The concept of noxious weeds did not exist at this time. Natural processes that facilitate long distance seed transport include wind, water, and birds.

In 1841, the United States Exploring Expedition passed along the bottom edge of the analysis area and explored the area for four days. One of the duties of this party was to collect representatives of all plant species. The Expedition traversed through riparian, oak woodland, shrubland, and savannah habitats of the analysis area. Presently, these habitats bear the heaviest infestations of introduced plants and noxious weeds. The lack of collection of any introduced plants in the analysis area demonstrates the healthy and natural condition of the ecosystem at that time.

Conifer forest habitat was traversed in nearby watersheds and presumably explored while the party was in the area. Of the published list of plants collected, none of the nonnative plants were specific to the analysis area. The collection notes for one nonnative plant, *Erodium cicutarium* (redstem storksbill), state that this plant is "found throughout the interior of Oregon, common and apparently indigenous" (Wilkes 1862). While not specifically mentioned for this watershed, it is assumed to have occurred here. Most of the nonnative plants collected were associated with established forts and ports.

**Special Status and Survey and Manage Plant Species and Habitats**
The United States Exploring Expedition led by Lieutenant Charles Wilkes in 1841 was established for scientific purposes. This early scientific expedition included two botanists and several naturalists. These botanists collected specimens of vascular plants, fungi, mosses, algae, and lichens that were later identified by leading scientists specializing in these particular groups (Wilkes 1862; McKelvey 1956).

A review of the published species lists from 1841 showed none of the species currently on either the Special Status Species list or the Survey and Manage Species list. Specific population and distribution data for this time does not exist, but the data suggests that these species were uncommon prior to Euro-American settlement. Notably, *Cypripedium*s (orchids) were collected by Wilkes in Washington and northern California. *Cypripedium*s are some of our more widespread rare plants. Apparently, none were encountered in Oregon.

Besides the Wilkes expedition, the Hudson Bay Company party led by trapper Peter Skene Ogden in 1827, and the party that established the Applegate trail provided general descriptions of the landscape. It is generally recognized that plant communities in southern Oregon are fire maintained. These communities developed through naturally occurring summer lightning-caused fires and fires deliberately set by indigenous people usually in the late summer through autumn. The valley bottoms and foothills were covered with widely spaced, large California black oak with grasses and forbs beneath. Occasionally there would be savannahs or groves of large Ponderosa pine in these lowlands. Streams were bordered by brush, cottonwoods, and alders. The mountain forests were probably composed of large diameter, well-spaced trees.

**Special Areas with Botanical Resources**
*Holton Creek Research Natural Area*
The Holton Creek Research Natural Area (RNA) is relatively unchanged from its pre-Euro-American condition. The Euro-American caused changes to this RNA result from fire suppression. Under the historic fire pattern, it is expected that this forest would be an open grown, multi-storied stand with a patchy but generally open understory of small trees and shrubs.

## FOREST DENSITY AND VIGOR

Core samples from Douglas-fir and ponderosa pine between the ages of 91 and 167 years indicate that these present day, large diameter trees were free to grow when they first became established (USDI, BLM, 2000). This growth indicates low stocking levels or more open growing conditions. Sample trees grew 2 to 3 inches per decade in diameter and the diameter growth rate gradually decreased to 1.5 inches per decade over a period of 30 to 50 years. Few sample trees were suppressed at the time of establishment. Tree diameter growth has been below 1.5 inches per decade since 1950.

Historical information is somewhat misleading in regard to actual tree stocking levels early in the 1900s. Although forest mapping indicated that there were few large trees on a per acre basis, more trees were present in the understory. In places there were probably thousands of seedlings per acre, especially in the higher elevations. The 1958 USDI maps indicate that beneath the large diameter pine and Douglas-fir trees, there was a white fir (south part of analysis area), Douglas-fir, and hardwood understory.

As tree growth and vigor declined in the mid-1900s, bark beetles probably started to become an important factor in changing the height and size class structure of the forests. The western pine bark beetle caused mortality in the large diameter ponderosa pine, the true fir engraver beetle in patches of white fir, and the Douglas-fir bark beetle in suppressed Douglas-fir trees. Pathogens probably became more apparent as more even-aged stands became established and matured.

Forest stands are dynamic in nature and will continue to change in stocking levels and species composition over time.

## FIRE AND AIR QUALITY

The historical fire regime of the analysis area was characterized by frequent (1 to 25 years) and widespread fires resulting from the hot, dry summers. Accounts documented by early settlers of Oregon indicate that wildfires were common, widespread, and produced substantial amounts of smoke which impacted visibility and the health of local residents (Morris 1934). These periodic fires consumed understory and ground fuels thus leaving a large gap between the overstory and ground. This in turn reduced the probability of a crown fire. Typically, fire intensity was low because frequent fires limited the time for fuel accumulation. Consequently, the effects of individual fires on flora, fuels, and fauna were minor, creating a more stable ecosystem.

Fires maintained most valley bottomlands and foothills as grasslands or open savannas. Forests created from frequent, low intensity fires have been described as open and park-like, uneven-aged stands characterized by a mosaic of even-aged groups. Ponderosa pine, Douglas-fir, sugar pine, and white fir were the most common species. Depending on understory vegetation conditions, these species have some resistance to fire as mature trees. As saplings, ponderosa pine is the most resistant followed by sugar pine, Douglas-fir, and white fir. Frequent fires had major structural effects on young trees, favoring ponderosa pine as a dominant species and white fir as the least dominant in this forest type. Without fire, Douglas-fir and white fir became the dominant species because these species are more tolerant of understory competition than the pine species.

Wildfires were likely the primary emissions source that influenced air quality. During summer and early fall, ongoing wildfires, ignited by lightning, would flare up as weather conditions allowed causing intermittent smoke episodes throughout the region.

## TERRESTRIAL WILDLIFE SPECIES AND HABITATS

**Wildlife Overview**

Prior to Euro-American contact, Native Americans influenced habitat conditions in much of the analysis area by burning. The natives routinely burned areas to maintain conditions suitable for the plants and animals they relied on for their subsistence, including roots, tarweed, deer, and elk. The native burning maintained an early seral condition in the grasslands, shrublands, mountain meadows and probably some of the forested areas. Due to these habitat conditions, deer and other species preferring these early seral conditions were undoubtedly quite abundant.

Grizzly bear, gray wolf, and other large carnivores were probably found in limited numbers throughout the analysis area. Healthy populations of beaver were present in the low gradient portions of most rivers and streams in the analysis area. Beaver populations, however, were decimated in the early and mid-1800s by Euro-American trappers.

It is not feasible to discern the acreage and distribution of the various habitat types prior to the historic period, but some reasonable assumptions can be made. It seems likely that the conifer forest land base is approximately what it was prior to the historic (1850) period, but there was probably a greater proportion of old-growth forest. Oak-woodland habitat was more abundant and in better condition, e.g, better spacing, less mistletoe, etc. Grasslands were also more abundant and in better condition because introduced noxious species were not present. Early seral habitat in shrub communities was more abundant since shrubland was burned by native Americans.

Wildlife species currently present in the analysis area were probably present in the early to mid-1800s with the exception of introduced species such as starling, Virginia opossum, ring-necked pheasant, etc. Species that were present then but have been extirpated from the analysis area include pronghorn, grizzly bear, and gray wolf.

**Threatened/Endangered Species**
The northern spotted owl is present in the analysis area, and was undoubtedly present prior to the historic period. However, specific reference to this species could not be found in the literature. As discussed above, old-growth conifer forest, which is primary habitat for the spotted owl, was probably more abundant in the pre-historic period, and one can reasonably infer that spotted owls were probably also more abundant.

*Northern Spotted Owl Critical Habitat*
Obviously, spotted owl critical habitat per se did not exist in the early to mid-1800s. Reference conditions for northern spotted owl critical habitat, therefore, will be addressed on the basis for its designation in 1992. Critical habitat is designated under the auspices of the Endangered Species Act of 1973. Critical habitat in the analysis area was established to maintain an adequate distribution of nesting, roosting, and foraging habitat, and to improve connectivity between Critical Habitat Units in a region of high fragmentation (USDI, FWS 1994). The area now in critical habitat was probably predominantly older forest in the pre-historic period, and would have provided the various functions described above.

**Special Status Species**
Based on the habitat associations thought to be present in the analysis area in the early to mid-1800s, all currently designated special status species were likely present at that time (see Current Conditions, Terrestrial Wildlife Species and Habitats). Since many of the threats associated with their current status were generally of no consequence prior to Euro-American presence, populations of the various species were probably greater and more stable.

**Survey and Manage Species and Protection Buffer Species**
As with the special status species, it can be assumed that the survey and manage species known or believed to be present in the analysis area (see Current Conditions, Terrestrial Wildlife Species and Habitats) were present in the analysis area when Euro-Americans arrived. All of these species seem to be positively associated with mature/old-growth conifer forest. Because there was a greater abundance of old-growth conifer forest and other threats to the species were minimal, populations were probably greater and more stable than today.

## HYDROLOGY

Prior to the introduction of water withdrawals for irrigation and mining in the analysis area, summer streamflows were directly related to the amount and timing of precipitation events. Years of high rainfall and large spring snow packs (primarily at higher elevations of Wagner Creek) resulted in summer flows that provided adequate water supplies for aquatic dependent species. Drought years produced low flows and many streams dried up in the summer.

Historic low flows in the analysis area were associated with years of low precipitation. Drought conditions for southwestern Oregon were noted in 1841, 1864, 1869-1874, 1882-1885, 1889, 1892, 1902, 1905, 1910, 1914-1917, 1928-1935, 1946-1947, 1949, 1959, 1967-1968, 1985-1988, 1990-1992, and 1994 (LaLande 1995; NOAA 1996). Irrigation withdrawals that began in the 1850s and became more extensive by the early 1900s greatly reduced summer streamflows throughout the analysis area. The transfer of water from the Little Applegate River to Wagner Creek via the McDonald ditch greatly increased the summer water available for irrigation out of Wagner Creek.

Historically, major flood events were generally the result of rain-on-snow events. The most severe floods in southwestern Oregon took place in 1853, 1858, 1861, 1890, 1927, 1948, 1955, 1964, 1974 (Gilmore 1952:318, LaLande 1995), and 1997. The extreme flow recorded at the Bear Creek gaging station in Medford occurred on January 1, 1997 (USGS 1999). A flood event occurred in Jackson Creek during the winter after the September 1955 Timber Mountain wildfire burned approximately 2,500 acres in the upper Jackson Creek analysis subwatershed (RVCOG 2001:4, 44). The flood caused great damage to the Jacksonville water system located in Jackson Creek. The 1997 flood caused a channel change in the lower reaches of Wagner Creek; the first channel change resulting from a flood since the county started keeping records in 1912 (RVCOG 1999:8).

Prior to the advent of Euro-American settlers, extensive wildfires were the primary upland disturbance capable of creating large openings in the rain-on-snow zone. Starting in the late 1800s, land development and timber harvest became major factors affecting vegetation removal in the rain-on-snow zone. These disturbances could potentially have affected the frequency and magnitude of peak flows resulting from rain-on-snow events.

Surface disturbances such as land development and road construction that began after Euro-American settlement in the mid 1800s disrupted the hydrologic network and affected the timing, magnitude, and frequency of peak flows.

The extent of grazing in the analysis area is unknown, although it is likely that cattle grazing occurred at the lower elevations in the late 1800s and early 1900s. Heavy grazing could have resulted in soil compaction and decreased infiltration.

## STREAM CHANNEL

Prior to Euro-American influences, the West Bear Creek Watershed Analysis Area consisted of free flowing streams that experienced normal events of flooding and drought. Bedload materials originating from upper reaches moved downstream, or were deposited on the floodplain. The streams probably had adequate amounts of large woody material to provide channel structure and dissipate the energy of peak flows. The lower reaches of the streams contained woody material washed downstream from the headwaters. Additional woody material was contributed by streamside woodlands. The lower reaches of the streams probably had greater sinuosities, side channels, and lower width/depth ratios, than what is seen today. Floodplain and meander widths were likely somewhat wider than they are today and streams easily accessed their floodplains. Beavers occupied these streams and built dams that added woody material to systems. The woody material trapped and stored fine sediments, and reduced water velocities.

The arrival of Euro-Americans in the mid 1800s brought significant impacts to the streams that influenced the shape of the stream channels. Fur trapping began in the 1830s, substantially decreased the beaver population. The associated loss of beaver dams resulted in scouring of channel beds and banks and increased width/depth ratios.

Mining began in 1851 with the discovery of gold in Jackson Creek and soon mining had a major influence on stream channels in the analysis area. Within the watershed analysis area, placer mines were operating on Jackson Creek, Anderson Creek, and on Wagner Creek and its tributaries. Mining scoured out channel beds and banks, redeposited gravels outside of the streambed, and released large amounts of sediment into the stream. Streams were straightened and channelized, stream elevations dropped as banks were scoured out, and pools filled in with sediment.

Logging and land clearing for agricultural use resulted in the removal of large woody material from stream channels in addition to removal of streamside trees. This depleted the existing large wood and sources for future large wood recruitment. Floods became more destructive without sufficient instream structure to slow the high stream energy. As more streambank erosion occurred and as the streams downcut, the channels became entrenched.

As the watershed analysis area became more populated, roads were built and some streams were channelized or straightened to facilitate road construction. These channel-confining actions restricted the natural tendency of streams to move laterally. Channelization of some reaches occurred to prevent the loss of agricultural lands to flood damage. Low gradient streams in valley bottoms became entrenched and were not able to access the adjacent floodplain except during major peak flow events. Channel width/depth ratios increased and sinuosities were lowered as stream gradients increased. Stream velocity decreased along with a decrease in bedload transport capability which lead to increased sediment deposition.

## WATER QUALITY

Generally, water quality in the West Bear Creek Watershed Analysis Area was probably very good prior to Euro-American settlement: low summer water temperatures, acceptable chemical and biological parameters, and low sediment/turbidity levels. This was due to the wide, diverse riparian zones, low width/depth ratios, greater summer flows, and low sediment input. However, the historic range of natural variability included drought periods that adversely affected stream temperatures and other water quality parameters, major storm events that resulted in increased sediment being transported to streams, and major floods that caused increased erosion from channel cutting. Higher fire frequencies prior to fire suppression may have resulted in periodic episodes of sparse riparian vegetation along some stream reaches and subsequent higher stream temperatures until the riparian vegetation became established.

Land clearing activities, starting with mining in the 1850s and then agricultural development in the late 1800s, resulted in a reduction of riparian vegetation allowing more solar radiation to reach the streams. Increased water temperatures were likely a result of these activities. Intense streamside livestock grazing during the turn of the century may have contributed to a loss in vegetative cover and subsequent heating of the streams. Irrigation withdrawals during this same time period lowered streamflows and contributed to increased stream temperatures. Logging in the mid-1900s contributed to increased water temperatures as trees within the riparian zones were harvested. Logging also resulted in less large woody material in the stream channels. Road construction adjacent to streams resulted in reduced riparian vegetation and channelization. Loss of large wood, stream channelization, and channel alterations associated with hydraulic mining and dredging resulted in greater width/depth ratios. Wide, shallow streams tend to have higher stream temperatures.

Ground-disturbing activities such as hydraulic mining, dredging, road building, quarry development, logging, land clearing, water diversion ditch construction, agriculture, and unmanaged livestock grazing contributed sediment to streams. Large volumes of sediment were washed down many of the creeks as a result of hydraulic mining (RVCOG 2001:5). Sediment and turbidity levels increased substantially after extensive logging and associated road building occurred, especially on steep slopes.

Unmanaged livestock concentrations adjacent to and in streams likely resulted in increased fecal coliform levels. Streams and tributaries were often used by area residents as dumping sites and conveyances for sewage in the late 1800s and early 1900s.

## RIPARIAN AREAS

Historically, the lower reaches of streams in the analysis area meandered through grasslands with widely dispersed groves of oaks and pines before meeting up with Bear Creek. Dryer, east facing ravines were filled with brush. In the riparian corridors, oaks, pines, and cottonwood would have been fairly abundant, with willows and alders as dominant shrubs. This landscape was most likely the result of annual burning in the valley by native Americans (LaLande and Pullen 1999).

The forests of the higher elevations were composed of small patches of large diameter Douglas-fir, pine, and white fir. The species composition of the riparian vegetation in these upper corridors was presumably similar to what is seen today except the stream corridors had conifers in older age groups and the corridors were wider and generally continuous. Large wood, which adds structure to the stream and is important for fish habitat (see aquatics section) would have been readily available. Riparian corridors were host to numerous frogs, birds, raccoons, and beaver (Pullen 1996:VI-6).

The arrival of Euro-Americans in the mid 1800s brought significant impacts to the riparian corridors. Fur trapping began in the 1830s to 1840s and resulted in a substantial decrease in the beaver population. Mining began in 1851 with the discovery of gold in Jackson Creek. Dredging and hydraulic mining denuded the riparian vegetation. Nearby trees were also removed to build mining equipment and cabins.

Logging began in the early 1900s, peaking in the 1940s, and many of the readily available conifers within the riparian zone were harvested. This depleted any remaining large wood and therefore sources for future large wood recruitment.

As the watershed analysis area became more populated, roads and clearing for agriculture reduced riparian width. Livestock grazing along streams probably further reduced riparian vegetation. Non-native weeds were introduced through land use practices in the first half of this century. This included the introduction of Himalayan blackberries, a highly invasive species that does not provide shade, dissipate energy during high flow events, or enhance flood-water retention and ground-water recharge the way native species did in the past.

## AQUATIC WILDLIFE SPECIES AND HABITATS

Before Euro-American settlement, fish habitat was optimal. Well shaded and diverse riparian zones kept water temperatures low. Streams were not channelized and could meander, providing both slow water for rest and rearing, and fast water for food production. Sediment input was low, so clean spawning gravels were maintained. Surrounding forests provided large wood necessary for creating pools and adding structure to the streams.

Wagner Creek, Anderson Creek, Coleman Creek, Griffin Creek, Jackson Creek, and Willow Creek supported large runs of summer steelhead. Valley reaches of these streams probably also supported some runs of fall chinook and Coho. The resident species were probably the same as those present today: cutthroat trout, rainbow trout, and sculpin. Native Americans harvested fish for consumptive use and developed annual rituals around their harvest, but had relatively little impact upon total fish production (Southwest Oregon Salmon Restoration Initiative, 1997).

Gold was discovered in Jackson Creek in 1851, and placer mining quickly became commonplace in most of the streams in the watershed analysis area. By the summer of 1861 all the surface placers and creek beds had been worked extensively and miners began to use hydraulic mining (Gilmore 1952). The invasive nature of mining practices caused severe changes in fish habitat. Large quantities of gravel were dredged from the stream and deposited into tailings, reducing spawning habitat and channelizing the streams. Miners often removed the riparian vegetation and nearby trees to build mining equipment and cabins. The reduction of shade probably increased stream temperatures. Woody material needed for pool development and structure for the stream was also reduced.

Since flowing water was necessary, mining took place during the same period of time that spawning, incubation, and fry rearing takes place. Any eggs or fry residing in these gravels were destroyed. Mining also contributed a significant amount of fine sediments, which can decrease food production, and fill in spawning gravels and pools (Meehan, 1991).

In addition to mining, trappers had removed most of the beaver, which through their dams had provided pools and side channels used for rearing habitat. Beaver dams also added woody material to streams, trapped and stored fine sediments, and reduced water velocities.

In the 1870s, fruit orchards became an important commodity (Gilmore 1952:323-324). This led to an increased demand for water, and major irrigation works expanded (LaLande 1989:13). The tributary streams in the basin became “over-allocated” for water rights, particularly for the summer and fall flows so important for rearing juvenile steelhead. Irrigation diversions were rarely screened before the 1940s, which may have been a significant factor in fish declines (Southwest Oregon Salmon Restoration Initiative, 1997).

The orchard boom led to a high demand for wood crates, fueling the growing timber industry. Logging contributed to increased water temperatures as trees within the riparian zone were harvested. Logging and the road construction associated with it probably resulted in an increase in sediment to the streams, choking spawning gravels and filling in pools.

Grazing also began in the late 1800s. The extent of grazing in the analysis area was unknown, but heavy grazing in the riparian areas could have caused further reduction in riparian vegetation, increased fine sediments, and contributed to bank destabilization.

As the ground-disturbing activities described above increased in the 1900s, more sediment was deposited into the streams. An additional complication was that there was less woody material to trap and store it. The amount of sediment in the streams soon exceeded a stream's capability to transport it downstream. The excess fine sediment eliminated habitat for aquatic insects, reduced the permeability of spawning gravels, filled in pools, and blocked the interchange of subsurface and surface waters (Meehan 1991).

# SYNTHESIS AND INTERPRETATION

The Synthesis and Interpretation section compares current conditions with reference conditions of specific ecosystem elements and explains significant differences, similarities, or trends and their causes.

## HUMAN USES

**History**
Two radically different patterns have characterized land use in the West Bear Creek Watershed Analysis Area. For thousands of years, indigenous people followed a hunting-fishing-gathering way of life, based on a small-scale, subsistence-oriented economy. Approximately 150 years ago, the advent of Euro-American settlement brought fundamentally different land use patterns based on complex technologies and an economic system connected to global markets.

Prior to this change, native people managed the land by working with natural processes, such as fire, to enhance a broad spectrum of resources important to them. Indigenous technologies combined the use of simple tools with a sophisticated understanding of the landscape to promote habitat for game animals and abundant vegetable products needed for food and materials. This way of life resulted in an open landscape, with grasslands and prairies at lower elevations, oak and oak-pine savannahs in the foothills, and meadows in the forested uplands.

This pattern of resource enhancement gave way to patterns of resource extraction, beginning with the actions of the first fur trappers in the early nineteenth century. Following the removal of native people in the 1850s, the analysis area became home to settlers who brought with them increasingly powerful technologies, as well as attitudes that hastened the transformation of the native environment through a wide variety of actions.

Farming, ranching, mining and logging generally characterized the economy of the analysis area in the late nineteenth century, with these activities stimulated by the advent of the railroad in the late nineteenth century. Subsequent improvements in local transportation in the twentieth century have brought all parts of the analysis area into increased economic production. These changes have also concentrated the population into the towns and cities located within the analysis area. The location of two of these cities (Medford and Central Point) is a function of the transportation network i.e. the railroad.

**Major Changes**
During the last 150 years substantial changes have taken place across the landscape of the analysis area. In the nineteenth century, newcomers cleared land for ranches and for fuelwood; introduced a host of new plant (agricultural crops and weeds) and animal (farm and ranch animals) species; plowed under native meadows for farms; dammed, diverted, and channelized streams for mining, agriculture, and transformation; and hunted unwanted predators (grizzly bears and wolves) and other species (antelope and bighorn sheep) to local extinction.

In the twentieth century logging expanded along with the post-World War II explosion of roads and improvements in transportation. The development of orchards and other agriculture increased demand for irrigation. Successful fire suppression eliminated wildfire as a disturbance mechanism, changing the composition and character of local vegetation. Lumber mills, burning practices for frost protection in orchards, smudge pots, and wood stoves collectively degraded air quality throughout the region.

The effects of these actions are written on the land: the hydrology of the analysis area has been altered through irrigation, water withdrawals, dams, roads, channelization, and other actions such as hydraulic mining; erosion is more severe in some places than in the past; soil productivity has been affected in some areas by compaction, hot fires, and changes in vegetation patterns; vegetation patterns have been altered through agriculture, fire suppression, grazing, and other actions; topography has changed in places through the construction of quarries and roads, and stream alterations; and native species (plants and animals) have disappeared or become reduced through a number of human actions or through competition with non-native species.

**Current Trends**

The management of federal land in the analysis area has been profoundly affected by policy changes that began in the 1970s with congressional passage of the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA). Further changes came to the Pacific Northwest with the adoption of the Northwest Forest Plan by the BLM and Forest Service. In particular, the Aquatic Conservation Strategy and Survey and Manage components of the Northwest Forest Plan have prompted the federal agencies to focus on ecosystem health and restoration when designing projects.

Current management direction for federal land in the analysis area is being shaped by concern over the build up of hazardous fuels throughout the landscape. Forest managers are taking a landscape scale approach to timber harvest, focusing on density management and thinning from below. Although these treatments cover far more acres at one time than clear cuts or heavy partial cuts, harvests are designed to remove the smaller diameter, high density components of the forest, leaving the largest, healthiest trees behind. Harvest methods have changed as well. Logging contracts often require the use of helicopters to minimize road building and ground disturbance to sensitive areas.

The dramatic reduction in the amount of federal timber available to logging companies since the early 1990s has likely resulted in an increase of harvests on private lands. Harvest practices on private land are regulated by the Oregon State Forests Practice Act, first implemented in the early 1970s. The Act has been amended several times. Recent changes have addressed criteria for harvesting in riparian areas, snag retention, green tree retention, and restrictions on the size of clear cuts. Logging on private land is also subject to federal laws such as the Endangered Species Act of 1973. Overall, there are far fewer restrictions that apply to harvest on private land, and in general the goal of private operators remains the maximization of fiber production.

Although non-federal land, which makes up a majority of the analysis area, is not subject to the regulations that govern federal land managers, increased public awareness about resource issues is generating concern about the management of these lands as well. Local watershed councils, non-profit environmental organizations, and other concerned citizens are working with local land owners on a variety of resource issues. Grant money and federal assistance is increasingly available for landowners who seek assistance for initiating improvements on their land that will benefit surrounding lands as well.

One of the most significant influences on the condition of non-federal lands and resource use throughout the analysis area is the dramatic increase in the area's population. Although it is not known how much the population in analysis area has increased, population increases in the towns and cities located within, or partially in the analysis area provide strong evidence that this population has increased dramatically in the past decade. The populations of Central Point, Medford, and Talent increased by 62 percent, 32 percent and 58 percent respectively. New road, home and business construction is evident throughout the analysis area and is likely to continue. Hobby farms and vineyards are increasing as large-scale agriculture, including livestock grazing, decreases. The federal lands in the analysis area do not currently support any livestock grazing. Livestock grazing continues on non-federal lands, but is changing along with the demographics of the area. Although the overall number of livestock on the landscape may be decreasing, the density of animals such as llamas, horses, emus, cows, and other animals may be increasing in some areas.

The development of an intensive road network has profoundly influenced the analysis area's landscape and future development will continue to do so. Designed primarily for access, transportation, and transport, roads have wide-ranging impacts on the ecology of the analysis area.

Natural surfaced roads contribute the greatest amount of sediment to streams in the analysis area. Roads located in unstable areas and adjacent to streams, as well as those with inadequate drainage control, minimal or no maintenance, and no surfacing are most likely to cause sedimentation of stream habitats. Stream-adjacent roads confine the channel and restrict the natural tendency of streams to move laterally. Roads crossing through riparian areas have fragmented riparian habitat connectivity. Some culverts impede or prevent fish passage.

Forest roads diminish soil productivity simply by taking the area they occupy out of timber production. Traditionally, this has been viewed as "the cost of doing business." A maintained road surface is out of production as long as it is maintained. Vegetation may fill in the road surface when maintenance is stopped, but the growth rate is far less than for undisturbed soil. Four miles of road per square mile is roughly equivalent to 16 acres per square mile that is taken out of production.

Roads affect wildlife by removing habitat and altering behavioral patterns. Construction of roads inevitably removes habitat for various wildlife species. Vehicles using roads disturb wildlife and change behavioral patterns. Habitat within varying distances of roads is not used to the extent it would be if the roads were not present. This may have a far greater impact on wildlife than the immediate loss of habitat. There is little disturbance to wildlife from roads that are totally closed to vehicles.

Roads are also a source of recreational activity as evidenced by the Back Country Byway program which appeals to the growing segment of the American population that drives for pleasure. Roads also provide the aging population, as well as the increasing segment of physically challenged, an opportunity to view some of our scenic treasures. The access provided by roads may also contribute to the illegal removal or destruction of resources. Cultural resource sites within a quarter mile of a road are at greatest risk from looting. Access also allows for the illegal dumping of trash in the analysis area. This is apparent on Anderson Butte Road.

New road construction on federal lands has slowed in recent years as a result of the Northwest Forest Plan and other policy changes. New construction on federal lands is often coupled with the closure or decommissioning of existing roads. Considering the small percentage of federal land in the analysis area, this is not likely to offset the impacts of continued road construction on non-federal lands in the remainder of the analysis area.

The analysis area will continue to be a popular destination for those seeking outdoor recreation opportunities. One of biggest trends in recreation across the country and in the analysis area is a steady increase in the use of Off-Highway Vehicles (OHVs). For over 40 years, motorcycle riders and other OHV enthusiasts have utilized public and private lands in the analysis area for recreation, taking advantage of an extensive network of roads and trails. Trails used by OHVs have primarily been created through historic OHV use, rather than formal trail construction. This lack of planning has resulted in many trails with design or erosion problems. The 1995 Medford District Resource Management Plan (RMP) limited OHV use to existing roads and designated trails on most federal lands within the analysis area. However, the BLM has not yet engaged in a formal planning process to designate OHV trails, and OHV users continue to create cross-country trails. This is readily apparent on federal lands that have recently been cleared of brush during fire hazard reduction activities.

A new generation of OHVs has provided riders with more reliable, dependable machines that are capable of traveling longer distances and operating on steeper slopes. The new capability has created a demand for longer trail opportunities and has expanded the range of OHV use in the analysis area. At the same time, residential development is encroaching on areas of both historical and new OHV use. Other types of recreation such as hiking, horseback riding and mountain biking have also increased in recent years. User conflicts have been reported in the analysis area and could increase without careful management.

## EROSION PROCESSES

Natural erosion rates have been altered and/or accelerated by human management and activities such as road and home building, timber harvest, grazing, ohv use, irrigation, mining, wildfire and prescribed burning. Major storms like the one on New Year's Day 1997 increase the potential for both natural and human-influenced landslides to transport sediment to nearby streams.

Non-surfaced roads, OHV trails, gravel operations, irrigation and home construction have had the greatest impact on the amount of sediment reaching streams. There have been hundreds of miles of roads and trails created in the analysis area over the last century. Many of the roads are maintained throughout the year but still yield sediments higher than natural levels.

Past timber harvest, particularly clearcut logging, greatly increased soil erosion rates over natural levels. Although the effects of ground disturbing activities decrease rapidly the first few years after logging, it takes several years for erosion rates to return to near natural levels. This is particularly the case where logging slash is broadcast burned immediately after logging has occurred.

The increase in fuel loading due to fire suppression in the analysis area has increased the potential for a high intensity wildfire. High intensity fires can burn off the duff layers that protect soils from erosive and gravitational forces. These fires may also cause soils to become hydrophobic (soils that do not allow penetration of rainfall and snow melt), which results in much less infiltration and a higher risk for soil erosion and topsoil loss. A high intensity wildfire along the steep, stream-adjacent sideslopes would increase the potential for landsliding and severe erosion for at least one to two years following a fire.

Concentrations of cattle and sheep along streams, ponds, and other wetlands may have contributed to a loss of vegetative cover and subsequent erosion in the riparian areas. Erosion from grazing is most severe when it occurs near streams and on steep slopes. There are no active grazing allotments on federally administered lands in the analysis area. Severe problems resulting from over-grazing in this analysis area have not been documented.

Human activities have a significant influence on erosion rates in the analysis area. In the past, mining, clear-cutting, and other human activities accelerated erosion rates. In recent years, erosion has decreased to slightly above natural levels due to changes in land management policies and practices.

## SOIL PRODUCTIVITY

Clearcut timber harvest methods, burning, and isolated instances of over-grazing may have contributed to diminished soil productivity by increasing erosion rates and reducing native vegetative cover and plant material that would otherwise be recycled into the soil. Timber harvest and any associated prescribed burning may have also reduced the amount of coarse woody material across the landscape.

Although site-specific soil impacts may not be significant, cumulative effects to the soil from various activities could be very limiting over a long period. Natural levels of soil productivity have been reduced where ground-based logging has occurred. Tractor logged areas with designated skid roads have soil productivity losses ranging from 5 to 10 percent, while areas with unrestricted tractor logging have soil productivity losses near 20 percent.

Road building has taken land out of timber production and has indirectly reduced soil productivity. A maintained road surface is out of production as long as it is maintained. Vegetation may fill in the road surface when maintenance is stopped, but the growth rate is far less than for undisturbed soil. On average, approximately four acres of land is taken out of production for every one mile of road built. No new roads have been built on federally administered lands for several years and most new construction is coupled with road decommissioning and restoration.

On federally managed lands coarse woody material (CWM) is being maintained at natural levels or possibly on an upward trend. Although CWM levels naturally fluctuate, the lack of fire has allowed CWM levels to rise. Change in timber harvest methods on federal land, such as the elimination of clearcutting, has also contributed to an increase in CWM levels on federal land. CWM levels on private lands are not known.

The biggest threat to soil productivity in this analysis area is the potential of an intense wildfire that would drastically reduce vegetative cover and increase soil erosion.

## LANDSCAPE VEGETATION PATTERN

Fire suppression, plant succession, and logging are the main processes that have affected the landscape since the turn of the 20th century. Since fire suppression began at this time, the forest land matrix has become more contiguous and larger in size because of the lack of fire disturbance and the process of plant succession (Franklin and Dymess 1973). These two processes have allowed high stocking levels of trees and shrubs to become established. Tree species composition has also changed across the landscape. The pine and oak species and incense-cedar now compose a smaller percentage of the total forest species composition, and Douglas-fir has become the dominant species since plant succession has been unimpeded. This is not desirable because pine, oak, and incense-cedar have better drought resistant characteristics that can influence tree vigor.

Forest management selection methods and small sized patch cuts and clearcuts (less than 40 acres) have allowed for the creation of distinct patches within the forest matrix. The harvesting simulates fire in regard to maintaining even-aged forest patches in the landscape pattern, but does not lower vegetation densities in the remainder of the adjacent forest.

Urbanization and agriculture activities in the valley have eliminated homogeneous stands of Oregon white oak trees, and have altered the native riparian vegetation. Vegetation that now exists between the agricultural and urban areas is patchy. Many of the plant species now growing in the valley are non-native. The Oregon white oak trees have been replaced with pear orchards and other tree species such as sweetgum, red maple, silver maple, eastern and mid-western oak species, sycamore, redwoods, and many other introduced species that appeal to local residents. Dense patches of blackberry species have invaded riparian areas and have shaded out native tree species such as Oregon white ash, black cottonwood, bigleaf maple, and red alder.

Although there are more non-native species present today and their abundance is greater than in historic times, these species have not influenced the vegetation pattern across the landscape to any large extent. Since these non-native species are herbaceous in form, they are commonly found in the grasslands, shrublands, and agricultural areas, and may tend to maintain the openness of these areas. The effects of non-native species are more subtle. In general, natural succession of native species is usually retarded by the non-native species invading their habitat and out-competing them for nutrients, water, and light. Suitability decreases as native species decrease in abundance and decreases the quality of wildlife habitat, agricultural productivity, and recreation areas. The effects of the loss of native species is probably not yet realized.

# PLANT SPECIES AND HABITATS

**Introduced Plant Species and Noxious Weeds**

Introduced plants and noxious weeds have greatly increased in number of species and area occupied from the reference condition to the present. A few species are considered controlled, such as *Hypericum perforatum* (St. John's wort), but most continue to spread. Active control methods are usually reserved for the more harmful noxious weeds, leaving the more benign noxious weeds and introduced plants to spread unchecked.

The natural processes that spread noxious weeds and introduced plants (usually seed transport by wind, water, birds, and animals) continue to operate. These processes tend to contribute to the expansion of established populations rather than the long distance establishment of new populations. As these populations become large, the opportunities for spread by natural processes increases.

Human actions that contribute to noxious weed and introduced plant establishment and spread continue to occur. Accidental long distance seed transport is associated with all modes of human travel. Purposeful introductions to gardens (that subsequently escape) and seedings for erosion control associated with roads, slides, and wildfires, are common actions that contribute to noxious weed and introduced plant establishment and spread. Agricultural operations, urban development, and other ground disturbing actions also contribute to noxious weed and introduced plant establishment and spread. As more humans occupy, travel, and develop the area, the opportunities for spread increases.

Invasions by noxious weeds and introduced plants alter ecosystem structure and function. Biodiversity and productivity is reduced. Water, nutrient, and energy cycles are altered. In many cases, natural (including fire) succession is stalled. Human society and human health are directly affected. Also, these noxious weeds and introduced plants threaten rare plant and animal populations and physically alter their habitat.

**Special Status Plant Species and Habitats**

For the special status species known to occur in the analysis area, habitat condition of hardwood and conifer forests, open areas, and rock outcrops is critical. Since Euro-American settlement, most habitats have been altered directly or indirectly. Often these alterations would be considered as having negative effects on rare plant habitat. Commonly, for plants that have very specific habitat requirements, alteration of site conditions results in an unsuitable environment.

Factors contributing directly to special status plant habitat alteration include timber harvest, vegetation conversion for agricultural uses, plant collection, woodcutting for fuel and other uses, urban and rural development, road building, rock source development, water impoundments and diversions. Factors contributing indirectly to special status plant habitat alteration include fire suppression, introduction of nonnative plants, unnatural distribution of native pollinators, plant community fragmentation, and over-grazing. Some of these habitat alterations should be considered irreversible for management purposes, such as, existing roads, quarries, water impoundments and diversions, and land converted for human uses.

Habitat conditions should improve on BLM-managed lands with the proposed management objectives and recommendations, current silviculture and prescribed fire techniques. Prescriptions designed to simulate or move a plant community toward pre Euro-American settlement conditions should be effective over time.

**Survey and Manage Plant Species and Habitats**
All Survey and Manage species known to occur in the analysis area are found in hardwood or coniferous forests. These habitat types have been affected by past timber harvest, fire suppression, road building, wood chip material salvage, firewood cutting, introduction of nonnative plants, decreased biodiversity, unnatural distribution of native pollinators, plant community fragmentation, and over-grazing.

Habitat conditions should improve on BLM-managed lands with proposed management objectives and recommendations and current silviculture and prescribed fire techniques. Density management, hazard reduction, uneven-age management, oak woodland restoration, patch treatments, species composition manipulation should direct the plant community to a pre Euro-American settlement condition.

**Special Areas with Botanical Resources**
*Holton Creek Research Natural Area*
The Holton Creek Research Natural Area has been relatively unaffected by direct actions of Euro-Americans. However, indirect effects of fire suppression have caused plant community alteration. Decades of fire suppression has presumably caused this forest to have a well-developed understory of conifers and shrubs, an increased occurrence of white fir (*Abies concolor*), and a prevalence of dwarf mistletoe (*Arceuthobium douglasii*).

A management plan has not yet been written for this RNA. Undoubtedly, it will contain management recommendations to re-introduce fire and therefore direct the forest to a pre Euro-American settlement condition.

## FOREST DENSITY AND VIGOR

Core samples from 102 to 217 year-old Douglas-fir and ponderosa pine trees (trees that became established in the 1700s and 1800s) show they were growing at least 1.5 inches in diameter every decade for three to nine decades before a decline in diameter growth started. This indicates that these tree, which are now considered to have late-successional characteristics, initially grew with little or no surrounding tree competition. Frequent fires kept tree stocking levels low. Most of the present day, younger tree age classes, which became established in the late 1800s or early 1900s and now predominate the landscape, grew under maximum stocking conditions and do not show periods of rapid diameter growth. These trees have been growing less than 1.5 inches in diameter for the last 30 to 90 years. High tree stocking levels have been maintained since Native Americans stopped using fire across the landscape and fire suppression was initiated. As a result, the forest matrix appears to be contiguous across the landscape.

The decrease in fire frequency has also allowed natural plant succession to change the species composition and structure of grasslands, shrublands, and woodlands. Shrubs and trees have invaded grasslands, decreasing the size of these open, native grass communities. The historic, relatively open shrublands have become overstocked, more uniform in structure, and present a severe fire danger today. The open oak woodlands that were managed for acorns by the Native Americans have also changed dramatically. Shrub species have invaded the woodlands because of fire suppression. Oak trees are now multi-stemmed instead of single stemmed and Douglas-fir is prevalent in the overstory and understory. These factors have resulted in the decline of oak tree vigor and acorn production.

The conifer forests and their various stages of development are also influenced by numerous ecological and physical processes. Coarse woody material (CWM) appears to be the heart of numerous ecosystem processes and it is a vital part of forest productivity. CWM is defined as fallen trees and tree pieces, fallen branches larger than 1 inch in diameter, dead roots, and standing dead trees. As a general rule, CWM decreases from high to low elevations. West and south aspects have smaller amounts also because of drier conditions. In the lower elevations, CWM is usually less than 10 tons per acre. The more moist, higher elevations have approximately 10 to 20 tons of CWM per acre. The moist sites have larger diameter trees so amounts of CWM tend to be greater. Historically there was less CWM across the landscape because it was consumed frequently by fires. Where clearcutting and whole tree utilization occurs on private property, CWM remaining could be 10 tons or less.

In the historic forests, bark beetles and pathogens were probably more benign due to low tree stocking levels. The present day overstocked forests have allowed for a decline in forest growth and vigor resulting in the dramatic increase of bark beetle populations and increasing tree mortality. The various bark beetles throughout the analysis area that are causing extensive tree mortality on the drier sites are moving the forest stands to a more open condition. Where the Douglas-fir trees are dying adjacent to shrublands and woodlands and on dry ridge-tops, there is an opportunity to reestablish drought tolerant species such as ponderosa pine and incense cedar. Dwarf mistletoe species are also causing tree mortality on a small scale.

As forest stands increase in age, there is a higher probability of some type of disturbance. Since many of the mature second growth forest stands in the analysis area are 100 years of age and older, they are currently more susceptible to disturbance. Some stands are still in the stem exclusion stage of development, but many stands are entering the understory reinitiation stage because of the ecological processes discussed (Oliver and Larson 1990). These processes are also part of the formation of late-successional forests by creating multi-cohort, multi-storied forests. Wind damage is another important process in mature forests, creating openings and reintroducing a new forest age class and seedlings of the desired species.

These various ecosystem processes must be monitored carefully if fire suppression across the landscape continues. Natural vegetation succession may not be desired everywhere. Without large openings in forest stands, the more shade tolerant species such as true fir species and Douglas-fir will predominate most forest stands, and early seral species will continue to decline. Silvicultural methods will be necessary to maintain and manipulate the structure and species composition of the forest stands if fire does not. Reduction of vegetation stocking levels is also needed if individual tree and forest vigor is to be maintained.

In summary, a few conclusions are apparent:

1. Forests in the lower elevations where annual rainfall is below 30 inches should not be expected to develop into large continuous matrix areas of dense, lush, late-successional forests (Franklin and Dyrness 1973). These dry, low elevation forests must be maintained at lower stocking levels with drought resistant species predominating. Openings are essential for maintaining the drought resistant early seral species. If the stocking levels of the vegetation are not managed, physical and ecological processes will continue to naturally thin the vegetation and the species composition of the early seral species may continue to decline.

2. It must be recognized that mature, overstocked forest stands across the landscape are being observed at one point in time. Numerous processes will continue to affect the forest stands' stocking levels and structure. As small-scale physical and ecological processes continue to create openings in the present day forest stands, more diverse stand structure will develop over time. With these processes and silvicultural treatments to control stocking levels, the potential exists for more vigorous future forests with late-successional characteristics.

3. Without vegetation stocking level management or low intensity fire, individual shrub and tree vigor will remain low and high levels of vegetation mortality may occur. Large stand replacement fires are also probable without stocking level management. Grasslands will continue to decrease in size, shrublands will remain impenetrable and present a severe fire hazard, and the vigor of the oak woodlands will remain low.

## FIRE AND AIR QUALITY

Historically, frequent, low intensity fires maintained most valley bottomlands and foothills as grasslands or open savannas. Forests fashioned from frequent, low intensity fires have been described as open and park-like, uneven-aged stands, characterized by a mosaic of even-aged groups. Douglas-fir, ponderosa pine, sugar pine, and white fir were the most common species. Depending on understory vegetation conditions, these species have some resistance to fire as mature trees. As saplings, ponderosa pine is the most resistant, followed by sugar pine, Douglas-fir, and white fir. Frequent fires had major structural effects on young trees favoring ponderosa pine as a dominant species and white fir as the least dominant in this forest type.

Fire suppression over the past century has effectively eliminated five fire cycles in southwest Oregon mixed conifer forests (Thomas and Agee 1986). The absence of fire has converted open savannas and grasslands to woodlands and initiated the recruitment of conifers. Oregon white oak is now a declining species largely due to fire suppression and its replacement by Douglas-fir on most sites.

Fire-intolerant, shade-tolerant conifers have increased and species such as ponderosa pine and sugar pine have declined. This conversion from pine to true fir has created stands that are subject to stress, making them susceptible to accelerated insect and disease problems (Williams et al. 1980).

The horizontal and vertical structure of the forest has also changed. Surface fuels and the laddering effect of fuels have increased and this increases the threat of crown fires, which were historically rare (Lotan et al. 1981). Fire exclusion has caused a shift from low-severity fire regimes to a high severity regimes. This is characterized by infrequent, high intensity, stand replacement fires. Fire is now an agent of ecosystem instability as it creates major shifts in forest structure and function on a large scale.

In summary, the fire hazard for this analysis area has increased over time. Focus of fire hazard reduction projects on the low severity fire regime areas can help restore these areas. Further changes in how wildfire is managed across the landscape may be needed for maintenance. These changes may include management of wildfire for resource benefits as opposed to the current direction for full suppression. However, full suppression strategy will always be a major part of fire management within this analysis area due to the top priorities of protecting life, resources and property.

Air quality can be adversely effected by prescribed burning and wildfires. Prescribed burning conducted in compliance with federal, state, and local smoke management regulations should minimize adverse effects to populated areas. Furthermore, specific burning and mop-up strategies and tactics can be employed to reduce emissions. Fire hazard reduction projects, over time, should affect the long-term emissions from wildfires within the analysis area. This effect should be a reduction of emissions as lighter fuel loads are consumed as the fire intensities over time are reduced through fuels management.

## TERRESTRIAL WILDLIFE SPECIES AND HABITATS

**Wildlife - General**

Vegetative conditions are the primary influence on terrestrial wildlife/animal populations and their distribution within the analysis area and across the greater landscape. A variety of processes have changed the vegetation within the analysis area over time. These include natural and human-caused disturbances and natural succession. Current conditions of the analysis area differ from reference conditions primarily due to human-caused disturbances such as timber harvest, agriculture, fire suppression, introduction of exotic plant species, and residential development.

A direct comparison of the acreage of current and reference vegetative conditions is not possible. Some generalizations, however, can be made based on some of the processes known to have taken place in the analysis area. Mature/old-growth habitat has declined in the analysis area due to timber harvest. Therefore, it can be assumed that populations of wildlife species preferring the structure and conditions provided by this habitat type have also declined.

The quality of the mid-seral conifer habitat has declined primarily as a result of fire suppression. Historically, much of this habitat was characterized by more open canopies (as a result of fire) and a healthy herbaceous and shrub component. This combination provided habitat for an array of species. Due to fire suppression, however, many of the mid-seral stands are now single-storied with a high degree of canopy closure and virtually no understory vegetation. In comparing wildlife use of dense-canopied, single-storied stands to more open multiple-storied stands, data in Brown (1985) suggest that approximately twice as many vertebrate wildlife species prefer multiple-storied stands versus single-storied stands.

Much of the early seral conifer habitat (grass-forb, shrub and sapling/pole) is present as a result of timber harvest. Consequently, snags and large down woody material are probably deficient in these habitats, and this condition will persist as these stands mature. Thus, populations of those species requiring or preferring snags and large down woody material have likely declined, and populations will remain suppressed until there is recruitment of these habitat features as a result of ecological processes.

The absence of fire has allowed much of the oak and oak/pine woodlands to become over-dense and has also allowed conifer and shrub encroachment at greater than historic levels. The result is increased mortality, reduced growth, and diminished mast (acorn) production, particularly in the larger oaks. Because the large oaks provide both natural cavities and generally good acorn crops, they are important to a variety of wildlife species. Populations of those species that depend on these features of the oak and oak/pine woodlands have probably declined.

Like oak-savannah habitat, the quality of shrubland habitat has also declined due to fire suppression. Fire is the primary process in the development of early seral conditions in this plant community. In the absence of fire, much of the habitat has matured and early seral habitat is deficient. As a result, populations of those species preferring early seral conditions of this plant community are probably declining.

The quality and quantity of native grass/forb/herbaceous habitat have declined rather dramatically due to the invasion of noxious weeds, the planting of non-native grasses, and the encroachment of shrubs and conifers. Practically all non-agricultural grasslands in the lower elevations of the analysis area are now fields of noxious weeds and grasses (e.g., yellow starthistle and medusahead rye). The introduction of other non-native grasses has generally occurred as a result of well-meaning projects, but nevertheless has resulted in the decline of native grasses. Encroachment of trees and shrubs has primarily been the result of fire exclusion over the past century. This decline in quality and quantity of native grassland habitat has adversely impacted herbivores in the analysis area.

**Threatened/Endangered Species**

Primary habitat for the northern spotted owls, a federally threatened species, is mature/old-growth forest habitat. A decrease in this habitat from historic to present levels as a result of logging is apparent. Due to the decrease in suitable habitat, it is reasonable to assume that the existing northern spotted owl population has declined from historic levels. The current population in the analysis area will likely continue to decline because future timber harvest will further decrease the abundance of mature/old-growth forest habitat.

**Northern Spotted Owl Critical Habitat**

Northern spotted owl critical habitat was designated in 1992. Approximately 1,100 acres of Critical Habitat Unit (CHU) OR-75 are in the analysis area. When designated, the management emphasis in CHU OR-75 was to maintain an adequate distribution of nesting, roosting, and foraging habitat and improve connectivity between CHUs OR-74 and OR-76

(USDI 1994). With the adoption of the Northwest Forest Plan in 1994 (USDA and USDI 1994a), the generally accepted primary function of critical habitat outside of Late Successional Reserves (LSR) is to facilitate spotted owl dispersal/connectivity between the LSRs.

Most CHUs have some degree of overlap with an LSR, however, there is no overlap between CHU OR-75 and the LSR system. This concerns the U.S. Fish and Wildlife Service because there is no current management emphasis anywhere in the CHU to provide nesting/roosting/foraging habitat, although this was one of the primary reasons for designating CHU OR-75.

**Special Status Species**

The decrease in mature/old-growth habitat is responsible for the listing of a number of the special status species found in the analysis area. These species prefer mature/old-growth mixed conifer forest for feeding, breeding, and/or sheltering, and, as in other areas, the decrease in late-successional habitat in the analysis area has likely caused a decline in the populations. These species are not expected to be extirpated from the analysis area, but recovery of the populations to pre-historic levels is not anticipated since removal of this habitat on private and public land is expected to continue.

Some species have received special status designation due to habitat loss or degradation and/or other factors not related to the loss of late-successional habitat. For example, a contributing factor in designating the western pond turtle is predation by bullfrogs, an introduced species. As with the species designated due to late-successional habitat loss, these species are not expected to be extirpated in the analysis area, but population recovery to pre-historic levels is not anticipated since the human-influenced processes that contributed to their designation will likely continue. Other species are designated as special status simply because there is a general lack of life history data. As these data gaps are filled, it is possible these species could be removed from the special status species list.

**Survey and Manage and Protection Buffer Species**

All survey and manage and protection buffer species known or suspected to be present in the analysis area (see Current Conditions) are believed to be associated with and prefer late-successional habitat. Great gray owls use this habitat for nesting, but forage in meadows, agricultural land, and in the early seral stages of mixed conifer forests. It is unknown how management in the analysis area has affected overall habitat conditions for the great gray owl. Populations of the various bat species listed in the Northwest Forest Plan have likely declined as many are linked with the bark fissures of old-growth trees and the snag component of these stands. With so little understood about actual habitat requirements of many of the mollusk species, it is unknown how the change in vegetation patterns from reference to current conditions has affected these species.

The Northwest Forest Plan mandates that when survey and manage and protection buffer species are found on public lands they be afforded protective measures. This strategy should abate further major population declines on federal lands, and if employed over the long-term, populations could recover in some areas.

## HYDROLOGY

The streamflow regime in the West Bear Creek Watershed Analysis Area reflects human influences that have occurred since Euro-American settlers arrived. Adverse affects to the streamflow regime include changes in the timing and magnitude of both peak and low flows.

Potential effects of peak flows greater than bankfull flow may include channel widening, bank erosion, channel scouring, landslides, and increased sediment loads. These are normal occurrences in a dynamic, properly functioning stream system; however, increases in the magnitude and frequency of peak flows due to human-caused factors can magnify the effects. The dominant human-caused disturbances that could alter peak flow hydrologic processes in the analysis area are: extensive road building, timber harvest, and land clearing for agricultural, urban, and residential development. These types of disturbances are most evident in the Griffin Creek and Jackson Creek analysis subwatersheds. Hydrologic processes affected include reduced infiltration (resulting from soil compaction), disruption of subsurface flow, and reduced evapotranspiration. These changes to the hydrologic regime have the potential to increase the magnitude and frequency of peak flows in the tributaries and main stems. Openings in the transient snow zone due to past timber harvest and roads are of particular concern as they tend to produce higher streamflows during rain-on-snow events. The majority of the transient snow zone in the analysis area is within the Wagner Creek, Anderson Creek, Coleman Creek, and Griffin Creek analysis subwatersheds. Any increase in the magnitude and frequency of peak flows will diminish as vegetation regrowth occurs in harvested areas. Permanent road systems intercept surface runoff and subsurface flow, which prevents the streamflow regime from returning to pre-disturbance levels.

Reduced summer streamflows are detrimental to fish and other aquatic species and have a negative impact on water quality. Water withdrawals, irrigation return flows, and creeks used as conveyances have had the greatest impact on summer streamflows in the analysis area. During the irrigation season (April 1 - October 31) mainstem streamflows in the analysis area do not follow a natural flow regime. The majority of water diverted from streams in the analysis area is used for irrigation. Wagner, Griffin, and Jackson Creeks are fully appropriated at both the 50 and 80 percent exceedance levels (water availability information is not available for Anderson, Coleman, or Willow Creeks). Population increases in areas not served by a city water supply have resulted in an increased number of wells drilled. Groundwater depletion in the analysis area will further reduce streamflows.

## STREAM CHANNEL

Stream channels in the West Bear Creek Analysis Area have been heavily influenced by the influx of Euro-American settlers, beginning in 1851 with mining. Mining scoured out channel beds and banks, redeposited gravels outside of the streambed, and released large amounts of sediment into the stream. Streams were straightened and channelized, stream elevations dropped (incised) as banks were scoured out, and pools filled in with sediment. The gravel tailings, lower stream elevations, and channelization are still present. As mining tapered off, logging and land clearing for agricultural use resulted in the removal of large woody material from stream channels in addition to removal of streamside trees. This depleted the existing large wood and sources for future large wood recruitment. There continues to be a lack of large wood available today. As a result, floods are more destructive without sufficient instream structure to slow the high stream energy. As more streambank erosion occurs and as the streams downcut, the channels become entrenched.

As the watershed analysis area became more populated, roads were built and some streams were channelized or straightened to facilitate road construction. The stream reaches in the valleys of the analysis area are in heavily developed urban areas such as Talent and Jacksonville. The stream channels are confined, restricting the natural tendency of streams to move laterally, even during large flood events. Some reaches have been channelized to prevent the loss of agricultural lands to flood damage. Low gradient streams in valley bottoms are entrenched and are not able to access the adjacent floodplain except during major peak flow events.

## WATER QUALITY

Overall, water quality has declined in the analysis area since Euro-American settlers arrived. Changes in water quality from reference to current conditions were predominantly caused by riparian vegetation removal, water withdrawals, irrigation return flows, channel alterations, roads, irrigation ditches, and poorly managed grazing. Water quality parameters known to be most affected by these human-caused disturbances are temperature, sediment, and bacteria.

Summer water temperatures for Wagner (Horn Gulch to headwaters), Coleman, Griffin, and Jackson Creeks exceed the state temperature criteria. These streams are designated as water quality limited and are on the 1998 Oregon 303(d) list. Lack of riparian vegetation, channel alterations, water withdrawals, and irrigation return flows have contributed to increased stream temperatures that can stress aquatic life and limit the long-term sustainability of fish and other aquatic species. High summer stream temperatures in Wagner Creek may be partially attributable to the 3.5 mile open ditch conveyance used to transport irrigation water from McDonald Creek in the Little Applegate River across Wagner Gap to the headwaters of Wagner Creek.

Sedimentation is identified by the Oregon Department of Environmental Quality (ODEQ) as a parameter of concern for Wagner, Coleman, Griffin, Jackson, and Willow Creeks. Roads, skid roads, OHV trails, riparian vegetation removal, channel alterations, and irrigation ditches are the primary human-caused disturbances that affect stream sedimentation in the analysis area. Accelerated surface erosion in areas of granitic soils (i.e. Wagner, Jackson, and Willow Creeks) are a particular concern for sediment delivery to streams.

Coleman, Griffin, and Jackson Creeks are on the 1998 Oregon 303(d) list for bacteria. Sources of high bacteria levels in the analysis area include human and animal waste and irrigation return flows.

Water quality is expected to improve on federal lands and remain the same or continue to degrade on private lands as the area is further developed. Riparian Reserves should promote the maintenance and improvement of riparian vegetation on BLM and USFS-administered lands within the analysis area. Protection of vegetation providing stream shade and recovery of riparian vegetation on federal lands should bring about some reduction of stream temperatures in the headwaters of Wagner, Griffin, and Jackson Creeks. Reduced amounts of road construction plus road stabilization, maintenance, and decommissioning on federal lands would likely decrease sedimentation from federal lands. Regulations governing private lands are not likely to bring about substantial water quality improvements, although stream and upland restoration efforts by landowners, watershed councils, and other groups on private lands should bring some site specific improvements. Natural surface roads and skid roads on steep slopes, especially those on granitic soil, will continue to supply sediment to stream systems. Streambank erosion caused by channel alterations and sediment contributed from irrigation ditches will be difficult to reduce and likely impossible to eliminate.

## RIPARIAN AREAS

The same human impacts that influenced stream channel and aquatic habitat impacted riparian areas. Historical mining removed the riparian vegetation and riparian dependent animals and plants disappeared. Nearby trees were also removed to build mining equipment and cabins. The lack of shade on perennial streams increased stream temperatures.

Loss of beaver and their dams resulted in a loss of marshes and ponds. Western pond turtles, herons, frogs, and other pond preferring species are undoubtedly less common now that the beaver are gone. The diversity of riparian vegetation was also decreased.

Historic timber harvest in riparian areas removed many of the readily available conifers within the riparian zone. This depleted large wood and sources for future large wood recruitment. Riparian areas recovering from historic timber harvest still have few large diameter trees. Fallen logs help regulate riparian humidity, contribute nutrients, and provide habitat for many plants, insects and animals.

Riparian areas provide corridors not only for movement of riparian dependent species, but also for upland species. Currently, the biggest influence on the condition and species composition of riparian corridors in the West Bear Creek Watershed analysis area is the developed condition of the land. The lower sections of all riparian corridors pass through developed areas of agriculture, rural-residential, urbanization, small farm use, and commercial land use. As a result, vegetation widths are 60 feet or less on perennial streams, with even less to none on intermittent and ephemeral draws (ODFW 1991, 1997). These narrow strips do not provide enough of a corridor for species movement.

Non-native weeds were introduced through land use practices in the first half of this century. This included the introduction of Himalayan blackberries, a highly invasive species that continues to replace native vegetation in large sections of riparian areas in the analysis area. Blackberries do not provide shade, dissipate energy during high flow events, or enhance flood-water retention and ground-water recharge the way native species do. Blackberry dominated riparian areas produce fewer insects and provide less nesting habitat than areas dominated by native species such as willows.

## AQUATIC WILDLIFE SPECIES AND HABITATS

The current condition of fish habitat in the West Bear Creek watershed is a result of the influence of Euro-Americans, beginning in 1851 with placer mining. Historical mining has confined channels, encouraged channel downcutting, destroyed riparian areas, and removed trees. In the lower reaches urban and agricultural development has inhibited recovery from these early impacts. As a result, there is little slow water for fish to rest and juveniles to rear, inadequate shade with accompanying high temperatures, and insufficient wood debris in the streams. In the upper reaches there is less development and riparian areas have had some time to recover. As described in the current conditions, these upper sections have more shade, some wood, and less sediment than the lower, more developed reaches.

The absence of beaver has reduced available slow water habitat and small side channels. Beaver ponds were excellent fish habitat, especially for juvenile fish. Western pond turtles, herons, frogs, and other pond preferring species are undoubtedly less common now that the beaver are gone.

The need for water that began with the orchard boom in the late 1800s has only increased. Most irrigation diversions are now screened, so fish are no longer diverted to their deaths. However, there are still water diversions operating in Jackson Creek, and diversions need to be monitored for proper fish screening. However, the heavy water removal for irrigation presents several problems for fish habitat. Water withdrawals result in low flows, particularly during the summer and fall when adequate flows are so important for rearing juvenile steelhead. As described in the hydrology section, irrigation return flows have contributed to increased stream temperatures that stresses aquatic life and limits the long-term sustainability of fish and other aquatic species. The over-allocation of water is a basin-wide problem not likely to diminish.

Lack of woody material continues to be a problem throughout the analysis area. The large urban and developed sections of streams, primarily in the lower sections, have little to no wood available. Riparian areas recovering from historic timber harvest still have few large diameter trees with the potential to fall into streams.

Sediment continues to exceed the streams capability to transport it downstream. Roads, skid roads, bank erosion, off-highway vehicle trails, irrigation ditches, and grazing all create sediment that ends up in the stream. Excess sediment eliminates habitat for aquatic insects, reduces the permeability of spawning gravels, fills in pools, and blocks the interchange of subsurface and surface waters (Meehan, 1991).

The net result of all these impacts is fewer fish. The loss of fish is not only a threat to the survival of the species, but the loss of nutrients released by decaying anadromous carcasses has an impact on the aquatic and terrestrial ecosystems.

# MANAGEMENT OBJECTIVES AND RECOMMENDATIONS

The Management Objectives and Recommendations section details the conclusions reached by the Watershed Analysis Team. These objectives and recommendations will be used to help guide future planning for BLM-administered land in the West Bear Creek Watershed Analysis Area.

## PRIORITY RECOMMENDATIONS

Although all of the recommendations identified below are priorities, the team identified three areas of particular concern. These areas of concern, discussed below, include illegal dumping on public land, forest health and fire hazard reduction concerns, and the need for a management plan for the John's Peak/Timber Mountain OHV Area.

### Illegal Dumping

There is a significant problem with the illegal dumping of household waste and other trash in the Anderson Butte area. Illegal dumping is not only visually unappealing, but toxins and hazardous waste are often introduced to the environment. The BLM needs to take measures to stop the prolific dumping of trash on public land.

### Forest Health and Fire Hazard Reduction

Recommendations identified below under Fire and Silviculture are strongly correlated. High vegetation densities are not only detrimental to individual tree vigor, but also present a high fire hazard. Although the dense young forests in the analysis area often contain thousands of trees per acre, they are still relatively vigorous and have a diverse species composition. In order to maintain this diverse species composition (sugar pine, ponderosa pine, incense cedar, Douglas-fir, madrone and California black oak) and stand vigor, the overly dense forests should be precommercially treated now. Reducing vegetation densities across the landscape not only improves individual tree vigor, but also reduces fire hazard.

### John's Peak/Timber Mountain OHV Area

The 1995 Medford District RMP created the John's Peak/Timber Mountain OHV area in order to provide for and manage OHV use. For over 40 years motorcycle riders and other OHV enthusiasts have utilized public and private lands in the analysis area for recreation, taking advantage of an extensive network of roads and trails. Trails used by OHVs have primarily been created through historic OHV use, rather than formal trail construction. This lack of planning has resulted in some trails with design or erosion problems. Some trails traverse Riparian Reserves, sometimes paralleling and crossing fish bearing streams. Although the 1995 Medford District RMP limited OHV use to existing roads and designated trails, trails have never been formally designated and OHV users continue to create cross-country trails. Other types of recreation such as hiking, horseback riding and mountain biking have also increased in recent years. User conflicts have been reported in the area of concern and will likely continue to escalate without careful planning. In order to address these issues, the BLM needs to develop a management plan for this area in the immediate future.

# MANAGEMENT OBJECTIVES AND RECOMMENDATIONS FOR BLM-ADMINISTERED LANDS

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **HUMAN USES** | | | |
| **Economic Development** | Encourage opportunities for local contractors to compete effectively on contracts for projects in the analysis area. | 1. Promote small-scale projects in forest, range, riparian, and other resources suitable for local administration and contractors. | High |
| | Produce a sustainable timber supply and other forest commodities on Matrix lands to provide jobs and contribute to community stability. | 1. Conduct timber harvest and other silvicultural activities in that portion of Matrix lands with suitable forest lands. | High |
| | Maintain and develop opportunities for special forest products to facilitate community economic development consistent with other resource objectives. | 1. Work with local groups to develop opportunities to harvest and sell special forest products. | Medium |
| **Public Involvement** | Maintain and promote contacts with local groups, landowners, community leaders, tribal and public agencies to facilitate continuing dialogue on the management of public lands in the West Bear Creek Watershed Analysis Area. | 1. Maintain and expand contacts with local groups. | High |
| | Provide opportunities for public and private entities to exchange information and develop consensus concerning land management actions within the analysis area, and to enhance awareness of local public concerns and issues affecting management of the analysis area's ecosystem. | 1. Utilize local avenues of communication, such as the *Ashland Daily Tidings* and *Medford Mail Tribune*, local newsletters and bulletin boards, and the Bear Creek Watershed Council's announcements.<br>2. Identify and incorporate tribal representation into all public involvement, and keep them informed of land management activities in the analysis area. | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Archaeology** | Assess archaeological sites to determine their scientific and heritage values and protect or recover those values as necessary. | 1. Conduct a Class III field inventory of the 10 acres of BLM lands included in the Rich Gulch National Register site.<br>2. Conduct a Class III field inventory of the additional 87 acres of BLM lands included in the Jacksonville Woodlands.<br>3. Work through partnerships with Southern Oregon University and the Southern Oregon Historical Society and other local groups to promote appreciation and understanding of the analysis area's cultural resources.<br>4. Define the types of historic and American Indian archaeological sites that are likely to occur within the analysis area. | High<br>High<br>High<br>Medium |
| | Conserve and protect archaeological/historical sites within the analysis area. | 1. Use careful land use planning to avoid impacts to these resources.<br>2. Monitor resources to control threats (such as erosion, vandalism) to them. | High<br>Medium |
| | Consider the concerns of Native American groups regarding cultural resources, including traditional cultural properties, within the watershed. | 1. Consult concerned Native American groups early in the planning stages of any project in the analysis area. | High |
| **Transportation** | Manage the transportation system to serve the needs of the users and meet the needs identified under other resource programs. | 1. Implement the Transportation Management Plan (TMP).<br>2. Implement Transportation Management Objectives (TMOs) for individual roads.<br>a. Maintain the road closure system.<br>b. Maintain all roads for the target vehicles and users.<br>c. Provide for initial fire suppression access.<br>d. Maintain a safe transportation system by removing hazards (e.g., hazard trees). | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Transportation** | (Continued)<br>Maintain a transportation system (including trails) that meets the Aquatic Conservation Strategy and Riparian Reserve objectives.<br><br>Landings and skid roads are not part of the transportation system but should be maintained to meet the Aquatic Conservation Strategy and Riparian Reserve Objectives. | (Continued)<br>1. Implement the Northwest Forest Plan Standards and Guidelines for Roads Management (USDA and USDI 1994a:C-32-33).<br>2. Follow the Best Management Practices for Roads in the Medford District Resource Management Plan (USDI, BLM 1995a:155-165).<br>3. Assess all roads and trails, especially in Riparian Reserves, and identify those in unstable and slide-prone areas, those with potential erosion/drainage problems, and those that are encroaching on a stream channel. Update the TMOs based on the findings.<br>4. Develop and implement plans for decommissioning, obliterating, upgrading (i.e., improve drainage, surface and stabilize) or rerouting the roads identified in recommendation #3 to protect Riparian Reserves, stream channels and water quality and meet TMOs. Replant obliterated road corridors to native tree and other native plant species.<br>5. Prioritize watershed restoration projects for roads and trails in Riparian Reserves and areas where roads accelerate landslides and erosion, especially where they contribute large amounts of sediment to streams.<br>6. Minimize soil compaction due to existing roads or skid trails in meadows and wetlands by decommissioning or obliterating roads and ripping skid trails. Where it is not feasible to close these roads, they should be improved to restrict traffic to the road prism.<br>7. Close natural surface roads during the wet season.<br>8. Maintain a minimum of four inches of rock surfacing on all BLM-maintained roads open for administrative access during the wet season.<br>9. Provide vegetative cover (native grass and conifers) on natural surface roads that are closed year-round.<br>10. Ensure that road stream crossings and cross drains are functioning as designed, especially following major storm events. Replace culverts that are improperly designed.<br>11. Minimize any increases in road mileage. | High<br>High<br>High<br>High<br>High<br>High<br>High<br>High<br>High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Transportation** | (Continued) | (Continued)<br>12. Use an interdisciplinary team to perform a project level, site-specific analysis for any proposed road or trail construction. Avoid new road construction, landings, or trails within Riparian Reserves, wetlands, and unstable areas unless approved by an interdisciplinary team that includes a fisheries biologist, hydrologist, and soil scientist.<br>13. Maintain a natural stream bed for fish passage wherever feasible and economical.<br>14. Identify skid roads and landings that are not critical for future management activities and decommission or obliterate them. Skid roads and landings in Riparian Reserves or unstable areas should be the highest priority for removal. | High<br>High<br>High |
| | Maintain or enhance current native terrestrial wildlife populations and distribution. | 1. Close roads during critical periods (generally October 15 to April 15) in subwatersheds where densities are greater than 1.5 miles per square mile of land.<br>15. Close roads that are not needed for administrative access or management activities. | High<br>High |
| | Restore land that has been taken out of production. | 1. Consider decommissioning or obliterating roads based on TMOs in order to put land back into plant production. | Medium |
| **Road Rights-of-way** | Cooperate with individuals, companies, counties, the state, and federal agencies to achieve consistency in road location, design, use, and maintenance. | 1. Maintain and implement reciprocal road right-of-way agreements.<br>2. Implement road use and maintenance agreements.<br>3. Evaluate and provide road right-of-way grants.<br>4. Obtain road easements for the public and resource management.<br>5. Work with other parties to stabilize roads and remove unneeded roads. | High<br>High<br>High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Other Rights-of-way and Authorizations** | Coordinate with individuals, companies, nonprofit groups, counties, state, and other federal agencies on all inquiries/applications for non-road rights-of-way, leases, permits, and exchanges on federally managed lands. | 1. Review each request on its own merits.<br>2. Respond to all requests in a timely manner.<br>3. Ensure consistency, fairness, and legal/environmental compliance in all decisions.<br>4. Monitor implementation of rights-of-ways and authorizations. | High<br>High<br>High<br><br>High |
| **Grazing** (Although there are not currently any active grazing allotments on federal land, certain objectives and recommendations would apply if any allotments were to become active.) | Manage livestock in a manner that maintains or improves Riparian Reserves to meet the goals of the Aquatic Conservation Strategy. | 1. Stress the importance of properly functioning riparian areas in the issuance of grazing authorizations.<br>2. Implement Best Management Practices (USDI, BLM 1995:172) and the Northwest Forest Plan (USDA and USDI 1994a:C33-34) to ensure movement toward land use objectives. | High<br><br>High |
| | Continue to provide livestock forage on designated allotments to meet societal needs, without compromising the ecological integrity of the uplands. | 1. Develop management strategies in consultation with the permittee to resolve resource conflicts that arise.<br>2. Update allotment plans as needed.<br>3. Control noxious weeds.<br>4. Maintain a list of vacant allotments, including specific management constraints and concerns, for future inquiries. | High<br><br>High<br>High<br>Medium |
| **Minerals** | Continue to coordinate with individuals, companies, counties, state, and other federal agencies on all inquiries/applications for mineral exploration and development. | 1. Respond to all inquiries/applications in a timely manner. | High |
| | Rehabilitate areas disturbed due to past mineral activity. On disturbed sites, ensure public safety and enhance other resources values such as riparian or fisheries habitat. | 1. Evaluate and prioritize known disturbed areas for rehabilitation.<br>2. Develop rehabilitation plans including a budget for targeted areas. Do this through an interdisciplinary effort.<br>3. Implement plans in a timely manner. | Medium<br>Medium<br><br>Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| | (Continued)<br>Provide for federal and public use of mineral materials consistent with National Environmental Policy Act (NEPA) requirements. | 1. Monitor pit development use during extraction.<br>2. Coordinate with local watershed councils and state agencies in developing new rock sources in the analysis area.<br>3. Prepare, or where existing, update long-term rock quarry management plans to ensure quality rock material is economically available for the future.<br>4. Develop mineral sources as necessary for public use | High<br>Medium<br>Low<br>Low |
| | Reduce sediments and pollutants from rock quarries. | 1. Avoid developing rock quarries in Riparian Reserves.<br>2. Rehabilitate abandoned rock sources to reduce sediments and pollutants. | High<br>Medium |
| **Recreation** | Maintain dispersed recreational opportunities. Utilize public input for planning priorities. | 1. Continue to encourage dispersed recreational opportunities that are compatible with other resource values within the analysis area.<br>2. Implement Off-Highway Vehicle designations contained in the Medford District Resource Management Plan. The possibility of future OHV facilities (parking areas, staging areas, and signing), will be analyzed and determined as part of the John's Peak OHV plan EIS, which will be started after this watershed analysis is complete. | High<br>High<br>High |
| **Unauthorized Use** | Minimize and/or reduce unauthorized use including dumping on BLM-managed lands. | 1. Continue coordination with state/county agencies to ensure that resource needs on adjacent public lands are considered and accommodated in private actions. Utilize law enforcement resources when appropriate.<br>2. Review and prioritize backlog cases and take steps to resolve in a timely manner.<br>3. Consider restricting access to areas such as Anderson Butte in order to prevent illegal dumping. | High<br>Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **EROSION PROCESSES** | | | |
| **Erosion** | Protect active and potentially active landslides and severely eroding areas. | 1. Designate Riparian Reserves to include unstable and potentially unstable landslides. Buffer unstable and potentially unstable landslide areas from management activities that could cause further instability. The size of the buffer will be based on site specific analysis to ensure further movement does not occur.<br>2. Rehabilitate active landslides and eroded terrain that contribute sediments to streams by planting appropriate native species, installing retaining structures or other stabilizing material.<br>3. Inventory all BLM-administered unstable lands to identify and prioritize potential restoration projects.<br>4. Avoid regeneration harvest treatments in steep, unstable sideslopes adjacent to Riparian Reserves. | High<br>High<br>High<br>High<br>High |
| **SOIL PRODUCTIVITY** | | | |
| **Soil Productivity** | Minimize the effects of fire to the soil. | 1. Avoid prescribed burning in areas prone to severe erosion and/or landslides.<br>2. Implement cool prescribed burns to maintain 50 percent duff and litter. Consider aspect, slope steepness, soil depth, and duff/litter cover. | High<br>High |
| | Minimize soil productivity losses due to compaction. | 1. Limit tractor skid roads to less than 12 percent of the harvest area with less than 6 percent loss in soil productivity.<br>2. Accomplish skidding when soil moisture levels are low (less than 15 percent) in areas with fine-textured soils or areas that have fine-textured soils with high rock content where mitigation efforts are difficult. Skidding could be accomplished during the winter when a minimum 12 inch snowpack exists and temperatures are below freezing the entire day. | High<br>High |
| **Soil Productivity** | Minimize loss of topsoil. | 1. Maintain a vegetative cover on the soil across the landscape throughout most of the year.<br>2. Minimize and mitigate bare soil areas caused by logging, road building, burning, and overgrazing. | High<br>Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **PLANT SPECIES AND HABITAT** | | | |
| **Non-Native Plant Species and Noxious Weeds** | Prevent or discourage the spread of non-native plant species and noxious weeds. Prevent or discourage any increase in abundance of these species where they currently exist in the analysis area. | 1. Emphasize prevention activities:<br>a. Minimize ground disturbing activities in the analysis area.<br>b. Use native species from local gene pools when plant materials are needed for project use. If the native species are unavailable or unsatisfactory, use non-invasive or non-persistent non-native species.<br>c. Clean vehicles and equipment after being in known noxious weed infestation areas.<br>d. Clean vehicles and equipment prior to site disturbance and prior to arrival at project area to avoid spreading noxious weeds. | High |
| | | 2. Use integrated pest management and appropriate research recommendations for control and/or eradication of noxious weeds. (See recommendations for noxious weed prevention listed under Vegetation). | High |
| | | 3. Continue cooperation with Oregon Department of Agriculture for species identification and tracking. | High |
| | | 4. Promote cooperation with local landowners and other government agencies. | High |
| | | 5. Use grazing systems and best management practices designed to encourage native grasses and discourage non-native annual grasses on upland ranges. | Low |
| | | 6. Increase public awareness of noxious weed species and their management. | Medium |
| | | 7. When native seed is not available, consider the use of sterile and/or adapted competitive grass species on disturbed sites to prevent the encroachment of noxious weed species, especially on low elevation sites. These grasses should improve nutrient cycling and reduce noxious weed seeds in the soil. As appropriate, convert these sites to native species. | High |
| | | 8. In areas where nonnatives are established, begin restoration efforts. Plant native seedlings. | Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Special Status Plant Species and Habitats** | Manage special status plant species and their habitats so as not to contribute to the need to list as threatened or endangered with the U. S. Fish and Wildlife Service and manage federally listed plants and their habitat so as not to jeopardize their continued existence. | 1. Mitigate impacts of management activities to special status and federally listed plants.<br>2. Monitor impacts of management activities and effectiveness of mitigation measures on special status and federally listed plants.<br>3. Survey the entire analysis area for special status and federally listed plant occurrence.<br>4. Develop and implement conservation strategies for Federal listed, candidate, and Bureau sensitive plant species.<br>5. Work with other agencies, universities, and private groups on monitoring and research projects for special status and federally listed plants. | High<br>High<br>Medium<br>Medium<br>Medium |
| | Maintain and enhance special status and federally listed plant populations, habitats, distribution and viability. | 1. Identify and map potential habitat for special status and federally listed plants found in the analysis area.<br>2. Identify important habitat characteristics of special status and federally listed plants found in the analysis area and design management activities that will duplicate these characteristics.<br>3. Monitor special status and federally listed plant populations to gain data on biology, phenology, demography, and ecology. | Medium<br>Medium<br>High |
| | Preserve, protect, and restore species composition and ecological processes of natural plant communities. | 1. Control noxious weeds and other exotic species.<br>2. Develop a sustainable and economical local native seed source for future reseeding efforts.<br>3. Use, when available, native species for all vegetation and revegetation projects.<br>4. Avoid the use of native species from non-local sources that may be a threat to local genetic diversity. | High<br>High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Survey and Manage Plant Species and Habitats** | Maintain and enhance survey and manage populations, habitats, distribution and viability. | 1. Implement survey protocols and management recommendations as they are developed. | High |
| | | 2. Maintain adequate down coarse woody material, an important habitat component for survey and manage fungi and bryophytes. | High |
| | | 3. Minimize soil compaction and humus layer disturbance, important site characteristics for survey and manage fungi. | High |
| | | 4. Monitor known sites to assess compliance with management guidelines and evaluate impacts of management actions. | High |
| | | 5. Monitor populations of survey and manage species to address identified data gaps. | Medium |
| **VEGETATION** | | | |
| **Seedlings through Poles, Mid-Seral, and Mature/Old Growth Vegetation Classes** | Increase growth, quality, and vigor of individual trees to prevent mortality of additional trees. Manage the stocking level of all tree species in the Interior Valley Zone. | 1. Reduce timber stand densities when the stands have a relative density index of 0.55 or greater by using appropriate silvicultural prescriptions to decrease the number of trees per acre (or basal area), to a relative density index of approximately 0.30 to 0.40. | High |
| | | 2. Manage for species composition by aspect (pine on south, west and some east aspects; Douglas-fir on east and north, etc.). | High |
| | | 3. Use pruning as an option for improving wood quality in fast-growing pole stands. | Low |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Seedlings through Poles, Mid-Seral, and Mature/Old Growth Vegetation Classes** | Design and develop a diverse landscape pattern and contiguous areas of multi-layered, late-successional forest (timber stands with diversified stand structure in regard to tree height, age, diameter classes, and species composition through uneven-aged management) over time. To meet the retention requirement on federal forest lands (USDA and USDI 1994a:C-44), no less than 15 percent would be in a late-successional class (Appendix I). Additional late-successional stands will be present outside of Riparian Reserves and areas of connectivity, most likely as isolated pockets of refugia. The remainder of the forest lands would be in earlier stages of seral development. | 1. Prescribe silvicultural treatments that promote contiguous areas of mature and late-successional forest land.<br>2. Use single tree selection, group selection, irregular uneven-aged and intermediate cutting treatments (thinning and release) methods, in combination or singly, when necessary to create diversified stand structure of varying seral stage development and create late-successional stand characteristics.<br>3. Commercial thin even-aged, single-story canopy stands that are within the designated 15 percent late-successional retention areas.<br>4. Consider selective harvest where dwarf mistletoe infestations have killed moderately sized patches of trees within the retention areas. | High<br>High<br>High<br>High |
| | Treat low elevation pine stands selected to meet the 15 percent late-successional retention requirement as soon as possible to restore pine species as the dominant species. | 1. Use the single tree selection and group selection methods to establish pine species regeneration on dry, ponderosa pine sites. Douglas-fir should be the species targeted for harvest from these sites.<br>2. Create open park-like pine stands over time that have diverse stand structure (many different age classes and canopy layers). | High<br>High |
| | Create openings and suitable seedbeds to promote the establishment and growth of pine species (especially sugar pine), incense cedar, and Douglas-fir. Increase the species composition of these species in forest stands where they are under represented. | 1. Use the group selection method to create openings of 0.25 to 2.0 acres. Approximately 5 to 20 percent of the commercial forest lands would receive the group selection method of harvest with a random pattern of group distribution across the landscape.<br>2. Create favorable seedbed conditions for ponderosa pine through prescribed burning or other methods that would reduce the thickness of the soil duff layer, especially around the pine trees. Plant trees in the openings to ensure adequate stocking of pine species. | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
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| **Seedlings through Poles, Mid-Seral, and Mature/Old Growth Vegetation Classes** | Assure survival of individual trees with late-successional characteristics by reducing vegetation competition in second growth timber stands. This also preserves genetic material. | 1. Reduce competition in Matrix lands by removing second growth trees that surround trees with late-successional characteristics. Create an approximate 25-foot crown space between the old tree and the remaining second growth trees. Cut only trees that are not associated (crowns entwined) with the late-successional tree. | High |
| | Design silvicultural prescriptions to manage dwarf mistletoe infestations (for Matrix lands, but may be applied to late-successional areas). | 1. Use selection method, pruning, and prescribed burning methods to control the rate and intensity of the parasite. Keep the mistletoe in draws and off of ridges. | High |
| | Reduce the fire hazard of the timber stands by decreasing the ladder fuels while meeting the needs identified under other resource programs (for Matrix lands, but may be applied to late-successional areas). | 1. Decrease the ladder fuels in forest stands by pre-commercial thinning dense patches of suppressed tree regeneration and shrub species, and the pruning of tree limbs. These treatments should eliminate fire fuels to a height of 6 to 12 feet above ground level. Cut tree limbs that extend into the pruning height area.<br>2. Form a mosaic of vegetative patterns by leaving untreated patches of vegetation scattered throughout the landscape. | High<br><br>High |
| | Retain at least 15 percent of all project areas, distributed throughout the landscape in an untreated condition. Untreated areas should be a minimum of 2.5 acres in size and can be in any combination of vegetation condition classes. | 1. Use landscape design to maintain designated patches of untreated vegetation in strategic locations (e.g., Riparian Reserves; critical habitat; wildlife corridors; areas between existing tree plantations, shrublands, woodlands, etc.). | High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
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| **Seedlings through Poles, Mid-Seral, and Mature/Old Growth Vegetation Classes** | Provide for well distributed coarse woody material (CWM is any large piece of woody material on the ground having a diameter greater than 4 inches and a length greater than 39 inches) across the landscape for maintaining the ecological functions of the species dependent on coarse wood (USDI, BLM 1994). Protect the largest coarse woody material already on the ground from management activities to the greatest extent possible. | 1. Leave a minimum of 120 linear feet of class 1 and 2 logs per acre greater than or equal to 16 inches in diameter at the large end and 16 feet in length in regeneration harvest areas as prescribed in the Standard and Guidelines for CWM listed in the Northwest Forest Plan (NFP) (USDA and USDI 1994a; USDI, BLM 1994). | High |
| | | 2. Modify amounts of CWM in areas of partial harvest to reflect the timing of stand development cycles that provide for snags and subsequent CWM from natural suppression and overstocking mortality. Assess the advantages of treatment to improve habitat conditions beyond natural conditions. The amount of CWM to leave should fall within a range of the average natural distribution. For projects in the analysis area, no less than 15 to 20 percent ground cover of CWM or less than 4.5 tons/acre will be acceptable. Smaller log pieces may be counted when they meet designated standards (USDI, BLM 1996). Leaving green trees and felling to provide a source of CWM well distributed across the landscape after harvesting should be part of the partial harvest prescription. | High |
| | | 3. Exceed the standards and guidelines of the NFP for CWM where forest stands are experiencing mortality and excess large CWM (16 inches or greater in diameter at the large end) is available. Girdle large diameter green trees in healthy stands to provide large diameter CWM for wildlife habitat and/or soil productivity. | High |
| | | 4. Perform surveys to determine average amounts of coarse woody material over the landscape for the commercial timber land base. | High |
| | | 5 Leave all trees that are providing shade for CWM that is 20 inches in diameter at the small end and a minimum of 8 feet long. | High |
| | | 6. Recruit CWM levels gradually over time in partial harvest areas that are appropriate for the site (for each respective vegetation zone). It may take two to three stand entries to acquire desired amounts of CWM especially in regard to large end log diameter requirements. | Medium |
| | | 7. Avoid consumption of CWM during prescribed burning activities. | Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
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| **Early Seral and Seedlings Vegetation Classes** | Enhance structural diversity of existing, young even-aged forest stands. | 1. Enhance the structural diversity of these vegetation classes by precommercial thinning treatments at staggered intervals and favoring trees of different heights and species at the time of treatment.<br>2. Perform release treatments as needed. | Medium<br>Medium |
| **Hardwood Vegetation Class** | Maintain or improve the natural functions and processes of the native grass/oak woodlands plant associations where appropriate. | 1. Manipulate vegetation species as necessary to maintain the natural functions and processes of the native grass/oak woodland plant associations.<br>2. Discourage high stocking densities of conifers by using manual treatments and prescribed burning.<br>3. Manage the abundance of shrub and noxious weed species.<br>4. Reduce the density of hardwoods to increase water and nutrient availability to the hardwoods for mast production where necessary.<br>5. Use prescribed burning and mechanical methods to accomplish recommendations 1 through 4.<br>6. Seed native grass species into areas of exposed, disturbed soil before noxious weeds become established. Under certain circumstances, desirable non-native grass species will be seeded (See Appendix J) where feasible. | High<br>High<br>High<br>High<br>High<br>High |
| | Introduce a younger age class into the oak woodlands. | 1. Cut suppressed and intermediate crown class trees to induce sprouting. Manage the sprout clumps to favor growth of the dominant sprouts. After the vigor is restored to the oak trees, acorn crops should provide for more natural regeneration.<br>2. Plant oak trees where appropriate. | Medium<br>Low |
| **Shrub Vegetation Class** | Maintain the integrity of the shrublands. | 1. Manage the density and species composition of the shrubs.<br>2. Concentrate density reduction efforts on the extremely dense shrublands on the south facing slopes and where there is big game habitat.<br>3. Control or retard the spread of non-native species, especially noxious weeds (see Non-native Noxious Weed recommendations). | High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
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| **Shrub Vegetation Class** | (Continued) | (Continued)<br>4. Use prescribed burning and mechanical methods to accomplish recommendations 1 through 4.<br>5. Seed native grass species into areas of exposed, disturbed soil before noxious weeds become established. Under certain circumstances, desirable non-native grass species will be seeded where feasible (see Appendix J).<br>6. Manage tree species to maintain the dominance of the desired shrub species. | High<br>High<br>Medium |
| **Grass Vegetation Class** | Maintain and/or improve the species composition of the native grasslands. | 1. Treat tree and shrub species with prescribed fire to maintain the dominance of native grasses.<br>2. Seed native grasses on recently disturbed areas to prevent the establishment of noxious weeds. Under certain circumstances, desirable non-native grass species will be seeded where feasible (see Appendix J).<br>3. Control or retard the spread of non-native species especially noxious weeds (see Non-native Noxious Weed recommendations).<br>4. Develop a native grass propagation program for grasses found in the analysis area. | High<br>High<br>High<br>Medium |
| **FIRE AND AIR QUALITY** | | | |
| **Safety** | Provide for firefighter and public safety in all fire management activities (including wildfires) across the landscape. This objective is mandated by the Department of Interior as the first priority in every fire management activity (USDI and USDA 1995). | 1. Treat high and moderate hazard areas around the rural interface areas. Reduce canopy closures, ground and ladder fuels in order to increase protection of private lands and structures. Treatment of fuels on private lands within the rural interface is mostly dependent on factors outside the control of the BLM.<br>2. Retain fire access routes based on transportation management objectives. These routes are needed to allow quick response times to wildfire starts and escape routes for the public and firefighters.<br>3. Coordinate with adjacent private landowners to treat hazardous fuels on private lands. | High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
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| **Resource Protection** | Promote long-term resistance of the lower and mid-elevation areas to stand replacement wildfires by reducing the fuel hazard. | 1. Develop a landscape strategy to reduce high and moderate fuel hazard. Coordinate this effort with federal, state, county, city, and private landowners.<br>2. Treat areas of continuous high and moderate hazard fuels in order to help reduce the size and intensity of wildfires. High priority areas would be adjacent to the rural interface area and adjacent to high values at risk (listed in Table 20, Current Condition section). Treatments should include thinning of overstocked timbered stands and the reduction of ground and ladder fuels in both commercial and noncommercial timber lands. Utilize mechanical and manual methods in conjunction with prescribed burning to achieve these objectives.<br>3. Utilize prescribed burning to maintain plant communities such as grasslands and oak woodlands. Fire will not only maintain these communities but also reduce the fuel hazard of these areas. | High<br>High<br>High |
| **Air Quality** | Minimize adverse impacts to air quality from fire management activities and wildfires. | 1. Conduct fire management activities in compliance with all federal, state, and local smoke management regulations.<br>2. Monitor particulate matter levels produced from fire management activities and wildfires to further refine smoke emission mitigation practices. | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **TERRESTRIAL WILDLIFE SPECIES AND HABITAT** | | | |
| **Terrestrial Wildlife Species and Habitat** | Maintain or enhance current native terrestrial wildlife populations. | 1. Develop and maintain an appropriate quantity and distribution of seral stages of the various plant communities found in the analysis area.<br>2.. Identify, protect, and where appropriate, enhance the special habitats identified in the Medford District Resource Management Plan (USDI, BLM 1995), such as caves/mines, talus, wetlands, and meadows.<br>3. Maintain adequate numbers of snags and amounts of coarse woody material (see Vegetation recommendations) for those species that require these special habitats for breeding, feeding, or sheltering.<br>4. Maintain or improve dispersal conditions within the analysis area and between adjacent watersheds.<br>5. Implement the Transportation recommendations that are specific to terrestrial wildlife.<br>6. Restore oak/pine woodlands through prescribed fire and appropriate silvicultural methods.<br>7. Rehabilitate/rejuvenate shrublands by using prescribed fire or other efficacious method.<br>8. Restore native grasslands. | High<br>High<br>High<br>High<br>High<br>High<br>High<br>High |
| | Ensure management activities do not lead to the listing of Bureau Sensitive or Bureau Assessment species as threatened or endangered. | 1. Inventory for Bureau Sensitive and Assessment species suspected but not known to occur in the analysis area.<br>2. Protect, maintain, or improve habitat conditions for those Bureau Sensitive and Assessment species found in the analysis area. | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **HYDROLOGY** | | | |
| **Hydrology** | Maintain and enhance instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows (Aquatic Conservation Strategy Objective #6; USDA and USDI 1994a:B-11). | 1. Follow Transportation recommendations.<br>2. Manage vegetation within the transient snow zone of the Wagner Creek, Anderson Creek, Coleman Creek, and Griffin Creek analysis subwatersheds to minimize large openings. Analyze site-specific projects for cumulative watershed effects on a drainage area (generally less than 6,000 acres) basis. Assess watershed conditions (e.g., riparian and stream channel condition, geomorphic landform, slope stability, precipitation, and compacted area) and reference conditions (including natural variability) to determine the percent hydrologic recovery that is appropriate for each drainage area. Use the following crown closure percentages (based on a combination of hardwoods and conifers), listed by tree species, and aspect, to represent full hydrologic recovery when conducting a site specific analysis.<br>Series / Aspect / Canopy Closure (%)<br>Pine / south, west / 20-30<br>Pine / north, east / 20-30<br>Douglas-fir / north / 50-70<br>Douglas-fir / south, west, east / 30-50<br>These canopy closures reflect reference conditions when forest fires were more frequent and other biotic agents such as insects, disease, and wind-throw were not controlled. The range of natural variability for vegetation in the West Bear Creek Watershed Analysis Area includes canopy closures that would be greater than and less than full hydrologic recovery. A range of percentages would be more accurate to represent changing forest conditions over time. These canopy closures should not be misinterpreted as the canopy closures that must be maintained by silvicultural prescriptions. Silvicultural prescriptions may result in some of these percentages being as much as 10 to 15% lower for short periods of time within a portion of a forest zone. Use the appropriate range of natural variability to manage transient snow zone canopy closures. | High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Hydrology** | (continued) | (continued)<br>3. Reduce upland fire hazard to minimize potential for catastrophic wildfires.<br>4. Encourage spring protection and minimize surface/groundwater diversions on public lands to ensure attainment of the Aquatic Conservation Strategy Objectives.<br>5. Require compliance with State regulations and permit limitations for water diversions, ditches, and pipelines on public lands. | High<br>High<br><br>High |
| | Maintain and enhance the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands (Aquatic Conservation Strategy Objective #7; USDA and USDI 1994a:B-11). | 1. Follow interim Riparian Reserve widths identified in the Northwest Forest Plan Standards and Guidelines for wetlands greater than one acre (USDA and USDI 1994a:C-30-31). Designate Riparian Reserve widths of 100 feet slope distance from the outer edge of wetlands less than one acre.<br>2. Follow Transportation recommendations that pertain to meadows and wetlands. | High<br><br>High |
| **STREAM CHANNEL** | | | |
| **Stream Channel** | Maintain and enhance the natural channel stability by allowing streams to develop a stable dimension, pattern, and profile such that, over time, channel features are maintained and the sediment regime under which aquatic ecosystems evolved is maintained and enhanced. | 1. Follow Transportation recommendations.<br>2. Follow Riparian Areas recommendations. | High<br>Medium |
| | Maintain and enhance the physical integrity of the aquatic system, including stream banks and bottom configurations (Aquatic Conservation Strategy Objective # 3; USDA and USDI 1994a:B-11). | 1. Promote growth of conifer and hardwood trees within Riparian Reserves, using silvicultural methods if necessary, to reach late-successional characteristics (where capable) for future large wood recruitment (see Riparian section).<br>2. Minimize activities that adversely affect streambanks and riparian vegetation. | High<br><br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **Stream Channel** | (Continued) | (Continued)<br>3. Maintain or enhance the streams' ability to dissipate the energy from high stream flows. Assess need for energy dissipators in stream channels and consider adding energy dissipators, such as large woody material or boulders, and riparian vegetation where appropriate. | Medium |
| | Maintain and enhance the sediment regime under which the aquatic ecosystem evolved (Aquatic Conservation Strategy Objective # 5;USDA and USDI 1994a:B-11). | 1. Follow Transportation and Erosion Processes recommendations.<br>2. Reduce the potential for altering the timing, magnitude, duration, frequency, and spatial distribution of peak flows (see Hydrology section).<br>3. Assess for eroding stream banks and stabilize where appropriate. | High<br>High<br>Medium |
| **WATER QUALITY** | | | |
| **Water Quality** | Maintain and enhance water quality necessary to support healthy riparian, aquatic, and wetland ecosystems (Aquatic Conservation Strategy Objective # 4; USDA and USDI 1994a:B-11). Achieve the principal water quality objectives in the West Bear Creek Watershed Analysis Area by increasing summer flows and reducing summer stream temperatures, sedimentation, and bacteria. | 1. Apply appropriate Best Management Practices (BMPs) (USDI, BLM 1995:149-177) to minimize soil erosion and water quality degradation during management activities.<br>2. Follow Hydrology recommendations 4 and 5 to increase summer flows.<br>3. Plant or maintain native species (from local genetic stock) in riparian areas and wetlands to provide adequate stream shading.<br>4. Protect riparian vegetation that provides stream shading as specified in the Riparian Areas recommendations.<br>5. Follow Transportation and Erosion Processes recommendations to reduce stream sedimentation.<br>6. Survey and stabilize actively eroding landslide areas that are contributing sediment to streams.<br>7. Encourage the Bear Creek Watershed Council and Talent Irrigation District to consider converting the McDonald Ditch to an underground pipeline for the purpose of delivering significantly cooler water to Wagner Creek. | High<br>High<br>High<br>High<br>High<br>High<br>High |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **RIPARIAN AREAS** | | | |
| **Riparian Reserves** | Decrease fragmentation within Riparian Reserves and maintain or enhance connectivity between Riparian Reserves. | 1. Follow Transportation recommendations.<br>2. Determine weaknesses in connectivity and plan management activities that enhance riparian habitat. | High<br>Medium |
| | Give the highest priority for restoration to Riparian Reserves most impacted by road development and/or roads located in unstable upland and landslide bench terrain. | 1. Follow the interim Riparian Reserve widths outlined in the Northwest Forest Plan (USDA and USDI 1994a:C-30-31).<br>2. Change or discontinue management activities that may prevent or retard restoration and/or enhancement of Riparian Reserve habitat.<br>3. Use an interdisciplinary process to design site-specific Riparian Reserve treatments if necessary to maintain and enhance riparian vegetation condition. | High<br>High<br>High |
| | Maintain and enhance the species composition and structural diversity of plant communities in riparian areas and wetlands. Supply amounts and distribution of large woody debris sufficient to sustain physical complexity and stability. Protect ground water flow. Protect riparian-dependent special status species. | 1. Give Riparian Reserves located adjacent to fish-bearing streams the highest priority for restoration to late-successional characteristics. Implement silvicultural treatments (density management) in Riparian Reserves to increase the large conifer component in fish-bearing streams, with early and mid-successional stands.<br>2. Implement silviculture treatments to reduce fire hazard especially where there are mid and-late successional conifer components within the Riparian Reserves of fish-bearing streams that are at risk of damage (or elimination) due to fire. | High<br>Medium |

| RESOURCE | OBJECTIVES | RECOMMENDATIONS | PRIORITY |
|---|---|---|---|
| **AQUATIC WILDLIFE SPECIES AND HABITAT** | | | |
| **Aquatic Wildlife Species and Habitat** | Maintain viable anadromous and resident salmonid fish and other aquatic wildlife populations with individuals of all life stages throughout their habitat. | 1 Ensure that management activities on BLM-managed lands meet the Aquatic Conservation Strategy (ACS) Objectives (USDA and USDI 1994a:B-11), and the management actions/direction in the Medford BLM Resource Management Plan (USDI, BLM 1995), and Best Management Practices (USDI, BLM 1995:149-177). | High |
| | Restore and protect aquatic habitat for all anadromous and resident fish and other aquatic resources. Restore and protect spatial and temporal connectivity within and between watersheds. | 1. Restore and/or diversify fish habitat and floodplain connectivity to maintain pool habitat, fish cover, spawning gravels, and bank stability. | High |
| | | 2. Promote future large wood recruitment in Riparian Reserves. | High |
| | | 3. Improve water quality and increase water quantity. Adhere to Water Quality and Hydrology recommendations. | High |
| | | 4. Avoid activities that degrade streambanks and riparian areas. Adhere to Riparian Area recommendations. | High |
| | | 5. Follow Transportation and Erosion Processes recommendations. | High |
| | | 6. Work with ODFW to make sure all irrigation ditches are screened. | Medium |
| | | 7. Work with ODFW, landowners, watershed councils to remove fish barriers. | |

# LANDSCAPE PLANNING OBJECTIVES AND RECOMMENDATIONS FOR BLM-ADMINISTERED LANDS

Recognizing that the landscape of the West Bear Creek Watershed Analysis Area is a complex web of interacting ecosystems, the watershed analysis team blended individual resource information to develop a landscape picture for BLM-administered lands. The team looked at the current condition of the terrestrial and aquatic components of the landscape and synthesized the information to formulate landscape level objectives and recommendations. These landscape level objectives and recommendations provide valuable information for planning projects and making management decisions. Map 24 shows areas across the landscape that need special consideration prior to project planning.

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **Riparian Reserves** | Maintain and enhance Riparian Reserve habitat to support well-distributed populations of native plants, invertebrate, and vertebrate riparian-dependant species, especially taking into consideration long-term plant community changes. | 1. Follow the interim Riparian Reserve widths identified in the Northwest Forest Plan (USDA and USDI 1994a:C-30-31) until site specific analysis occurs at the project level.<br>2. Follow Riparian Reserve module (USDA et al. 1997) to change boundary widths when necessary to meet management objectives.<br>3. Use an interdisciplinary process to design site-specific silvicultural treatments as needed to meet Aquatic Conservation Strategy Objectives (USDA and USDI 1994a:B-11).<br>4. Evaluate roads, skid trails, landings and OHV trails within Riparian Reserves and determine appropriate action, such as stabilize, improve drainage, decommission, etc.<br>5. Manage Riparian Reserves to improve riparian vegetation, stabilize streambanks, and reduce sediment. |

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **Unstable Areas** | Protect unstable and potentially unstable areas. | 1. Designate Riparian Reserves to include unstable and potentially unstable landslide areas.<br>2. Buffer management activities near unstable and potentially unstable landslides. The size of the buffer and extent of management activities will be based on site specific analysis. |
| **John's Peak/Timber Mountain OHV Area** | Develop a management plan for the Timber Mountain/John's Peak area to provide for OHV use as specified in the 1995 Medford District RMP. | 1. Ensure that the analysis area for the management plan is large enough to sufficiently address expanding OHV use and the associated cumulative effects.<br>2. Broaden the scope of the management plan to address different types of recreation, including hiking, horseback riding, and bicycling.<br>3. Involve adjacent landowners in the planning process.<br>4. Improve, re-locate, or decommission poorly located or designed trails with erosion problems, and trails that cross intermittent or perennial streams. |
| **Special Areas** | Manage the Holton Creek Research Natural Area to protect its resource values and to maintain its natural conditions. | 1. Follow management specified in the BLM Medford District Resource Management Plan (USDI, BLM 1995) and specific management plans as they are developed. |
| | Provide non-motorized recreational opportunities in the Jacksonville Woodlands. | 1. Remain partners with the City of Jacksonville, Jackson County, and the Jacksonville Woodlands Association in the preservation of the Woodlands through the existing cooperative agreement and the approved management plan for the Woodlands. |

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **15 Percent Late-Successional Retention Areas** | Over time, meet or exceed the 15 percent late-successional retention requirement on federal forest lands (USDA and USDI 1994a:C-44) to provide habitat to function as refugia for old-growth associated species that have limited dispersal capabilities such as fungi, lichens, bryophytes and vascular plants (see Appendix I). It must be remembered that natural succession will change tree stocking levels and size classes with time. There will be periods with more than 15 percent, and periods with less than 15 percent. | 1. Reserve late-successional stands off of ridgetops, most preferably in riparian zones.<br>2. Ensure that retained stands are distributed across the landscape, preferably in Riparian Reserves and not on ridgetops.<br>3. Identify and treat target stands to speed development of late-successional or old-growth habitat that will support a more connected network of continuous habitat than currently exists.<br>4. Treat reserve stands where necessary to maintain and create late-successional components, such as canopy cover, snags, and class I and II coarse wood (see Management Objectives and Recommendations, Vegetation, for coarse woody material amounts).<br>5. Prescribe silvicultural treatments aimed at restoring and preserving late-successional pine characteristics in pine associated stands that have been identified for retention, but are overstocked with Douglas-fir and other species. |
| **Matrix** | Maintain the isolated (landlocked) parcels of matrix land in a mature/late-successional seral stage when possible, helping to meet the 15% late-successional retention requirement. | 1. Use intermediate (commercial thinning) and selection harvest methods to achieve desired stand structure and species composition.<br>2. Consider regeneration harvest or defensible fuel profile zones (DFPZ) as an option when appropriate stand structures are retained: 16 to 25 large green trees per acre, and a minimum of 40 percent canopy closure (USDI, BLM 1995). |
| | Manage the larger, accessible parcels of matrix lands in a variety of vegetative seral stages according to Medford District Resource Management Plan (USDI, BLM 1995) guidelines. | 1. Manage by appropriate trees series zones to provide for a variety of stand structures (early through late-successional seral stages) while maintaining all native species. A variety of silviculture prescriptions can be applied. |

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **Matrix** | Provide general connectivity (along with other land use allocations such as Riparian Reserves) between late-successional reserves. | 1. Provide a renewable supply of large live trees and snags well distributed across the land in a manner that provides habitat for cavity using birds, bats, and other species. Regeneration harvest is an option when appropriate stand structures are retained, 16 to 25 large green trees per acre, and a minimum of 40 percent canopy closure (USDI, BLM 1995).<br>2. Leave a minimum of 120 linear feet of logs per acre greater than or equal to 16 inches in diameter and 16-feet long. Retain coarse woody material already on the ground and protect it from disturbance during treatment. |
| **High And Moderate Fire Hazard Areas** | Treat all vegetation condition classes in strategic locations, especially commercial forest stands, to ensure their survival from insects and fire, and enhance seral and structural development of the condition classes (see Map 20 for high and moderate fire hazard areas). | 1. Develop prescriptions that reduce fire hazard and improve vegetation health to protect natural resources or sites of cultural value from biotic disturbances (fire and wind).<br>2. Manage vegetation density of all vegetation condition classes to accomplish this objective.<br>3. Develop a landscape strategy to reduce high and moderate fuel hazard. Coordinate this effort with federal, state, county, city, and private landowners.<br>4. Create DFPZs on ridgetops in strategic areas.<br>5. Use selection silvicultural harvest methods to create or enhance the development of late-successional forests.<br>6. Treat pine series forest in the commercial base to create open park-like structure.<br>7. Target Douglas-fir stands for density management adjacent to shrublands or woodlands on south and west slopes, or on ridges that receive sunlight for most of the day. |

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **Northern Spotted Owl Critical Habitat Unit OR-75(Matrix lands)** | Provide for the intended function of CHU-OR-75 which is to provide nesting, roosting, foraging and dispersal habitat. | 1. Establish 100 acre late-successional reserves around all nest sites found in the critical habitat unit.<br>2. Minimize the loss or degradation of suitable spotted owl habitat within 0.7 miles of known spotted owl nest sites.<br>3. Ensure that projects do not downgrade suitable habitat to a function less than dispersal habitat (i.e., non-habitat), and that projects do not remove dispersal habitat. |
| **Roads of Concern** | Reduce road density and road-caused erosion, stabilize roads that are unstable, and reduce wildlife disturbance. | 1. Review roads of concern listed in Appendix K and consider stabilizing, closing, or decommissioning. |

| LANDSCAPE AREA | OBJECTIVES | RECOMMENDATIONS |
|---|---|---|
| **Transient Snow Zone** | Maintain the timing, magnitude, duration, and spatial distribution of peak streamflows within the range of natural variability. | 1. Manage vegetation within the transient snow zone of the Wagner Creek, Anderson Creek, Coleman Creek, and Griffin Creek analysis subwatersheds to minimize large openings. Analyze site-specific projects for cumulative watershed effects on a drainage area (generally less than 6,000 acres) basis. Assess watershed conditions (e.g., riparian and stream channel condition, geomorphic landform, slope stability, precipitation, and compacted area) and reference conditions (including natural variability) to determine the percent hydrologic recovery that is appropriate for each drainage area. Use the following crown closure percentages (based on a combination of hardwoods and conifers), listed by tree species, and aspect, to represent full hydrologic recovery when conducting a site specific analysis.<br>Series — Aspect — Canopy Closure (%)<br>Pine — south, west — 20-30<br>Pine — north, east — 20-30<br>Douglas-fir — north — 50-70<br>Douglas-fir — south, west, east — 30-50<br>These canopy closures reflect reference conditions when forest fires were more frequent and other biotic agents such as insects, disease, and wind-throw were not controlled. The range of natural variability for vegetation in the West Bear Creek Watershed Analysis Area includes canopy closures that would be greater than and less than full hydrologic recovery. A range of percentages would be more accurate to represent changing forest conditions over time. These canopy closures should not be misinterpreted as the canopy closures that must be maintained by silvicultural prescriptions. Silvicultural prescriptions may result in some of these percentages being as much as 10 to 15% lower for short periods of time within a portion of a forest zone. Use the appropriate range of natural variability to manage transient snow zone canopy closures. |

# DATA GAPS

This section identifies information that was not available for the West Bear Creek Watershed Analysis Area during the analysis. Items under each ecosystem element/subelement are listed in priority order if funding should become available for data collection.

## Human Uses

### *Unauthorized Use*
1. Property lines in locations where unauthorized use is suspected.

### *Transportation*
1. Road condition surveys.
2. OHV trail inventory analysis and recommendations.

### *Grazing*
1. Potential cooperative livestock related projects on private lands within the analysis area.

### *Archaeological Sites*
1. Systematic archaeological survey.
2. Formal evaluation of known archaeological sites.

## Erosion Processes
1. Field inventory and GIS mapping of all recent and active landslides and severely eroded terrain on BLM-administered lands.
2. Quantification of landslide and erosion rates accelerated by BLM-administered land (i.e., roads and clearcut harvesting) versus natural erosion rates.

## Soil Productivity
1. Duff thickness for various vegetation types within the analysis area.
2. Extent of soil productivity reduction caused by wildfire.
3. Quantification of disturbance effects on long-term soil productivity.
4. Amount of coarse woody material (by decay class) across the landscape.

## Plant Species and Habitats

### *Special Status Plant Species and Habitats*
1. Inventory of special status plants.
2. Inventory and population data of non-native plant species, including noxious weeds.
3. Demographic data on known populations.
4. Species response to management practices.

### *Survey and Manage Plant Species and Habitats*
1. Inventory of Survey and Manage lichens, bryophytes, and fungi.
2. Species distribution data.

## Forest Density and Vigor

1. Comprehensive data on drought tolerance for tree and shrub species (in bars of water tension).
2. More statistical data regarding the historic range, frequency, and distribution of vegetation over the landscape (should include all pine species, incense cedar, oak species, black cottonwood, red alder, and Oregon ash).

## Fire and Air Quality

1. Exact acreage and location of existing and past high hazard, medium hazard, and low hazard areas.
2. Data regarding the range, frequency, distribution, and interaction of insects, animals, vegetation and fire intensities.
3. Wildfire intensities and consumption rates over the landscape during differing climatic conditions through time.
4. Cultural understanding of fire use during prehistoric times.
5. Complete fire start information (e.g., location, cause, time) prior to 1969.
6. Classification of land by plant association within and outside fire regimes.
7. Utilizing above data to predict wildfire severity potential within the watershed through predictive models such as RERAP, and FARSITE.
8. Information regarding past and present trends in air quality due to fire management and wildfire activities.
9. Data regarding changes in populations of fire dependant plant and animals species.

## Terrestrial Wildlife Species and Habitats

1. Prehistoric, existing and desired relative abundance and patch size distribution of the vegetation condition classes found in the analysis area.
2. Occurrence, distribution, and population data for special status, survey and manage, and protection buffer species found in the analysis area.
3. Snag and coarse woody material abundance by vegetation condition class.

## Hydrology

1. Field surveys to identify stream categories for nonfish-bearing streams (permanently flowing or intermittent).
2. On-the-ground wetland inventory.

## Stream Channel

1. Sediment source locations in stream channels and upland areas, including roads.
2. Physical stream characteristics of stream reaches that have not been surveyed.

## Water Quality

1. Continuous summer stream temperature data for Anderson, Jackson, and Willow Creeks (this data collection is a low priority for BLM).
2. Dissolved oxygen, pH, fecal coliform, and turbidity data for Anderson and Willow Creeks (this data collection is a low priority for BLM).

## Riparian Areas

1. Amount of large woody material in riparian areas.
2. Amount, diversity, and age of riparian vegetation.

## Aquatic Wildlife Species and Habitats

1. Distribution and relative abundance of non-salmonid fish species.
2. Upper limits of fish use for salmonid species.
3. Upstream distribution and relative abundance of all native fish species.
4. Habitat requirements of non-salmonid native fish species.
5. Species composition, distribution and relative abundance of macroinvertebrates and amphibians.
6. Habitat condition including percent of shading along streams, geomorphology, pool/riffle/ratios, pool depth, and substrate composition in non-surveyed tributaries.

# MONITORING RECOMMENDATIONS

The following monitoring recommendations are made in order to gain a better understanding of the watershed processes and conditions within the West Bear Creek Watershed Analysis Area. Items under each ecosystem element are listed in priority order if funding should become available for monitoring.

## Human Uses

1. Monitor cultural resource site conditions (looting and natural deterioration),
2. Monitor cultural resource effectiveness of past survey strategies to locate sites.
3. Monitor changing public opinions, values, and expectations regarding land management issues.

### *Transportation*

1. Monitor roads to ensure that drainage structures are functioning as designed.
2. Monitor culverts on fishery streams to ensure that passage is adequate.
3. Monitor road blocks to ensure that they are effective.

## Soil Productivity

1. Survey duff thickness for various vegetation types in the analysis area prior to and after management actions.
2. Survey the analysis area for coarse woody material (CWM), especially in various ecological and vegetative types, in order to adjust amount of CWM needed across the landscape.

## Special Status Plant Species and Habitats/ Survey and Manage Plant Species and Habitats

1. Population demographic monitoring to determine species biology, life history, ecological requirements, and population trends.
2. Monitor pre and post management to determine microclimate changes and effectiveness of mitigation design.
3. Long term monitoring to determine impacts of management actions.

## Forest Density and Vigor

1. Monitor commercial forest stands for vigor by using relative density as an index.
2. Measure individual tree growth in commercial forest stands.
3. Analyze canopy closure before and after vegetation treatment.
4. Monitor amounts of coarse woody material before and after timber harvesting operations.
5. Monitor the number and quality of snags (and perhaps how the trees were killed: insects or pathogens).
6. Monitor acorn crops after oak woodland treatments.
7. Monitor the survival of individual pine trees after release treatments.
8. Measure humidity, air and soil temperatures for pre-treatment and post treatment areas across the landscape to learn the effects of timber harvest on natural regeneration establishment.

## Fire and Air Quality

1. Monitor changes in fire hazard over time as landscape fuel hazard reduction treatments are completed.
2. Monitor smoke emissions and impacts from wildfire and fuels management activities.
3. Monitor changes in populations of fire dependant plant and animal species over time.

## Terrestrial Wildlife Species and Habitat

1. Monitor site occupancy, reproductive status and reproductive success of threatened/endangered species found in the analysis area.
2. Monitor habitat use and population trend of the special status and other priority species found in the analysis area.
3. Monitor rate of recruitment/loss of snags and coarse woody material.
4. Monitor rate of seral stage change in the vegetative communities found in the analysis area.

## Hydrology

1. Monitor changes in transient snow zone openings.
2. Monitor changes in road density and soil compaction.

## Stream Channel

1. Establish permanent monitoring monuments to determine changes in channel morphology resulting from specific stream improvement projects.
2. Monitor changes in channel stability and condition by conducting periodic physical stream surveys (such as10-year intervals).

## Water Quality

1. Continue monitoring summer stream temperatures at existing sites.

## Riparian Areas

1. Assess the ability of the Aquatic Conservation Strategy and BLM Medford District Resource Management Plan's management direction to provide the anticipated level of protection to interim Riparian Reserves.
2. Monitor riparian habitat (i.e., large woody material, shading, microclimate) before and after implementing management prescriptions designed to improve riparian habitat.
3. Assess riparian species composition, age, density and health prior to and in conjunction with return intervals for timber harvest.

## Aquatic Wildlife Species and Habitats

1. Monitor changes in aquatic/riparian habitats, stream temperatures, water quality and fish populations by conducting periodic physical stream surveys and population inventories (i.e. 10-year intervals).
2. Collect baseline data on aquatic macroinvertebrate populations to determine the biotic integrity of stream habitat and trends in the analysis area.
3. Collect baseline data on amphibians such as foothill yellow-legged frog populations to determine the biotic integrity of stream habitat and trends in the analysis area.
4. In conjunction with ODFW, establish spawning surveys for steelhead and coho.
5. Establish upper limits of fish use and periodically revisit streams to see if it changes.

# RESEARCH RECOMMENDATIONS

The following research recommendations would provide additional understanding of ecosystem processes in the West Bear Creek Watershed Analysis Area. Items under each ecosystem element are listed in priority order should funding become available.

## Plant Species and Habitats

***Special Status Plant Species and Habitats***

1. Determine ecological requirements.
2. Determine the effects of micro-climate changes due to management activities on individuals and the population.

***Survey and Manage Plant Species and Habitats***

1. Determine ecological requirements.
2. Determine the effects of micro-climate changes due to management activities on individuals and the population.
3. Determine relationship of stand age to population viability.
4. Determine the forest tree density level required to sustain population viability.

## Forest Density and Vigor

1. Research the soil carbon/nitrogen ratios for various soils in the analysis area.
2. Study the available trace elements in the various soils of the analysis area and the requirements for the tree species.
3. Perform more comprehensive studies on the ecological requirements of Oregon white and California black oak to produce acorn crops, including optimum tree density (stems/acre), impact of competing vegetation (how much and which species can grow around the oaks?), and the occurrence, frequency, and intensity of fires needed to return nutrients to the soil to maintain healthy, productive oak woodlands.
4. Research longevity of conifer and hardwood trees on low elevation, drought-prone sites.
5. Determine evapotranspiration rates for endemic tree and shrub species (in inches of water).
6. Determine how many old-growth trees are needed on a per-acre basis to maintain ecosystem functions of late-successional forests.
7 Determine the area's coarse woody material requirements for maintaining site productivity.

## Terrestrial Wildlife Species and Habitat

1. Determine ecological requirements for the special status, survey and manage, and protection buffer species present in the analysis area.
2. Determine the optimum mix and distribution of seral stages of the vegetative communities found in the analysis area that would maximize the probability of persistence of all special status, survey and manage, and protection buffer species.

## Stream Channel

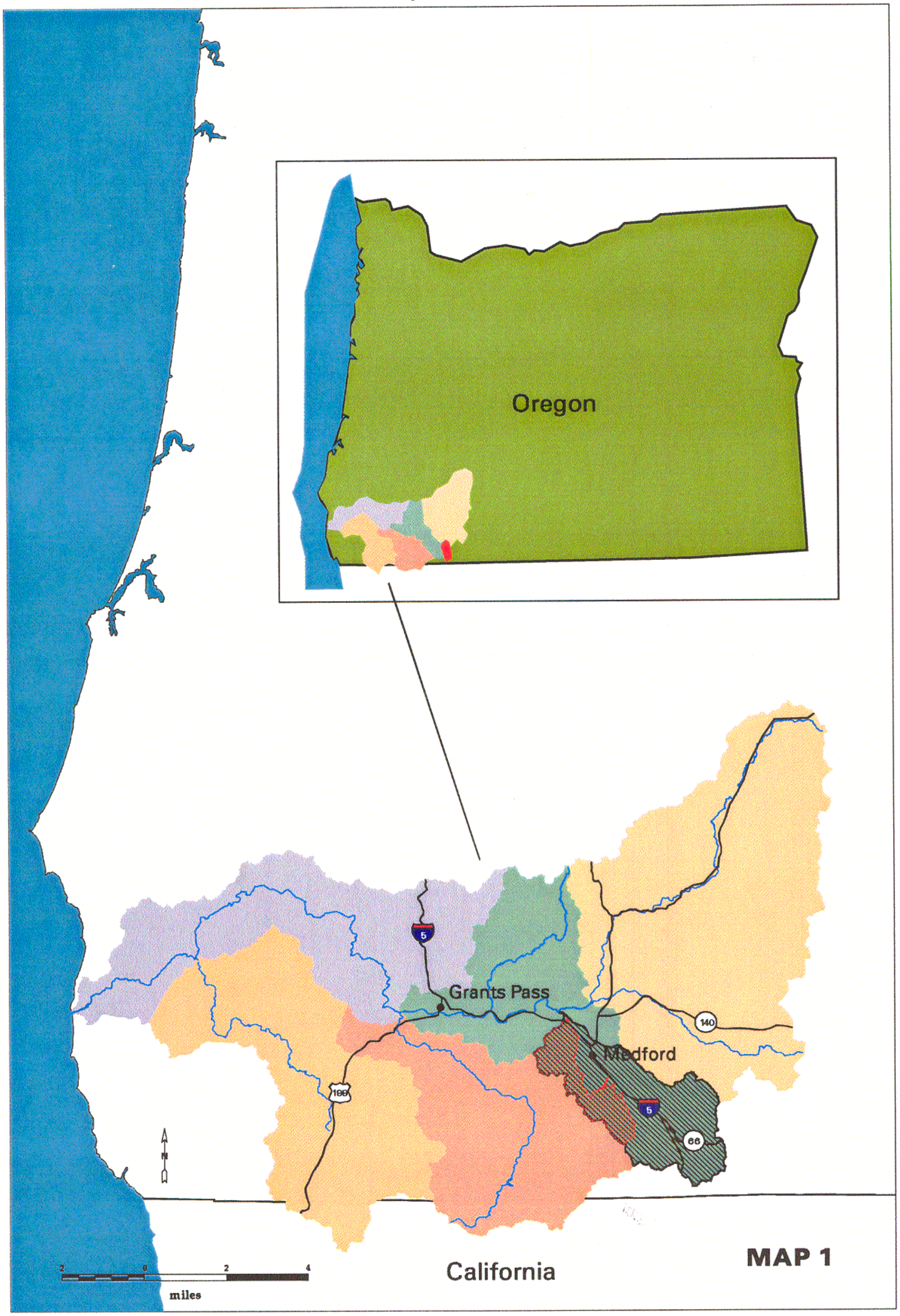
1. Determine amounts of large woody material needed in steep headwater channels.

## Aquatic Wildlife Species and Habitats

1. Determine impact of flow alteration and withdrawals on native fish habitat and populations.

# MAPS

## West Bear Creek Watershed Analysis Area
## Watershed Analysis Area Location

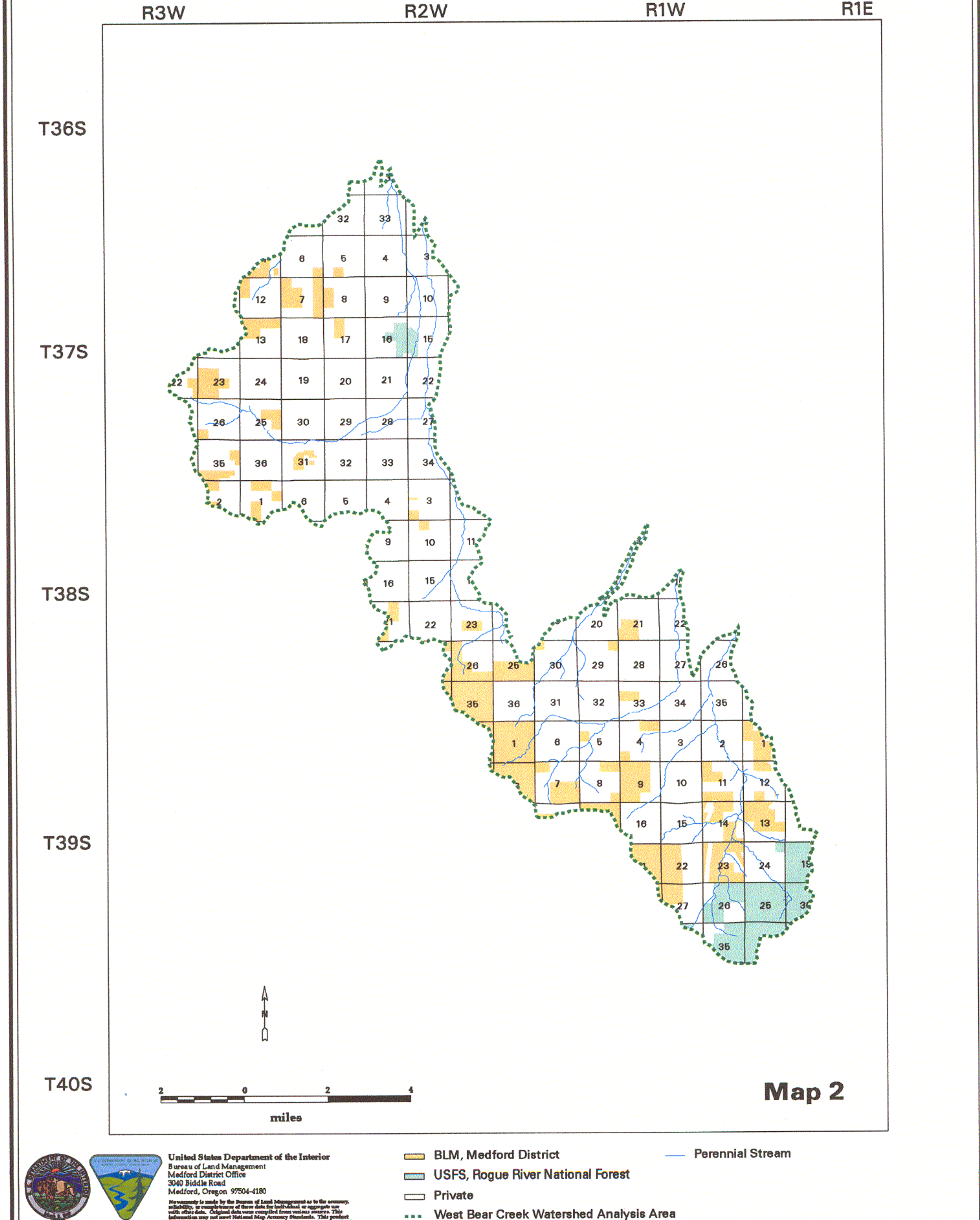



| | |
|---|---|
| Upper Rogue | Lower Rogue |
| Middle Rogue | Pacific Ocean |
| Applegate | Bear Creek Watershed |
| Illinois | West Bear Creek Watershed Analysis Area |

— Stream
— Highway

United States Department of the Interior
Bureau of Land Management
Medford District Office
3040 Biddle Road
Medford, Oregon 97504-4180

# West Bear Creek Watershed Analysis Area
## Land Ownership

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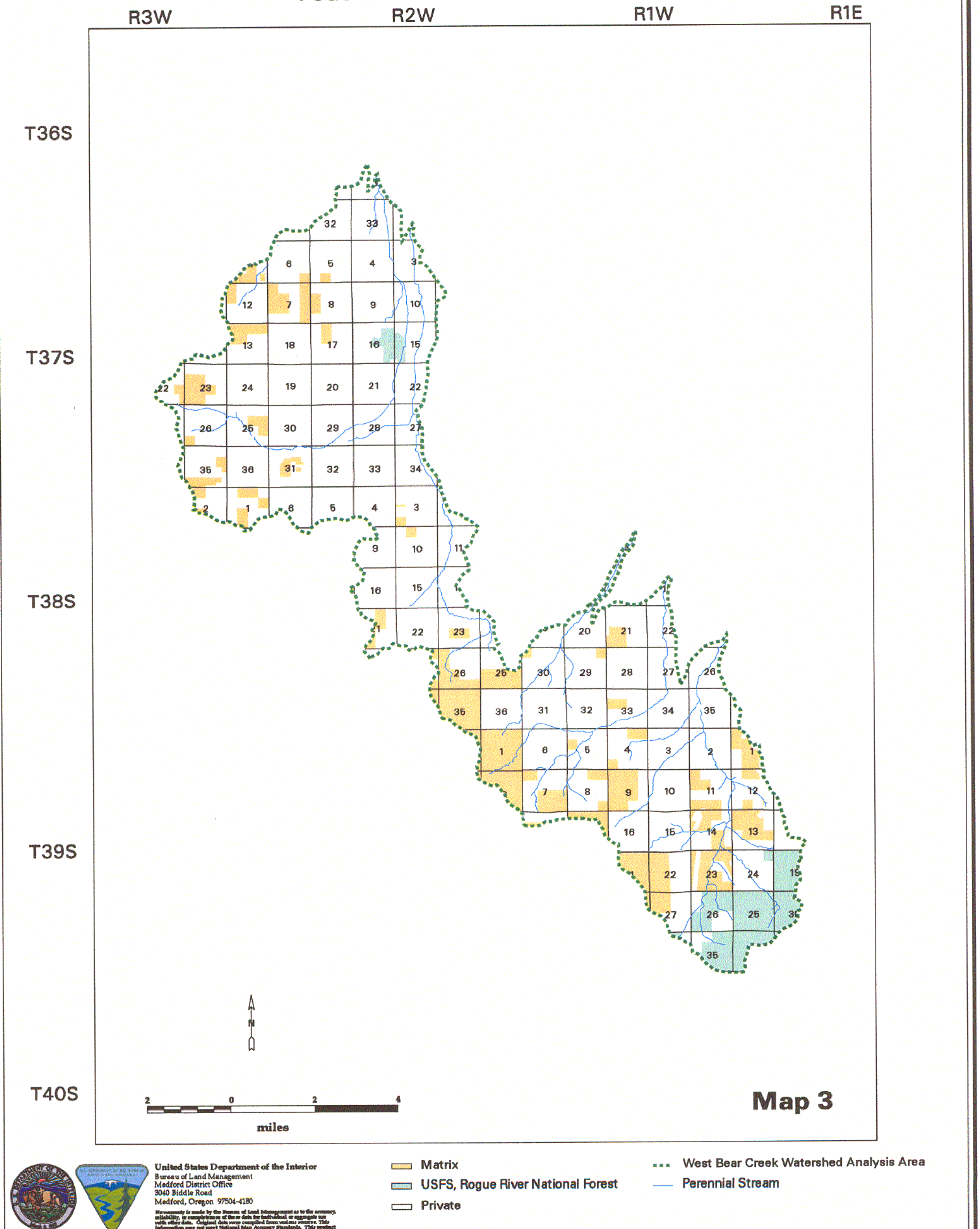
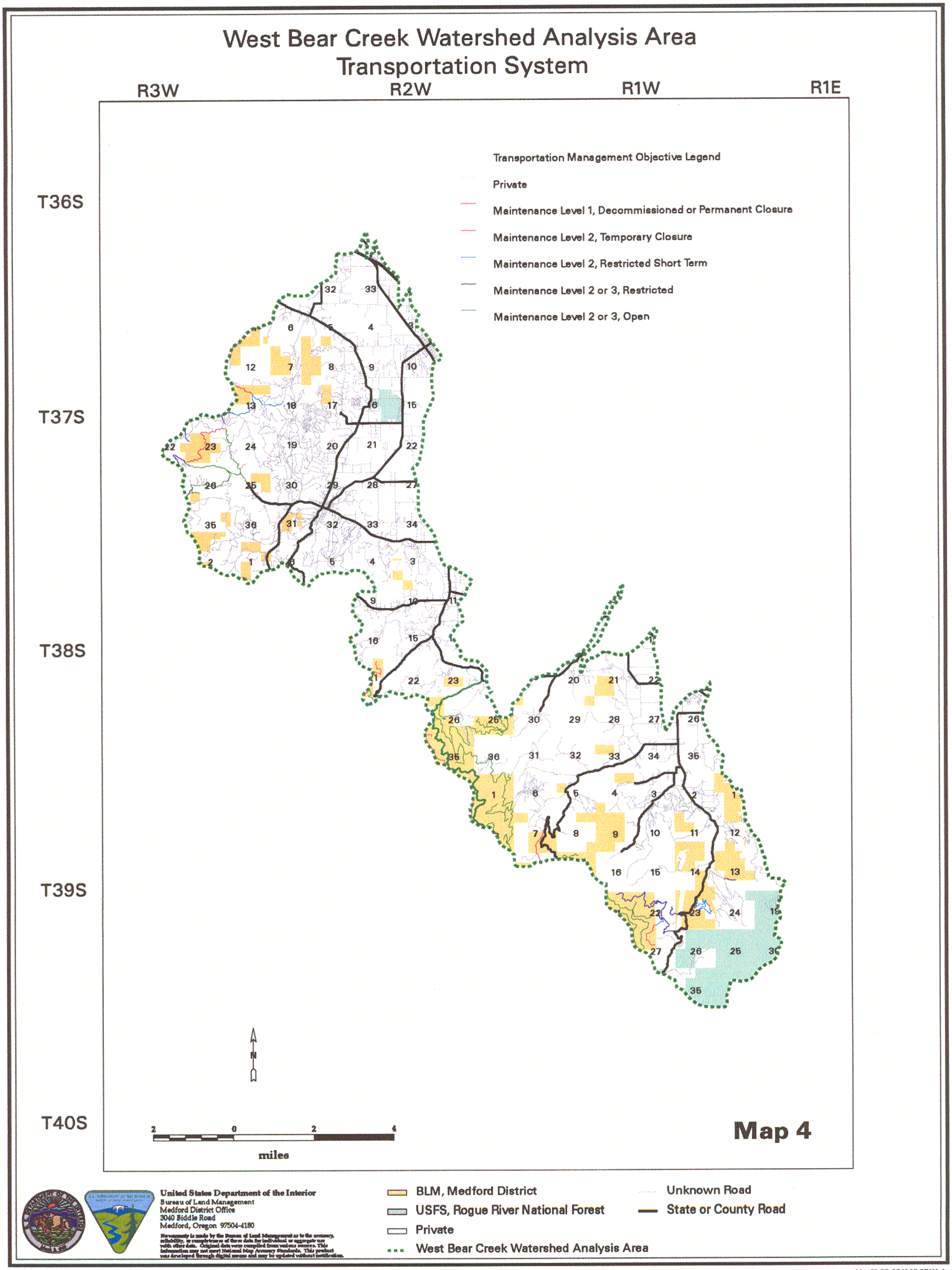
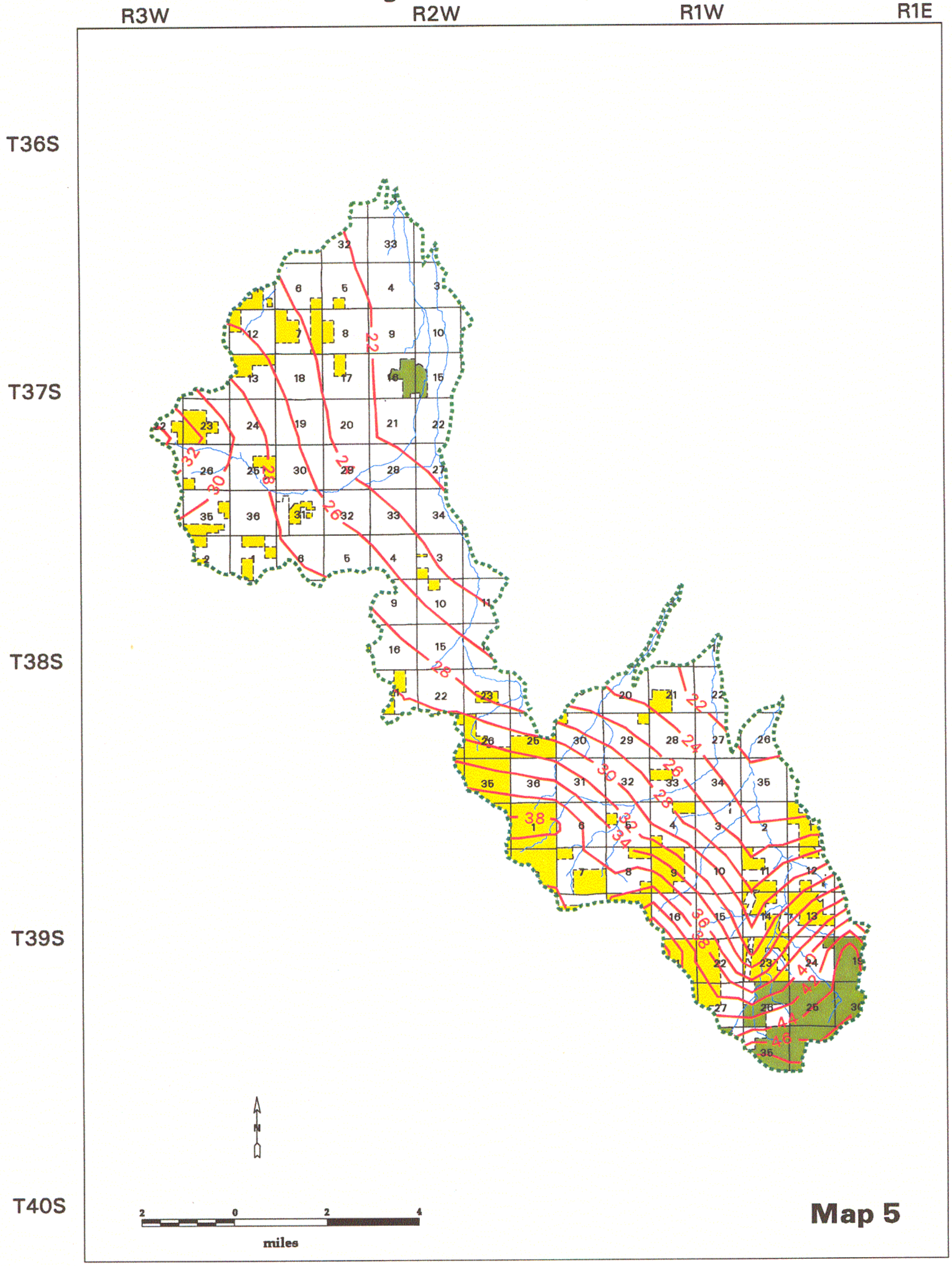
# West Bear Creek Watershed Analysis Area
## Federal Land Use Allocations




West Bear Creek Watershed Analysis Area
Transportation System
R3W
R2W
R1W
R1E
T36S
T37S
T38S
T39S
T40S
Transportation Management Objective Legend
Private
Maintenance Level 1, Decommissioned or Permanent Closure
Maintenance Level 2, Temporary Closure
Maintenance Level 2, Restricted Short Term
Maintenance Level 2 or 3, Restricted
Maintenance Level 2 or 3, Open
N
miles
Map 4
United States Department of the Interior
Bureau of Land Management
Medford District Office
3040 Biddle Road
Medford, Oregon 97504-4180
BLM, Medford District
USFS, Rogue River National Forest
Private
West Bear Creek Watershed Analysis Area
Unknown Road
State or County Road

# West Bear Creek Watershed Analysis Area
## Average Annual Precipitation

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- BLM, Medford District
- USFS, Rogue River National Forest
- Private
- West Bear Creek Watershed Analysis Area
- Perennial Stream
- Average Annual Precipitation Isoline (inches)

Source: Oregon Climate Services 1995

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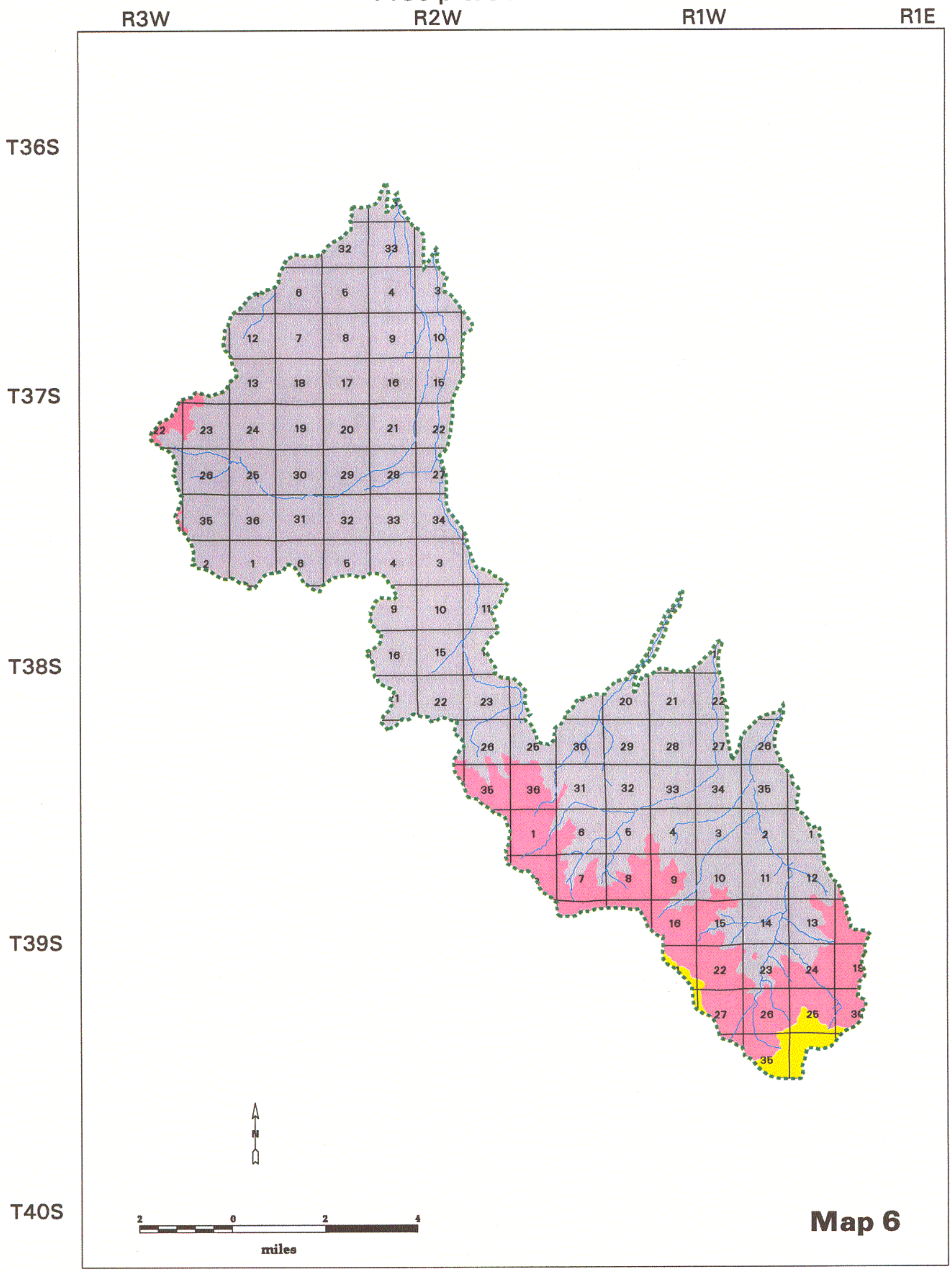
# West Bear Creek Watershed Analysis Area
## Precipitation Zones

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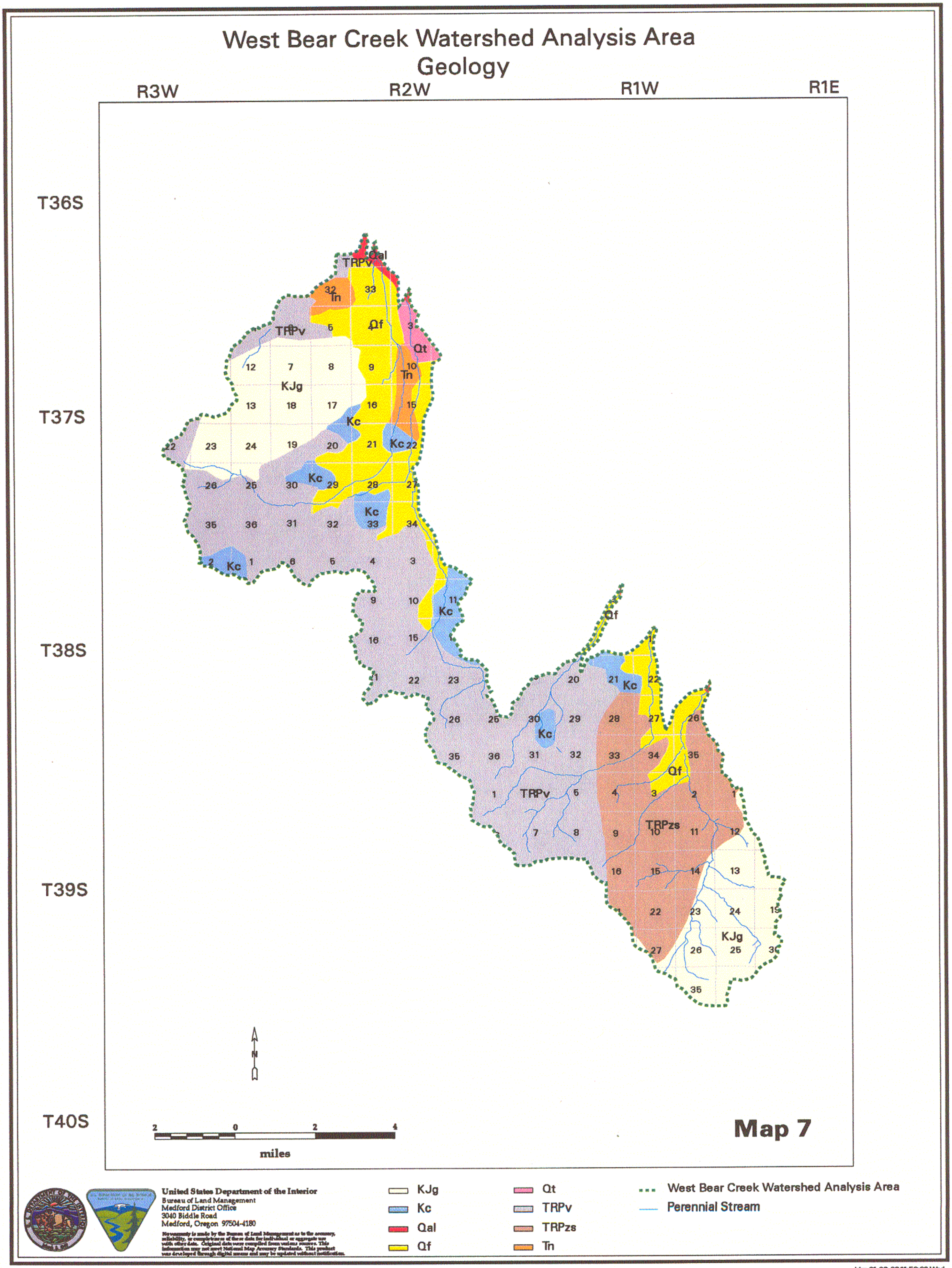
- Rainfall Zone <3500 Ft
- Rain-on-snow Zone 3500-5000 Ft
- Snow Zone >5000 Ft
- West Bear Creek Watershed Analysis Area
- Perennial Stream


West Bear Creek Watershed Analysis Area
Geology
R3W
R2W
R1W
R1E
T36S
T37S
T38S
T39S
T40S
miles
Map 7
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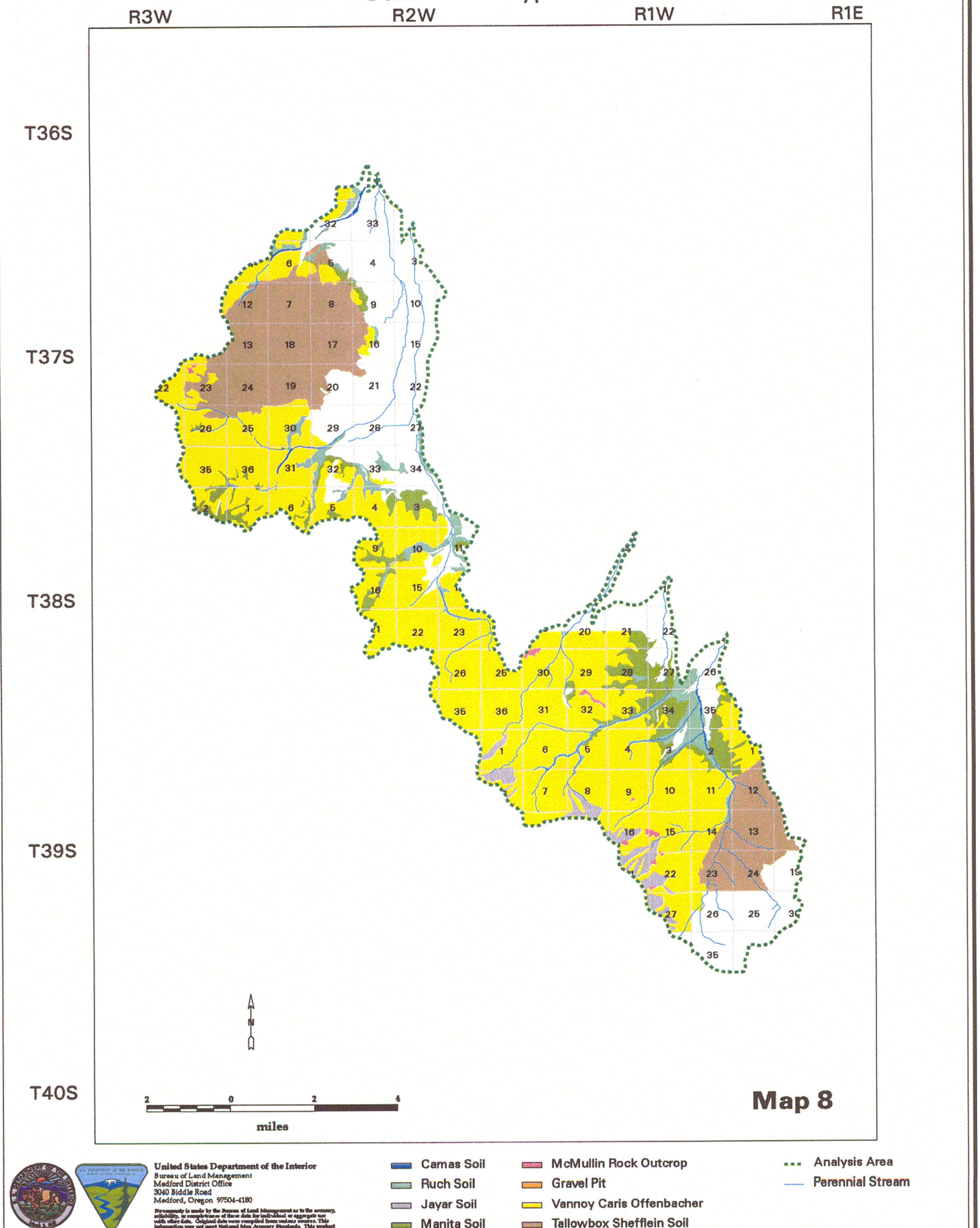
Medford, Oregon 97504-4180
KJg
Kc
Qal
Qf
Qt
TRPv
TRPzs
Tn
West Bear Creek Watershed Analysis Area
Perennial Stream

# West Bear Creek Watershed Analysis Area
## General Soil Types

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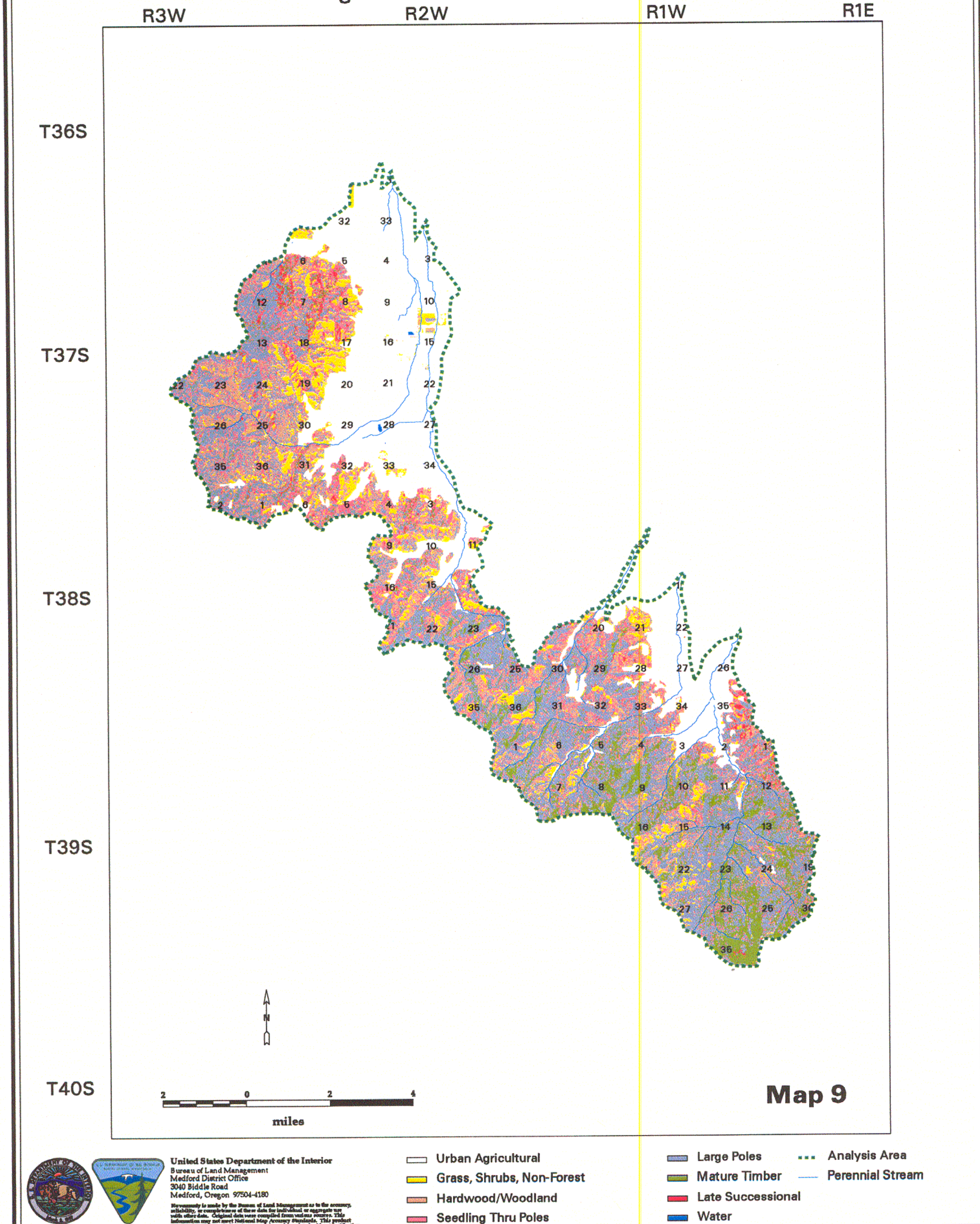
# West Bear Creek Watershed Analysis Area
## Vegetation Condition Classes

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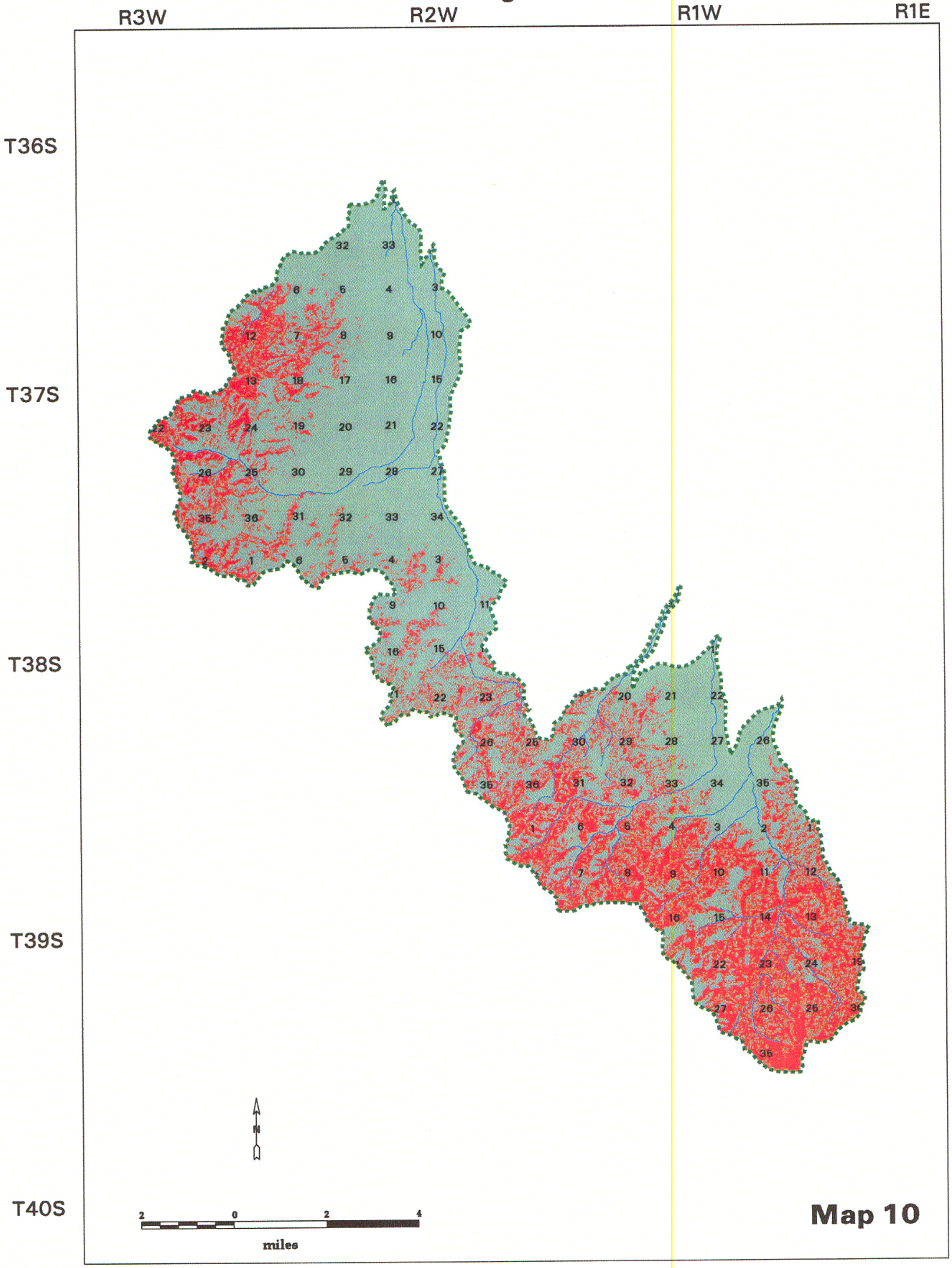
# West Bear Creek Watershed Analysis Area
## Fire Regimes




Low Fire Regime
Moderate Fire Regime
West Bear Watershed Analysis Area
Perennial Stream

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Created 5:45 PM Wednesday August 08, 2001 by lzowada
lz/usr5/westbearwa/map10.aml
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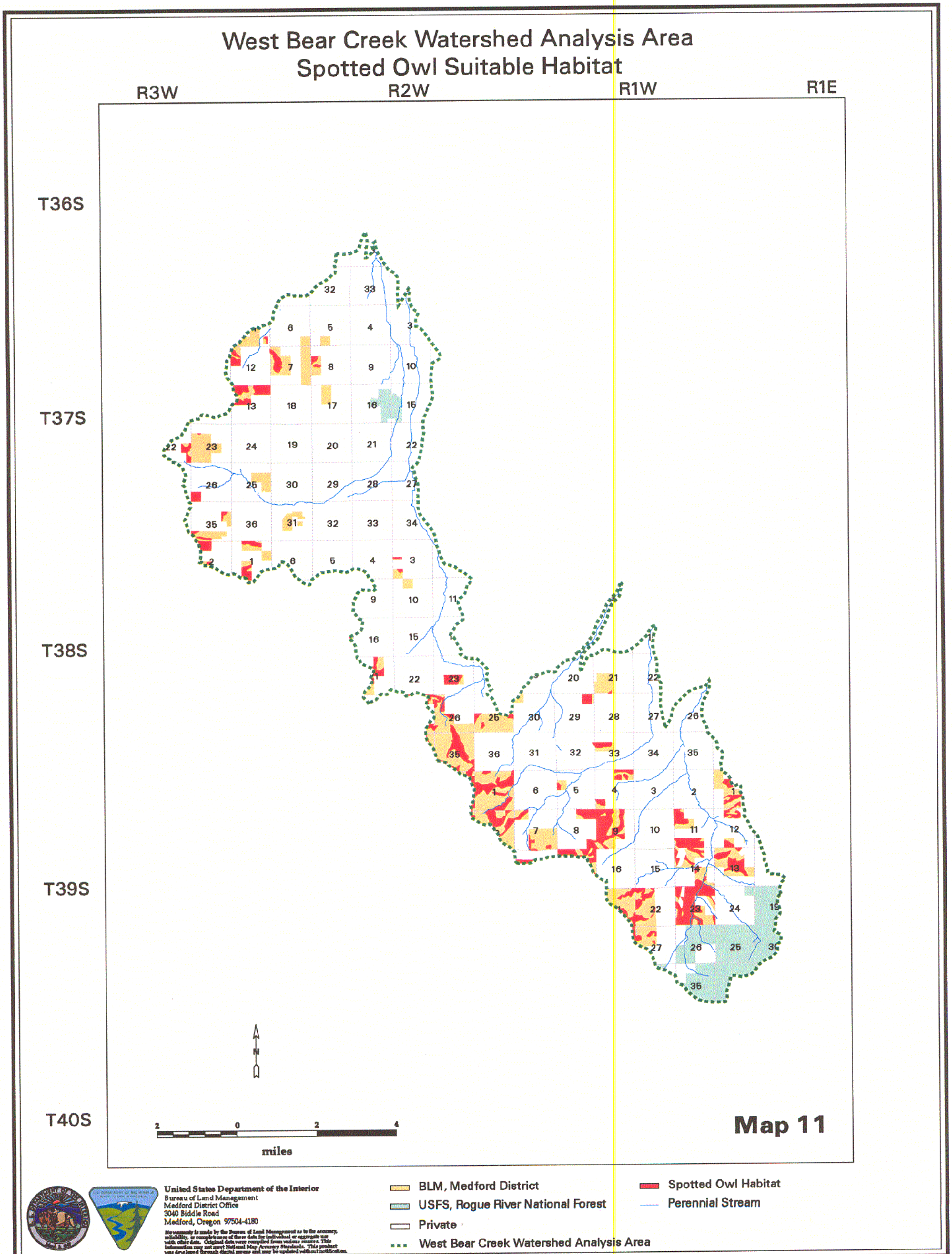


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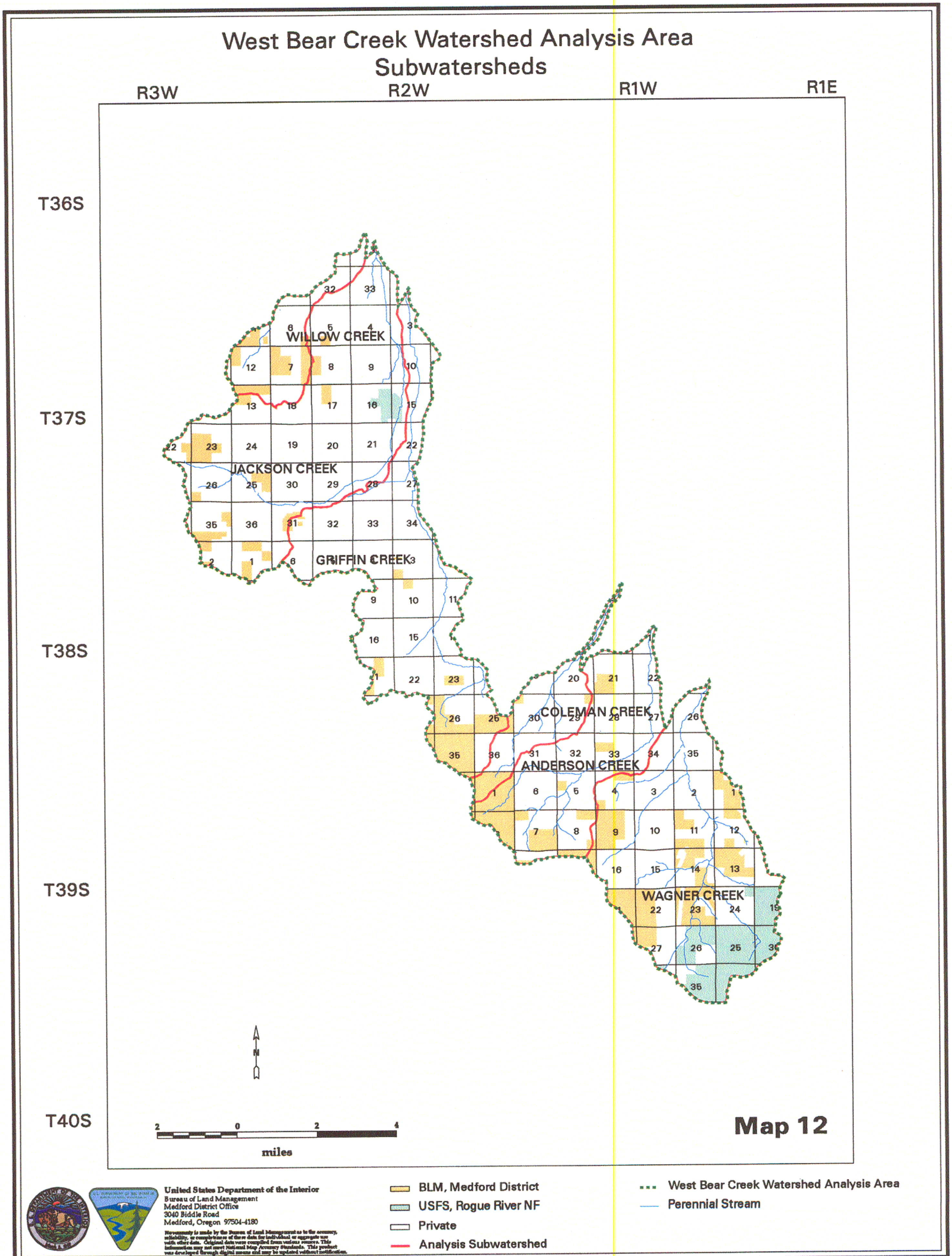

West Bear Creek Watershed Analysis Area
Subwatersheds
R3W
R2W
R1W
R1E
T36S
T37S
T38S
T39S
T40S
WILLOW CREEK
JACKSON CREEK
GRIFFIN CREEK
COLEMAN CREEK
ANDERSON CREEK
WAGNER CREEK
N
2
0
2
4
miles
Map 12
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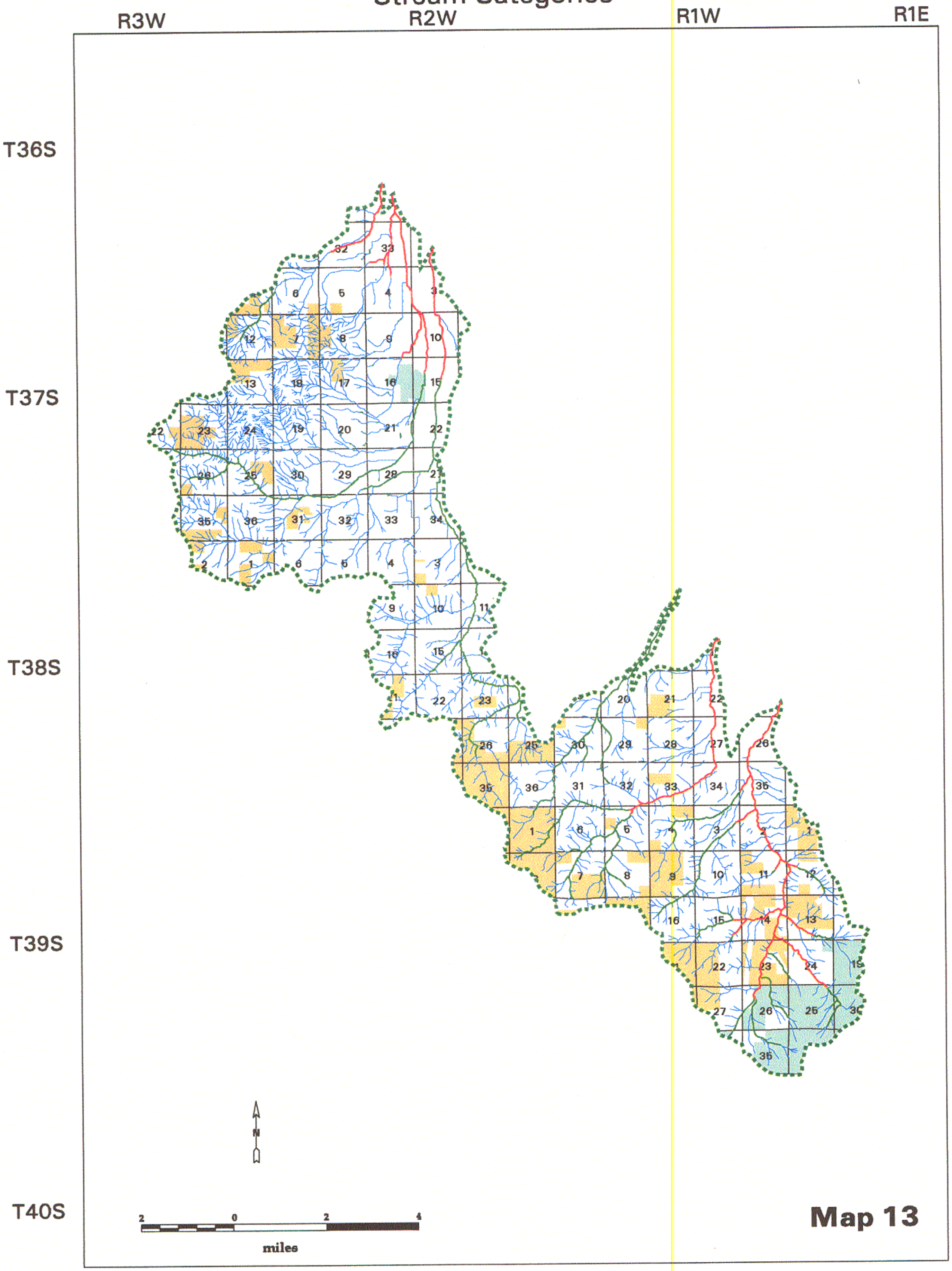
BLM, Medford District
USFS, Rogue River NF
Private
Analysis Subwatershed
West Bear Creek Watershed Analysis Area
Perennial Stream

# West Bear Creek Watershed Analysis Area
## Stream Categories

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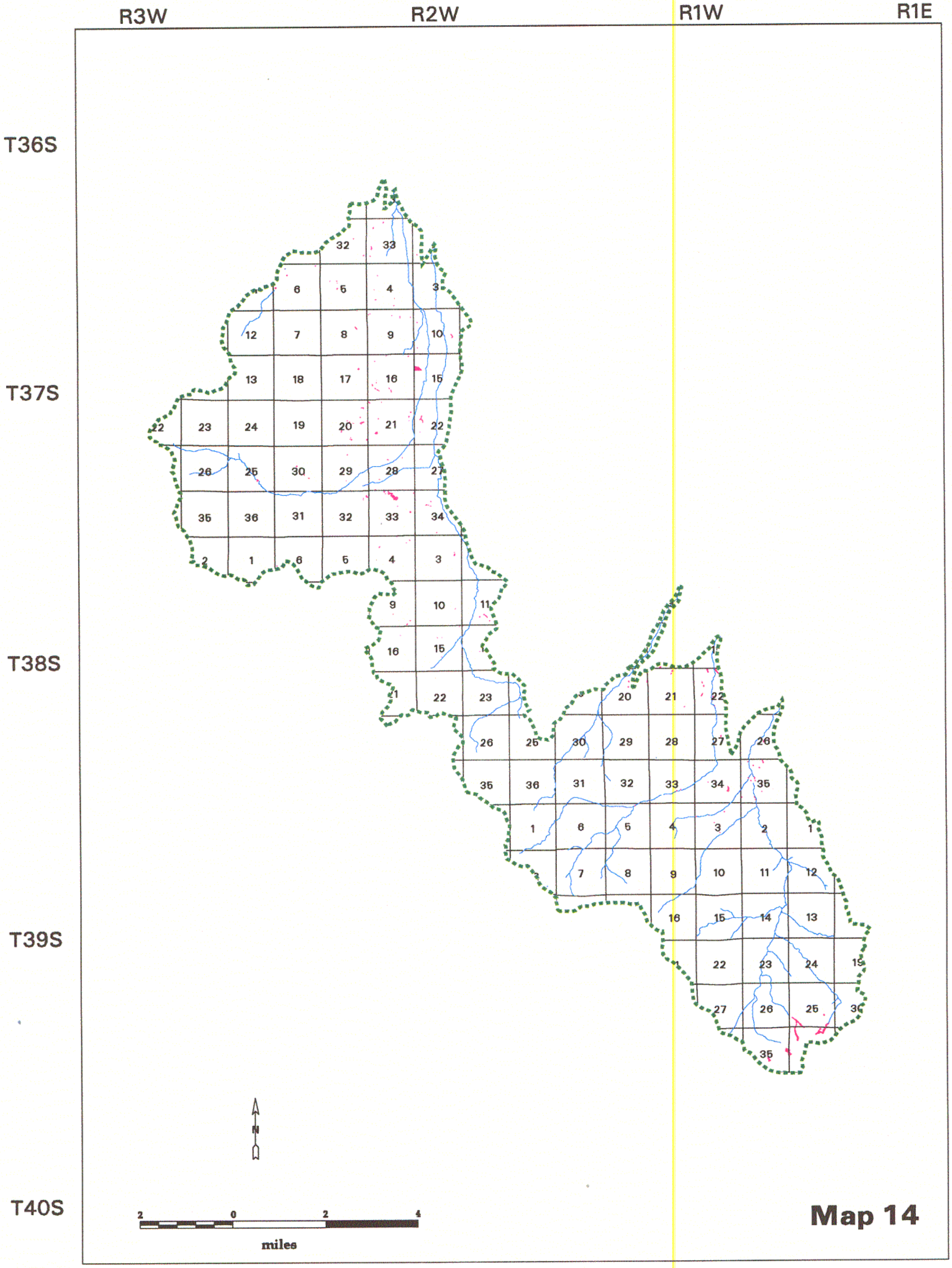
Created 11:07 AM Wednesday August 08, 2001 by lzowada    lz/usr5/westbearwa/map13.aml    blm.01-08-08.11:07:09.Wed

# West Bear Creek Watershed Analysis Area
## Wetlands




**Map 14**

- Lacustrine Wetland (None Present)
- Palustrine Wetland
- Perennial Stream
- West Bear Creek Watershed Analysis Area

Source: U.S. Fish & Wildlife National Wetlands Inventory (1984)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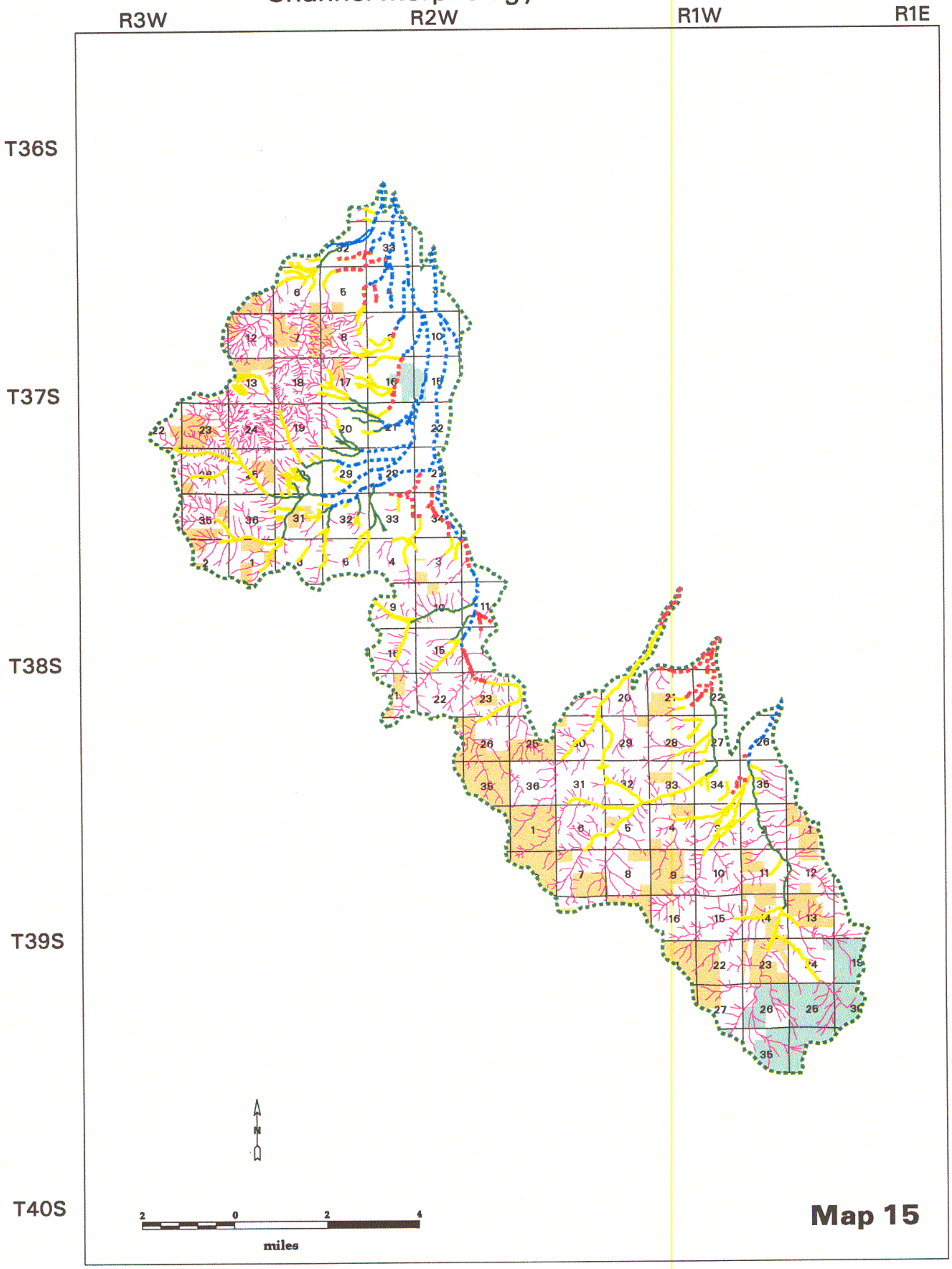
# West Bear Creek Watershed Analysis Area
## Channel Morphology Classification

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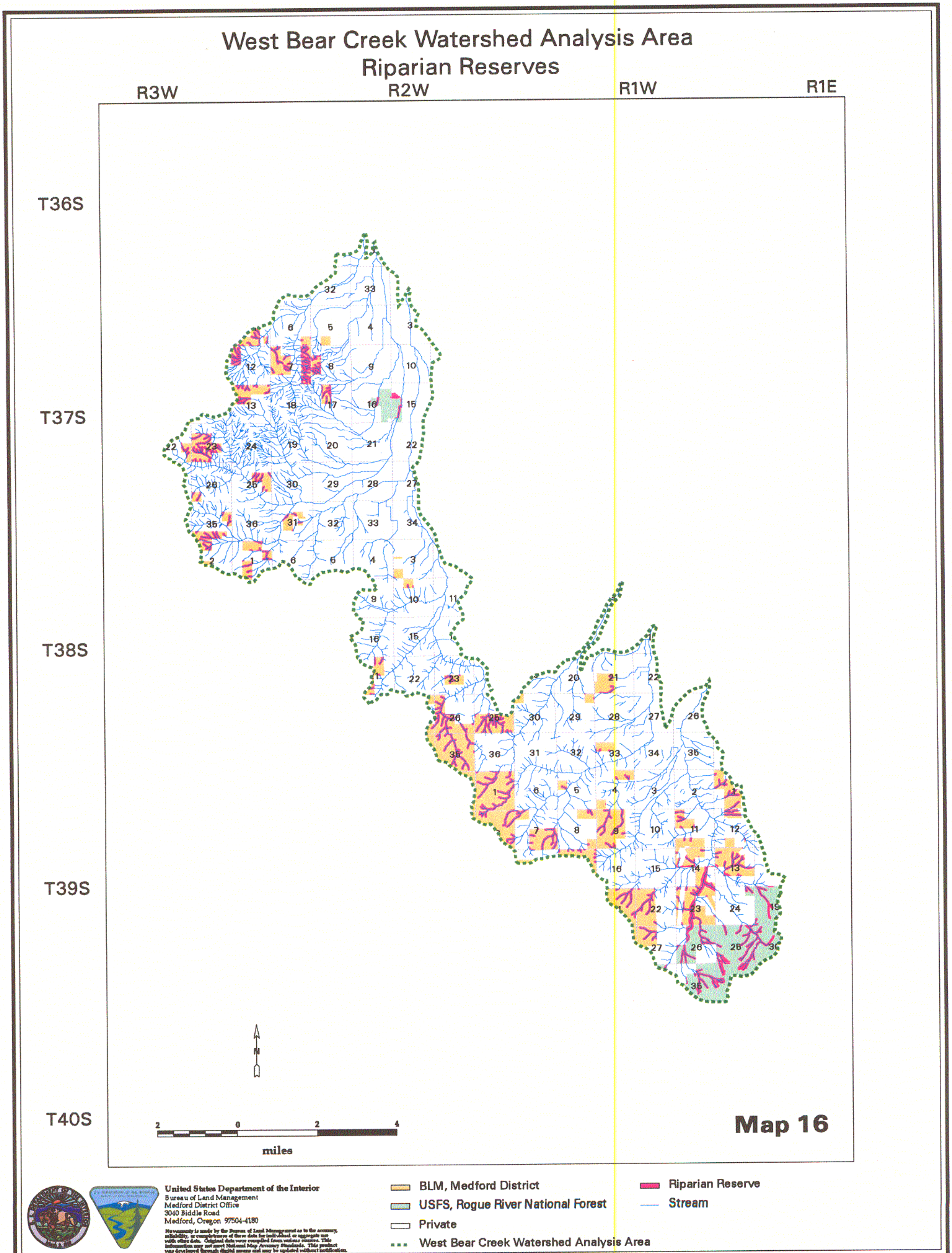
- BLM, Medford District
- USFS, Rogue River NF
- Private
- West Bear Creek Watershed

**Stream Channel Types (Rosgen 1996)**

- Aa+
- A
- B
- C
- F
- G

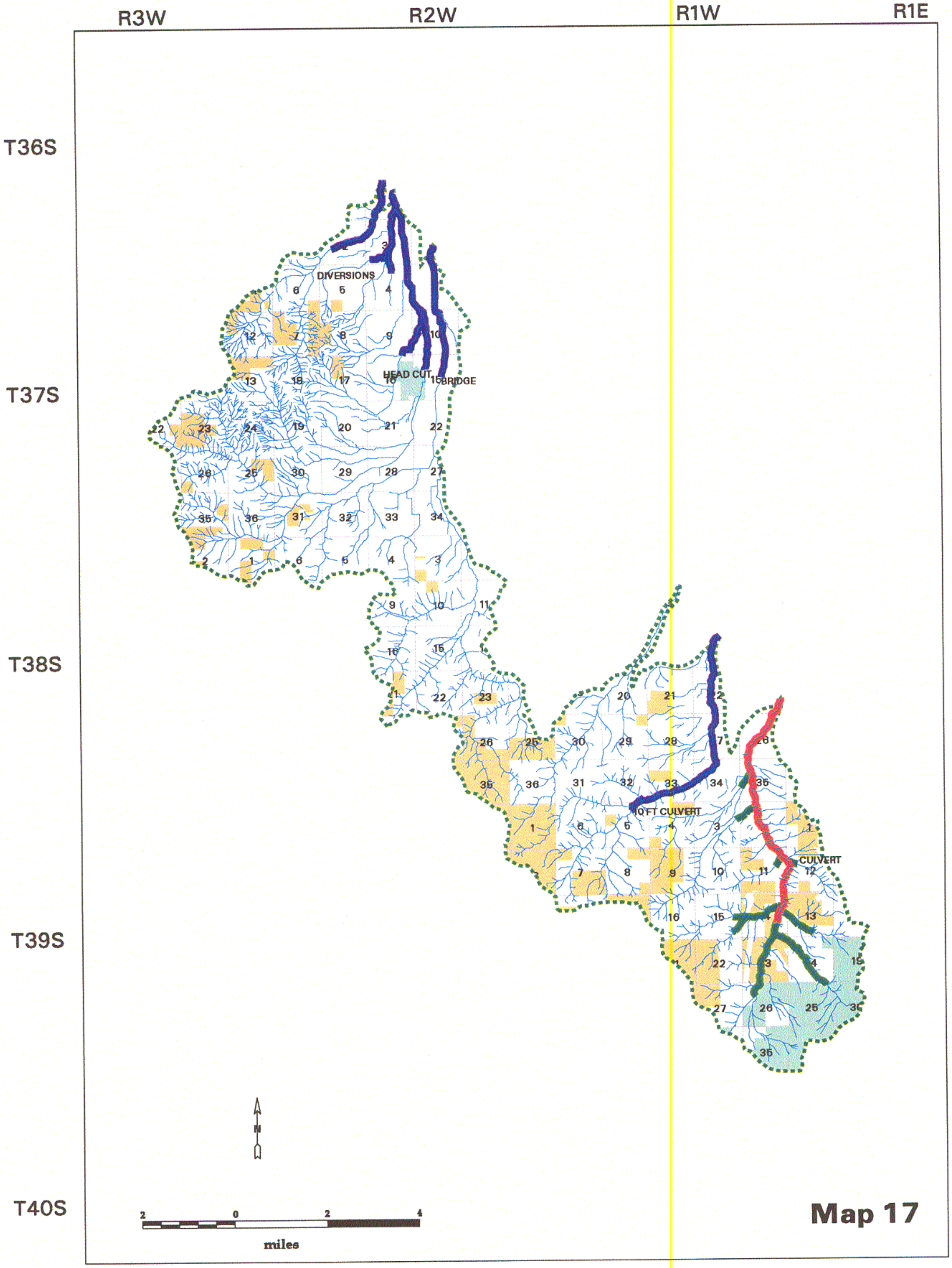
Created 11:08 AM Wednesday August 08, 2001 by lzowada    lz/usr5/westbearwa/map15.aml    blm.01-08-08.11:08:49.Wed




Created 8:48 AM Friday August 10, 2001 by lzowada

lz/usr5/westbearwa/map16.aml

# West Bear Creek Watershed Analysis Area
## Fish Distribution

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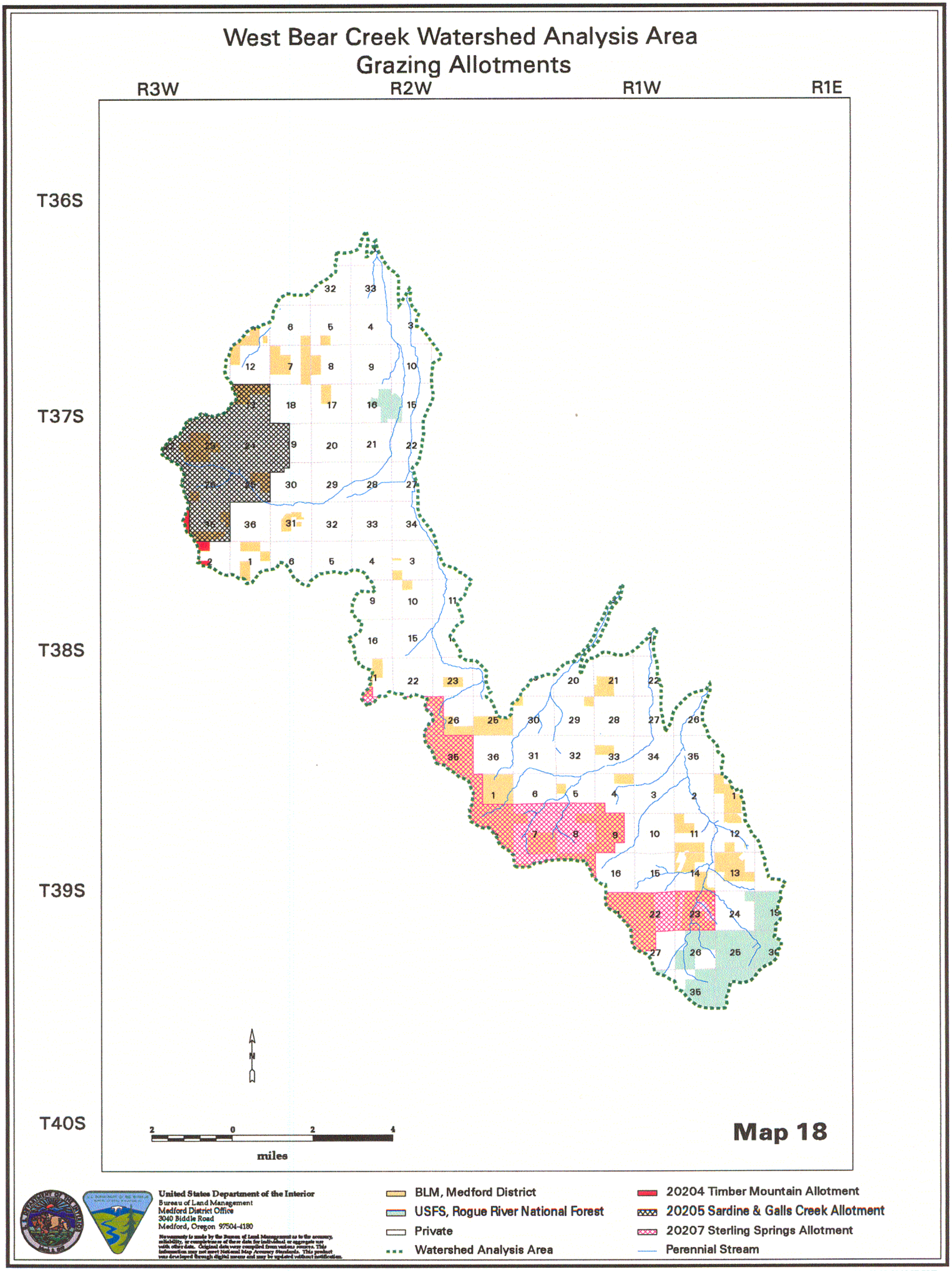
- BLM, Medford District
- USFS, Rogue River National Forest
- Private
- Analysis Area
- Steelhead and Rainbow Trout Stream
- Steelhead and Cutthroat Trout Stream
- Cutthroat Trout Stream
- Stream

Created 6:21 PM Wednesday August 0… by lz    usr5/westbearwa/map17.aml    blm.01-08-08.18:21:52.Wed


West Bear Creek Watershed Analysis Area
Grazing Allotments
R3W
R2W
R1W
R1E
T36S
T37S
T38S
T39S
T40S
miles
Map 18
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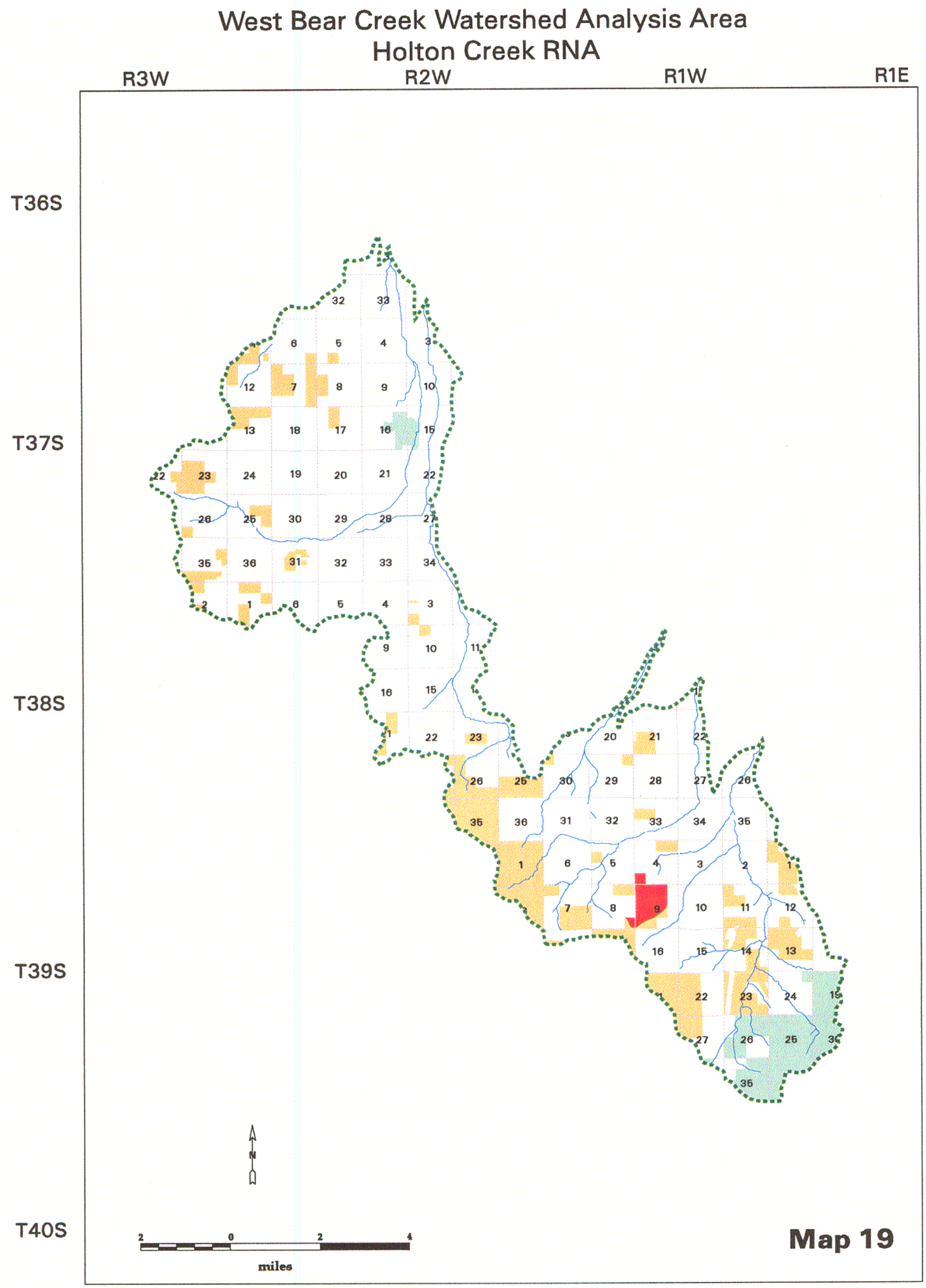
BLM, Medford District
USFS, Rogue River National Forest
Private
Watershed Analysis Area
20204 Timber Mountain Allotment
20205 Sardine & Galls Creek Allotment
20207 Sterling Springs Allotment
Perennial Stream
Created 4:37 PM Thursday August 09, 2001 by lzowada
lz/usr5/westbearwa/map18.aml
blm.01-08-09.16:37:56.Thu

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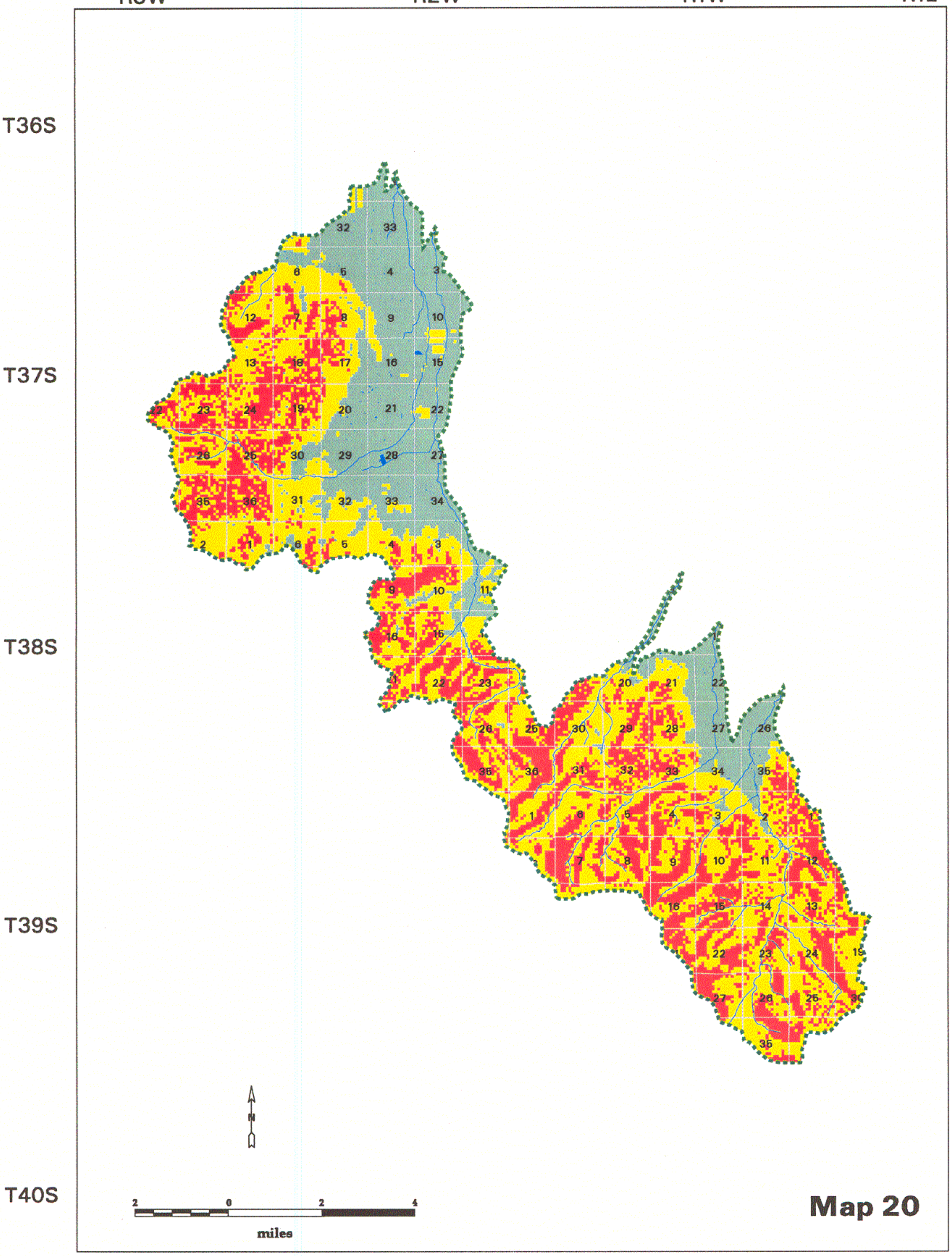
BLM, Medford District
USFS, Rogue River National Forest
Private
West Bear Creek Watershed Analysis Area
Holton Creek RNA
Perennial Stream

Created 4:47 PM Thursday August 09, 2001 by lzowada lz/usr5/westbearwa/map19.aml blm.01-08-09.16:47:22.Thu

# West Bear Creek Watershed Analysis Area
# Fire Hazard

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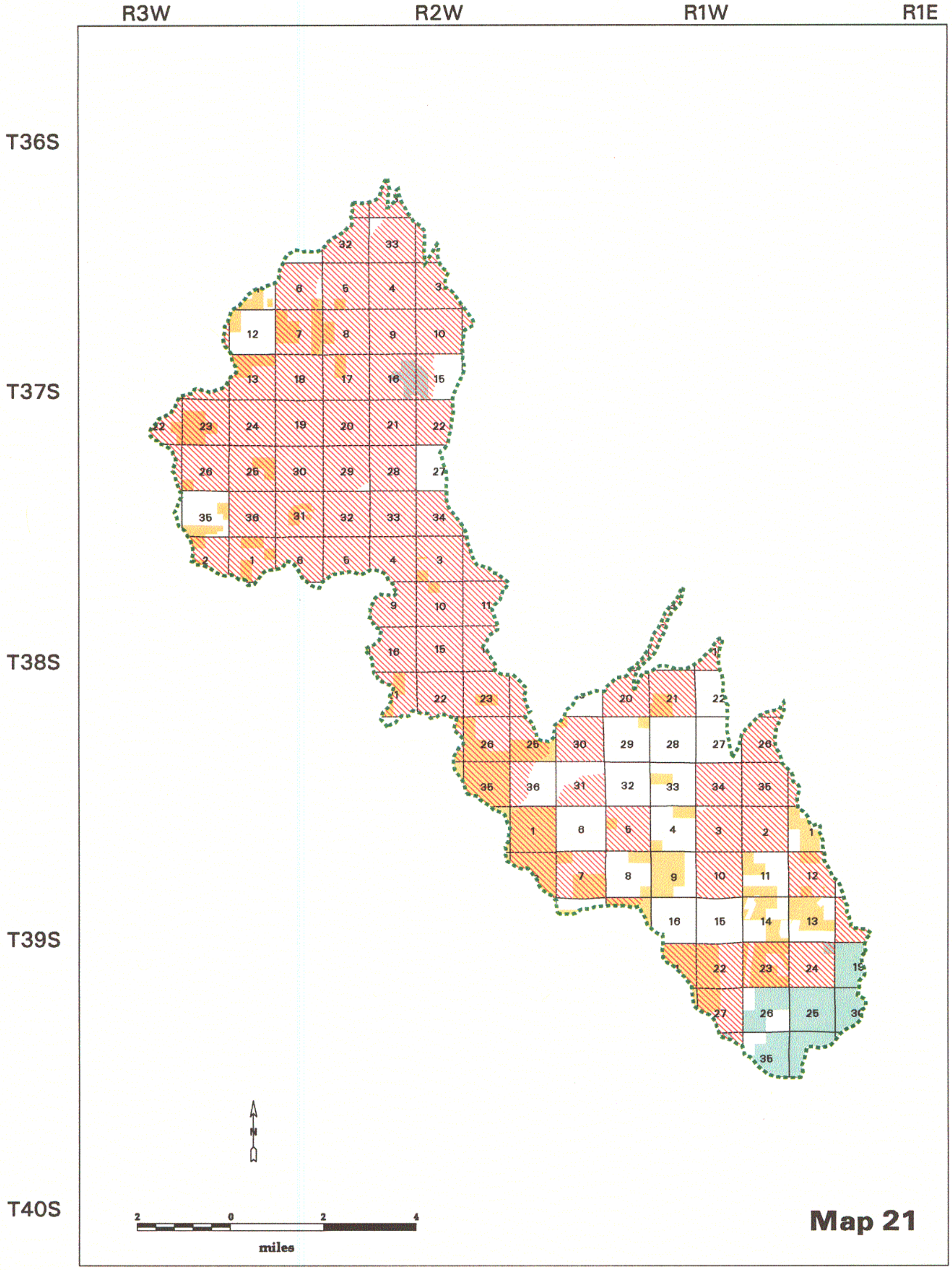
Low Hazard Rating
Moderate Hazard Rating
High Hazard Rating
Pond
Perennial Stream
West Bear Creek Watershed Analysis Area

Created 6:09 PM Wednesday August 08, 2001 by lz    usr5/westbearwa/map20.aml    blm.01-08-08.18:09:21.Wed

# West Bear Creek Watershed Analysis Area
## Sections With Road Density Greater Than 4 mi./sq.mi.

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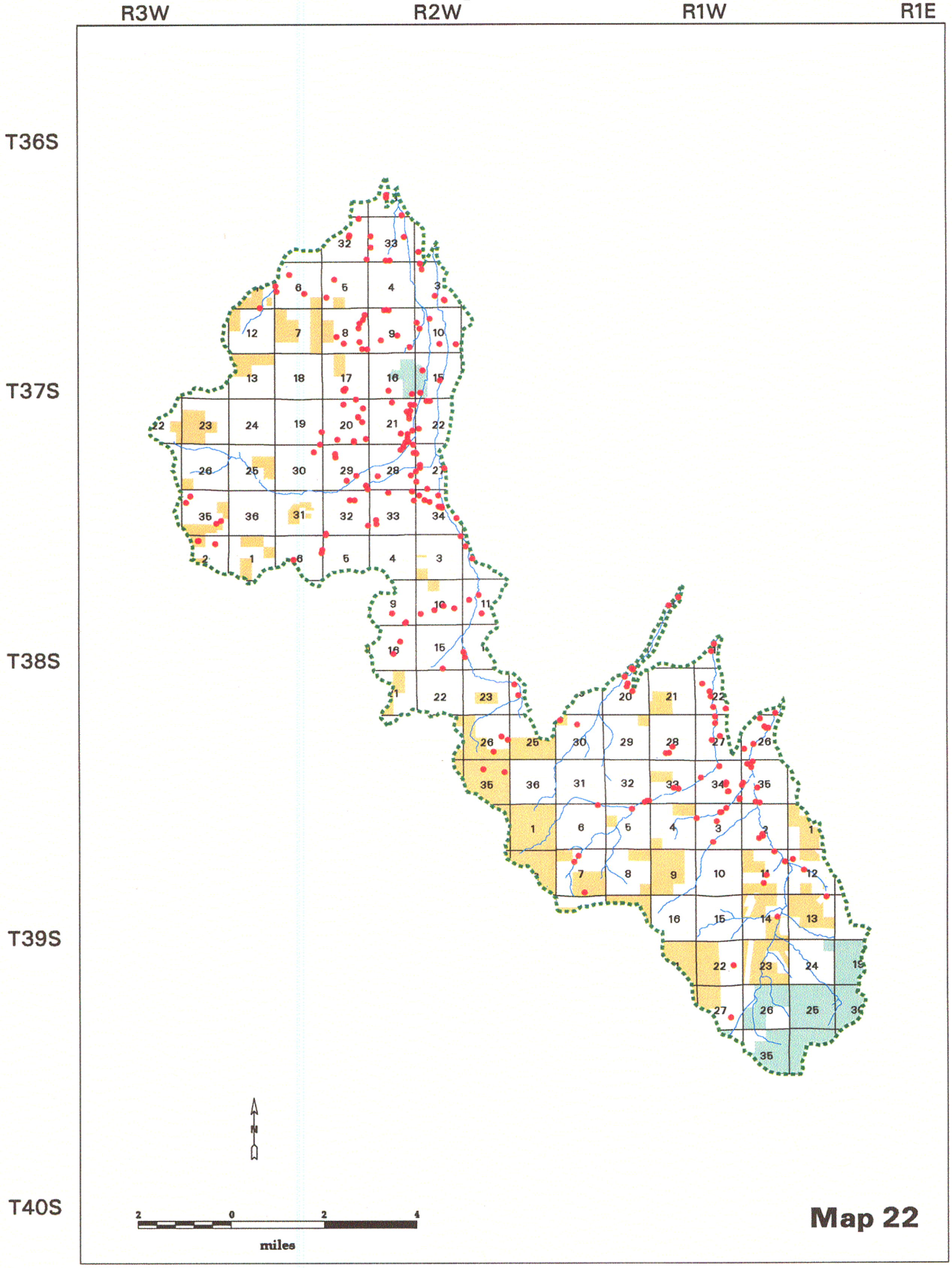
- BLM, Medford District
- USFS, Rogue River NF
- Private
- West Bear Creek Watershed Analysis Area
- ROAD DENSITY 4+ MI/SQ MI

# West Bear Creek Watershed Analysis Area
## Water Right Diversions





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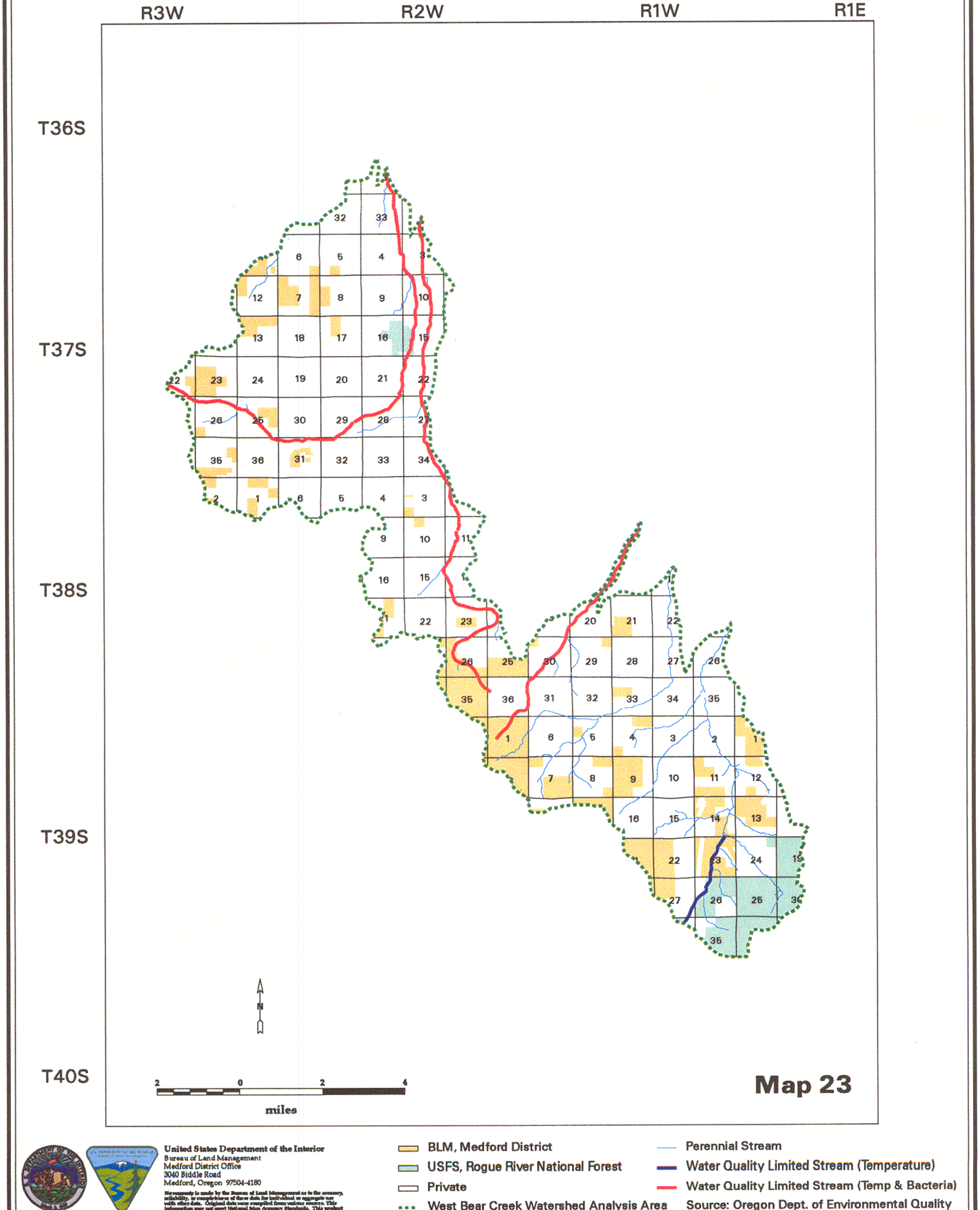
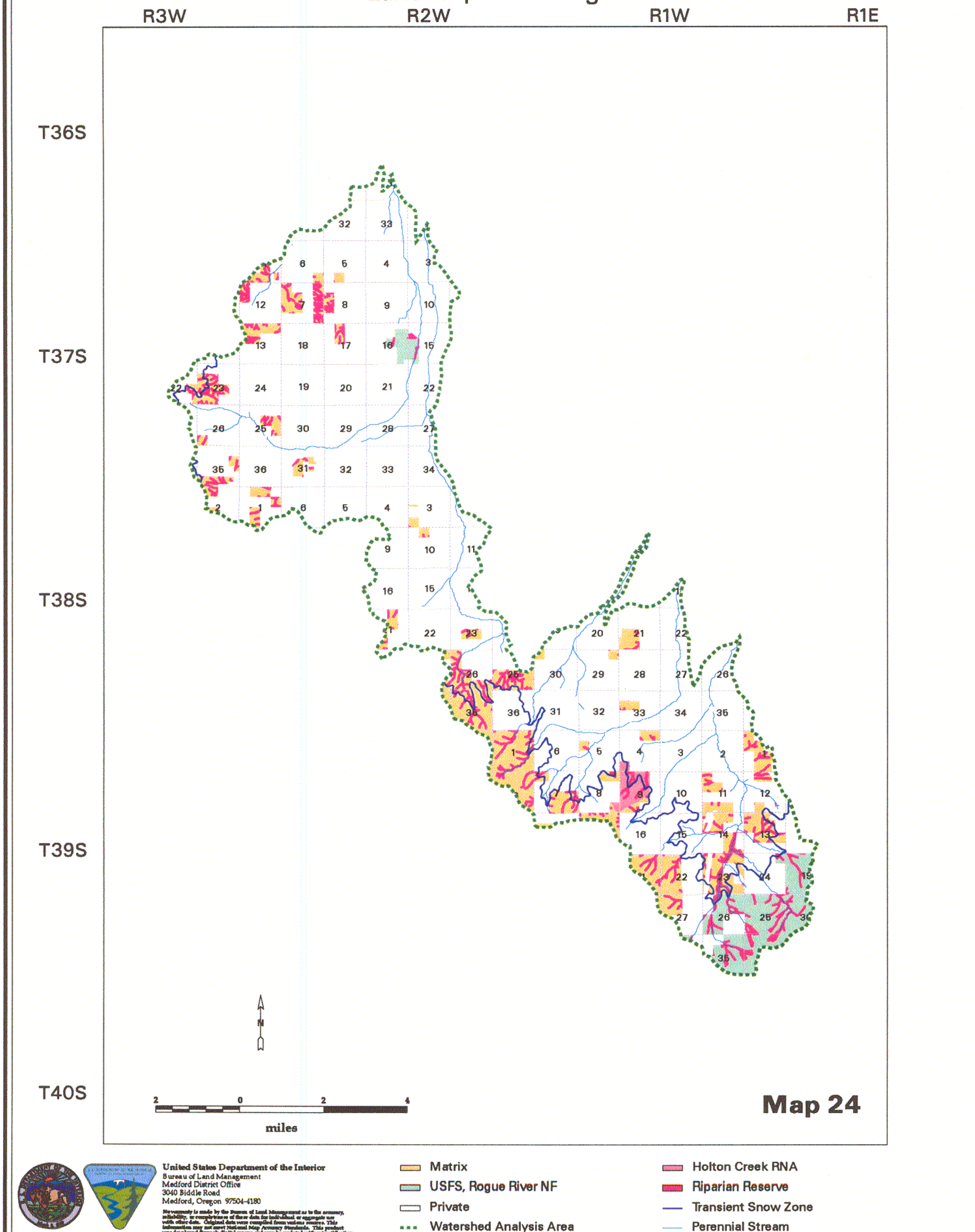
- BLM, Medford District
- USFS, Rogue River National Forest
- Private
- West Bear Creek Watershed Analysis Area
- Perennial Stream
- Water Diversion

Source: Oregon Water Resources Department

# West Bear Watershed Analysis Area
## Water Quality Limited Streams



# West Bear Creek Watershed Analysis Area
## Landscape Planning



# LIST OF PREPARERS

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| Ann Ramage | Cultural Resources and Environmental History |
| Joe Hoppe | Facilities, Lands, and Minerals |
| Greg Chandler | Fire and Air Quality |
| Mark Prchal | Geology, Erosion Processes, and Soil Productivity |
| Tim Westfall | Grazing |
| Scott Haupt | Landscape Vegetation Pattern and Forest Density |
| Brad Tong | Plants and Special Areas, Non-native Plants, and Noxious Weeds |
| Fred Tomlins | Recreation |
| Karen Bolda | Stream Channel, Riparian Areas, and Aquatic Wildlife |
| George Arnold | Terrestrial Wildlife |
| John Samuelson | Transportation System |
| **Support Team Members** | |
| Larry Zowada | GIS Maps and Information |
| Ken Brown | Logging Information |

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# APPENDICES

# APPENDIX A
# Public Comments

**Summary of Public Comments**

Approximately 400 fliers were sent to residents and interested parties in the West Bear Creek Watershed Analysis Area announcing dates and places for open house meetings. The fliers also invited the recipients to send written comments to the BLM concerning issues and management direction.

The open house meeting for the West Bear Creek Watershed Analysis Area was held at the Naval Reserve Center on Ross Lane on March 14, 2001. Fourteen individuals registered at the meeting. BLM employees were also available to receive comments and answer questions about the West Bear Creek Watershed analysis at the South Rogue-Gold Hill Watershed Analysis meeting in Gold Hill on March 13, 2001. BLM staff members recorded comments at both meetings, but attendees were encouraged to send written comments to BLM if additional issues and concerns came to mind.

Comments at the open houses concerned fire hazard reduction work around Jacksonville, spotted owls in the Jackson Creek area, a request to build trails for OHV use, dirt bike riding in the Anderson Butte area, geology as it relates to underground water sources, and the condition of Kenney Road.

In addition to comments received at the open house, BLM received 16 letters with comments concerning the West Bear Creek Watershed Analysis Area. Most of the comments discussed roads and off-highway vehicle (OHV) use. Fourteen letters favored keeping roads and trails open to OHV use or even the development of new trails for this form of recreation. Among these comments, there was a high level of encouragement for BLM to cooperate with user groups to maintain and improve the existing trails and designate new trails. Two respondents requested that the BLM only close roads and trails after consulting with the user groups and/or exploring cooperative mitigation efforts. Trail designation and signing was also requested. One respondent referred to only being able to access this area by OHV due to a physical handicap.

Other recreation uses referred to were snow sledding, remote control gliders and remote control trucks. One comment stated that the area was not viable for public recreation due to legal access problems.

Well documented site specific written comments were received on Wagner Creek between Rapp Road and the railroad trestle. These comments concerned fish use, habitat conditions, and water quality in Wagner Creek. Additional comments were received on the condition of Kenny Road, private and public property access, and mining claims.

The BLM appreciates those who took the time to write or to attend the open houses. Public comments were shared with the team members who developed this document and were taken into consideration during the analysis period.

# APPENDIX B
# Description of Symbols Used on Geology Map (Map 7)

| Map Symbol | Description of Map Units |
|---|---|
| KJg | Granitic rocks (Cretaceous and Jurassic) -- Mostly tonalite and quartz diorite but lesser amounts of other granitoid rocks. |
| Kc | Clastic sedimentary rocks (Cretaceous) -- Locally fossiliferous sandstone and conglomerate; marine fossils indicate early cretaceous age. |
| Qal | Alluvial deposits (Holocene) - Sand, gravel, silt and thin peat beds forming flood plains and filling channels of present streams. |
| Qf | Alluvial fan deposits (Holocene and Pleistocene) - Sand, gravel and silt in individual and coalescing fan-shaped deposits along valley margins. Typically occur where stream gradient decreases abruptly. |
| Qt | Terrace, pediment and lag gravels (Holocene and Pleistocene) – Unconsolidated deposits of gravels, cobbles and boulders intermixed and locally interlayered with clay, silt and sand. Mostly on terraces above present flood plains |
| Tn | Nonmarine sedimentary rocks (Eocene) -- Continentally derived conglomerate, pebble conglomerate, sandstone, siltstone, and mudstone containing abundant biotite and muscovite. Dominantly non-volcanic; clastic material derived from underlying older rocks. |
| TrPv | Volcanic rock, partly metamorphosed (Triassic and Permian) – Includes porphyritic andesite flows containing hornblende, pyroxene and plagioclase; breccia, agglomerate, tuff, and locally, some basalt flows and dacitic tuffs. |
| TrPzs | Sedimentary rock, partly metamorphosed (Triassic and Paleozoic) – Includes shale, mudstone, volcanoclastic sandstone, greywacke, conglomerate, tuff, and minor radiolarian chert and marble. |

# APPENDIX C
# General Soils Map Interpretations

**Soils formed in material weathered from sedimentary and igneous rock and mixed alluvium on fan terraces, ridges, knolls, hillslopes and alluvial fans.**

Brader-Debenger-Langellain

*Shallow and moderately deep, well drained and moderately well drained soils that have a surface layer of loam; on ridges and knolls*

The native vegetation on this map unit is mainly hardwoods and some conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 40 percent. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is about 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 35 percent Brader soils, 20 percent Debenger soils, and 15 percent Langellain soils. The remaining 30 percent is Shefflein soils on alluvial fans; Kerby, Medford, and Gregory soils on stream terraces; Carney, Selmac, and Coker soils on concave slopes.

Brader and Debenger soils formed in colluvium derived from sedimentary rock. Brader soils are shallow and well drained. The surface layer and subsoil are loam. Debenger soils are moderately deep and well drained. The surface layer is loam. The subsoil is clay loam. Langellain soils are moderately deep and moderately well drained. The surface layer is loam. The subsoil is clay. This unit is used mainly for hay and pasture or for livestock grazing. A few areas are used for home site development or wildlife habitat.

The main limitations in the areas used for hay and pasture or for livestock grazing are wetness in winter and spring, the depth to bedrock, restricted permeability, droughtiness, and compaction. The slope also is a major limitation in some areas. The Langellain soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for maximum forage production. Because of the layer of clay in the Langellain soils and the depth to bedrock in the Brader soils, over-irrigation can result in a perched water table.

Carney-Coker

*Moderately deep and very deep, moderately well drained and somewhat poorly drained soils that have a surface layer of clay or cobbly clay, - on alluvial fans and hillslopes*

The native vegetation on the Carney soils in this map unit is mainly scattered hardwoods and an understory of grasses, shrubs, and forbs. That on the Coker soils is mainly grasses, sedges, and forbs. Slopes generally are 0 to 35 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 18 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 55 percent Carney soils and 10 percent Coker soils. The remaining 35 percent is Brader and Debenger soils on knolls; Heppsie and McMullin soils on hillslopes; Padigan and Phoenix soils on concave slopes; Cove soils in drainageways; and Darow, Medco, and Tablerock soils.

Carney soils formed in alluvium and colluvium derived from igneous rock. Coker soils formed in clayey alluvium derived from igneous rock. Carney soils are moderately deep and moderately well drained. The surface layer is clay or cobbly clay. The subsoil is clay. Coker soils are very deep and somewhat poorly drained. The surface layer and subsoil are clay.

This unit is used mainly for tree fruit, hay and pasture, homesite development, livestock grazing, or wildlife habitat. The main limitations in the areas used for hay and pasture or for tree fruit are the high content of clay, a slow rate of water intake, wetness in winter and spring, droughtiness in summer and fall, and the slope. The Coker soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for the maximum production of forage crops and tree fruit. Because of very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crops. Because of the slope in some areas, sprinkler and trickle irrigation systems are the best methods of applying water. The high content of clay severely limits tillage. The soils are well suited to permanent pasture. The more sloping areas of this unit are used for livestock grazing. The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the slope.

**Soils formed in material weathered from Granodiorite on alluvial fans, ridges, and hillslopes.**

<u>TaBowbox-Shefflein</u>
*Moderately deep and deep, somewhat excessively drained and well drained soils that have a surface layer of gravelly sandy loam or loam and receive 25 to 40 inches of annual precipitation*

This . map unit is on hillslopes, ridges, and alluvial fans. Th . e native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 2 to 70 percent. Elevation 1,000 to 4,000 feet. The mean annual precipitation about 25 to 40 inches, the mean annual temperature 46 to 54 degrees F, and the average frost-free period 100 to 160 days.

This unit is about 55 percent Tallowbox soils and 30 percent Shefflein soils. The remaining 15 percent is Barron soils on alluvial fans, Clawson soil on concave slopes, and Rogue soils at elevations of more than 4,000 feet. Tallowbox soils are moderately deep and some excessively drained. The surface layer and subsoil gravelly sandy loam. Shefflein soils are deep and well drained. The surface layer is loam. The subsoil is clay loam and sandy clay loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping are of the Shefflein soils are used for hay and pasture o homesite development. The main fimitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management-concern, particularly on southfacing slopes. Management minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable systems should be used on the steeper slopes.

**Soils formed in material weathered from igneous rock on plateaus and hillslopes**

**Vannoy-Caris-Offenbacher**

*Moderately deep, well drained soils that have a surface layer of silt loam or gravelly loam*

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 15 percent of the survey area. It is about 35 percent Vannoy soils, 25 percent Caris soils, and 10 percent Offenbacher soils. The remaining 30 percent consists of Camas, Evans, and Newberg soils on flood plains; Abegg and Ruch soils on alluvial fans; Selmac soils on concave slopes; Manita and Shefflein soils on alluvial fans and gently sloping hillslopes; Dubakella soils, which formed in material derived from serpentinitic rock; McMullin soils on ridges and steep hillslopes; Tallowbox and Voorhies soils; and Jayar soils at elevations of more than 4,000 feet.

Vannoy soils have a surface layer of silt loam. The subsoil is clay loam, gravelly clay loam, and extremely gravelly clay loam. Caris soils have a surface layer of gravelly loam. The subsoil is very gravelly clay loam and extremely gravelly loam.

Offenbacher soils have a surface layer of gravelly loam. The subsoil is loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Vannoy soils are used for pasture or homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition and the slope. Seedling mortality also is a major management concern, particularly on southfacing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Caris soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

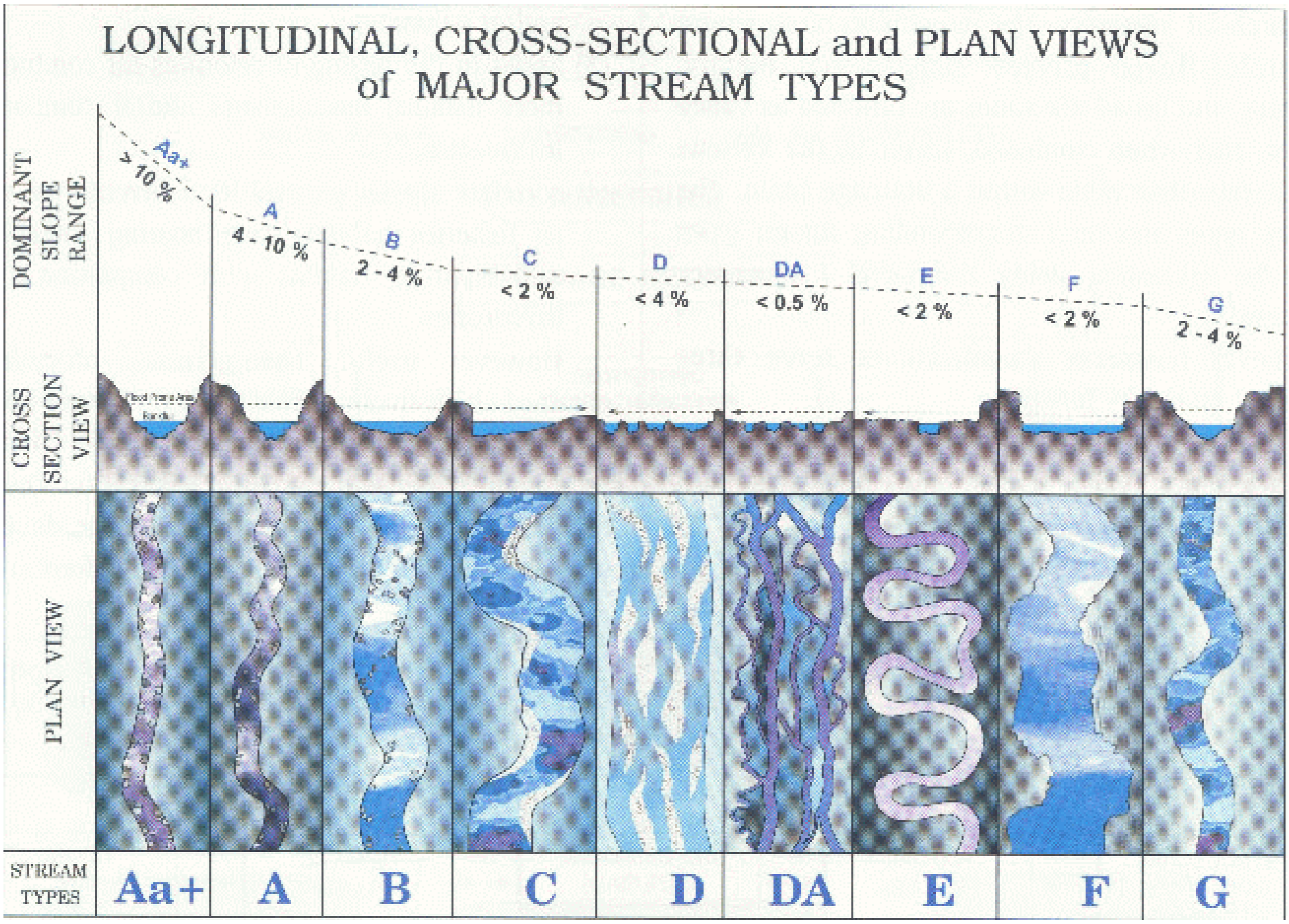
# APPENDIX D
## Introduced Plant Species and Noxious Weeds

| Scientific Name | Common Name | Noxious Weed List |
|---|---|---|
| *Anthriscus caucalis* | burr chervil | |
| *Arrhenatherum elatius* | tall oatgrass | |
| *Bromus diandrus* | ripgut brome | |
| *Bromus hordeaceus* | soft brome | |
| *Bromus tectorum* | cheatgrass | |
| *Capsella bursa-pastoris* | shepard's purse | |
| Cardaria draba | whitetop | B |
| *Centaurea maculosa* | spotted knapweed | B |
| *Centaurea repens* | Russian knapweed | B |
| *Centaurea solstitialis* | yellow starthistle | Target |
| *Cerastium glomeratum* | sticky chickweed | |
| *Chamaesyce prostrata* | prostrate spurge | |
| *Cichorium intybus* | chicory | |
| *Cirsium arvense* | Canada thistle | B |
| *Cirsium vulgare* | bull thistle | B |
| *Conium maculatum* | poison hemlock | B |
| *Convolvulus arvensis* | field bindweed | B |
| *Cynosurus echinatus* | bristly dog's-tail grass | |
| *Cytisus scoparius* | Scotch broom | B |
| *Dactylis glomerata* | orchard grass | |
| *Dipsacus fullonum* | Fuller's teasel | |
| *Erodium cicutarium* | redstem filaree | |
| *Euphorbia esula* | leafy spurge | Target |
| *Hedura helix* | English ivy | B |
| *Holcus lanatus* | common velvet grass | |
| *Hypericum perforatum* | St. Johnswort | B |

| Scientific Name | Common Name | Noxious Weed List |
|---|---|---|
| *Hypochaeris radicata* | hairy cats ear | |
| *Lactuca serriola* | prickly lettuce | |
| *Lythrum salicaria* | purple loosestrife | B |
| *Melilotus officinalis* | yellow sweetclover | |
| *Myosotis discolor* | forget-me-not | |
| *Phleum pratense* | timothy | |
| *Plantago lanceolata* | narrowleaf plantain | |
| *Poa bulbosa* | bulbous bluegrass | |
| *Rubus discolor* | Himalayan blackberry | |
| *Rubus laciniatus* | cut-leaved blackberry | |
| *Rumex acetosella* | common sheep sorrel | |
| *Rumex crispus* | curly dock | |
| *Sanguisorba minor* ssp. *muricata* | garden burnet | |
| *Stellaria media* | common chickweed | |
| *Taeniatherum caput-medusae* | medusahead | B |
| *Taraxacum officinale* | common dandelion | |
| *Torilis arvensis* | field hedge-parsley | |
| *Tragopogon dubius* | yellow salsify | |
| *Tribulus terrestris* | puncturevine | B |
| *Trifolium pratense* | red clover | |
| *Trifolium repens* | white clover | |
| *Valerianella locusta* | corn salad | |
| *Verbascum blattaria* | moth mullein | |
| *Verbascum thapsus* | common mullein | |
| *Vulpia myuros* | rat-tail fescue | |

# APPENDIX E
# Channel Morphology Classification

Broad-Level Stream Classification Delineation (Rosgen 1996)



# APPENDIX F
# Recent BLM Timber Sales

| Sale Name | Date Sold | Location (Township, Range, Section) | Unit | Harvest Type /1 | Harvest Method | Acres | Volume Removed MBF /2 |
|---|---|---|---|---|---|---|---|
| Section Line Gap | 06/26/86 | 39S, 1W, Sec. 7 | 1 | CC | Cable | 20 | 422 |
| Section Line Gap | 06/26/86 | 39S, 1W, Sec. 7 | 6 | SC | Tractor | 16 | 179 |
| Section line Gap | 06/26/86 | 39S, 1W, Sec. 7` | 4, 8 | OR | Aerial | 32 | 334 |
| Salty Dog | 05/25/89 | 38S, 2W, Sec. 21 | 1 | CC | Cable | 29 | 711 |
| Kane Forest | 05/24/90 | 37S, 1W, Sec. 6, 7, 17<br>37S, 2W. Sec. 1, 12, 13, 35 | Not named | MS | Aerial | 655 | 990 |
| Go Anderson | 07/26/90 | 38S, 2W, Sec. 26, 27, 34, 35<br>39S, 2W, Sec. 1, 11, 12 | Not named | MS | Aerial | 903 | 1995 |
| Go Anderson | 07/26/90 | 38S, 2W, Sec. 26, 27, 34, 35<br>39S, 2W, Sec. 1, 11, 12 | Not Named | MS | Cable | 52 | 105 |
| Anderson Salvage | 05/30/96 | 38S, 2W, Sec. 35<br>39S, 2W, Sec. 1, 2, 3, 11, 12 | ITM | MS | Cable | 25 | 44 |
| Sterling Rogue | 05/29/97 | 38S, 22, Sec. .27 | 1 | CT | Tractor | 4 | 20 |
| Isabelle /3 | 10/22/98 | 37S, 3W, Sec. 35<br>38S, 3W, Sec. 2 | 5B, 5C, 6 | DM | Aerial | 11 | 27 |
| Isabelle | 10/22/98 | 38S, 3W, Sec. 2 | 5B | DM | Cable | 6 | 14 |
| Isabelle | 10/22/98 | 38S, 3W, Sec. 2 | 5A | DM | Tractor | 28 | 67 |

1/ Harvest Type Codes: MS=Mortality Salvage; CC=Clearcut; SC=Select Cut; MSW=Modified Shelterwood
CT=Commercial Thin

2/MBF = thousand board feet

3/Timber sale not harvested as of February 2001

# APPENDIX G
# Grazing Use on BLM-Administered Lands

**West Bear Creek Watershed Analysis Area Allotment Summaries for BLM-Administered Lands**

| Allotment (Name and Number) | Percentage of Allotment in Analysis Area | Portion of Allotment in Analysis Area (BLM Acres) | Total Permitted Use (AUMs[1]) | Season of Use |
|---|---|---|---|---|
| Sardine and Galls Creek 20205 | 50 | 1,770 | 0 | Cancelled |
| Sterling Creek 20207 | 25 | 5,481 | 190 | Vacant |

1/ AUMs = animal unit months
*Estimated

# APPENDIX H
# Road Densities > 4.0 mi/sq. mi. and/or Road/Stream Intersections > 10/sq. mi.

| Township | Range | Section | Road Density (mi./sq. mi.) | Stream Crossings (Number) | Federal Road Miles (%) | Granitic Soils in Section? (Y/N) |
|---|---|---|---|---|---|---|
| **Wagner Creek Analysis Subwatershed** | | | | | | |
| 38S | 1W | 26 | 6.0 | 3 | 0.0 | N |
| 38S | 1W | 34 | 4.4 | 2 | 0.0 | N |
| 38S | 1W | 35 | 4.8 | 14 | 0.0 | N |
| 39S | 1E | 18 | 4.1 | 4 | 0.0 | Y |
| 39S | 1W | 2 | 10.6 | 38 | 0.0 | N |
| 39S | 1W | 3 | 9.9 | 31 | 0.0 | N |
| 39S | 1W | 4 | 4.0 | 25 | 9.7 | N |
| 39S | 1W | 10 | 6.3 | 33 | 0.0 | N |
| 39S | 1W | 11 | 2.7 | 15 | 0.0 | N |
| 39S | 1W | 12 | 6.7 | 30 | 0.0 | Y |
| 39S | 1W | 14 | 3.5 | 22 | 20.6 | Y |
| 39S | 1W | 21 | 6.4 | 8 | 100 | N |
| 39S | 1W | 22 | 5.9 | 9 | 50.8 | N |
| 39S | 1W | 23 | 4.1 | 19 | 44.2 | Y |
| 39S | 1W | 24 | 6.1 | 16 | 0.0 | Y |
| 39S | 1W | 27 | 4.4 | 12 | 40.0 | Y |
| **Anderson Creek Analysis Subwatershed** | | | | | | |
| 38S | 1W | 20 | 8.0 | 1 | 0.0 | N |
| 38S | 1W | 21 | 4.8 | 15 | 0.0 | N |
| 38S | 1W | 28 | 4.0 | 12 | 0.0 | N |
| 38S | 1W | 31 | 4.7 | 12 | 0.0 | N |
| 38S | 1W | 32 | 2.3 | 15 | 0.0 | N |
| 38S | 1W | 33 | 3.7 | 11 | 0.0 | N |
| 38S | 1W | 34 | 6.1 | 9 | 0.0 | N |

| Township | Range | Section | Road Density (mi./sq. mi.) | Stream Crossings (Number) | Federal Road Miles (%) | Granitic Soils in Section? (Y/N) |
|---|---|---|---|---|---|---|
| 39S | 1W | 5 | 5.9 | 23 | 1.7 | N |
| 39S | 1W | 6 | 10.4 | 60 | 0.0 | N |
| 39S | 1W | 7 | 4.6 | 13 | 42.0 | N |
| 39S | 2W | 1 | 6.0 | 5 | 100 | N |
| 39S | 2W | 12 | 5.7 | 6 | 100 | N |
| **Coleman Creek Analysis Subwatershed** | | | | | | |
| 38S | 1W | 20 | 5.3 | 6 | 0.0 | N |
| 38S | 1W | 30 | 4.2 | 19 | 2.4 | N |
| 39S | 2W | 1 | 5.1 | 6 | 100 | N |
| **Griffin Creek Analysis Subwatershed** | | | | | | |
| 36S | 2W | 34 | 6 | 2 | 0.0 | N |
| 37S | 2W | 3 | 15.2 | 3 | 0.0 | N |
| 37S | 2W | 10 | 19.1 | 6 | 0.0 | N |
| 37S | 2W | 22 | 4.2 | 2 | 0.0 | N |
| 37S | 2W | 28 | 4.8 | 3 | 0.0 | N |
| 37S | 2W | 31 | 11.9 | 8 | 4.4 | N |
| 37S | 2W | 32 | 13.5 | 37 | 0.0 | N |
| 37S | 2W | 33 | 6.9 | 8 | 0.0 | N |
| 37S | 2W | 34 | 7.2 | 15 | 0.0 | N |
| 38S | 2W | 2 | 9.2 | 5 | 0.0 | N |
| 38S | 2W | 3 | 8.3 | 15 | 0.0 | N |
| 38S | 2W | 4 | 6.9 | 17 | 0.0 | N |
| 38S | 2W | 5 | 11.9 | 21 | 0.0 | N |
| 38S | 2W | 6 | 8.0 | 8 | 0.0 | N |
| 38S | 2W | 9 | 7.3 | 25 | 0.0 | N |
| 38S | 2W | 10 | 7.8 | 23 | 0.0 | N |
| 38S | 2W | 11 | 9.2 | 16 | 0.0 | N |
| 38S | 2W | 14 | 9.7 | 13 | 0.0 | N |
| 38S | 2W | 15 | 10.0 | 43 | 0.0 | N |
| 38S | 2W | 16 | 4.2 | 21 | 0.0 | N |

| Township | Range | Section | Road Density (mi./sq. mi.) | Stream Crossings (Number) | Federal Road Miles (%) | Granitic Soils in Section? (Y/N) |
|---|---|---|---|---|---|---|
| 38S | 2W | 21 | 5.9 | 13 | 45.7 | N |
| 38S | 2W | 22 | 4.4 | 14 | 0.0 | N |
| 38S | 2W | 23 | 6.0 | 35 | 0.0 | N |
| 38S | 2W | 24 | 8.9 | 10 | 0.0 | N |
| 38S | 2W | 25 | 5.7 | 11 | 100 | N |
| 38S | 2W | 26 | 6.8 | 18 | 65.2 | N |
| 38S | 2W | 27 | 10.0 | 5 | 40.0 | N |
| 38S | 2W | 35 | 7.3 | 11 | 100 | N |
| 38S | 2W | 36 | 5.2 | 6 | 0.0 | N |
| **Jackson Creek Analysis Subwatershed** | | | | | | |
| 36S | 2W | 28 | 16.0 | 11 | 0.0 | N |
| 36S | 2W | 32 | 7.7 | 2 | 0.0 | N |
| 36S | 2W | 33 | 6.1 | 13 | 0.0 | N |
| 37S | 2W | 3 | 4.5 | 3 | 0.0 | N |
| 37S | 2W | 4 | 4.1 | 7 | 0.0 | N |
| 37S | 2W | 5 | 5.3 | 8 | 0.0 | Y |
| 37S | 2W | 8 | 7.9 | 34 | 1.3 | Y |
| 37S | 2W | 9 | 8.8 | 13 | 0.0 | Y[1] |
| 37S | 2W | 10 | 9.9 | 5 | 0.0 | N |
| 37S | 2W | 15 | 8.7 | 5 | 32.4 | N |
| 37S | 2W | 16 | 10.4 | 24 | 11.5 | Y[1] |
| 37S | 2W | 17 | 13.3 | 38 | 3.0 | Y |
| 37S | 2W | 18 | 11.1 | 47 | 0.0 | Y |
| 37S | 2W | 19 | 15.2 | 68 | 0.0 | Y |
| 37S | 2W | 20 | 10.0 | 27 | 0.0 | Y[1] |
| 37S | 2W | 21 | 5.1 | 10 | 0.0 | N |
| 37S | 2W | 22 | 5.5 | 3 | 0.0 | N |
| 37S | 2W | 28 | 6.7 | 4 | 0.0 | N |
| 37S | 2W | 29 | 10.0 | 16 | 0.0 | N |
| 37S | 2W | 30 | 10.8 | 40 | 0.0 | N |

| Township | Range | Section | Road Density (mi./sq. mi.) | Stream Crossings (Number) | Federal Road Miles (%) | Granitic Soils in Section? (Y/N) |
|---|---|---|---|---|---|---|
| 37S | 2W | 31 | 10.9 | 25 | 5.1 | N |
| 37S | 2W | 32 | 10.0 | 3 | 0.0 | N |
| 37S | 3W | 13 | 7.3 | 14 | 0.0 | Y |
| 37S | 3W | 14 | 14.5 | 4 | 0.0 | Y |
| 37S | 3W | 22 | 9.0 | 4 | 2.9 | Y[1] |
| 37S | 3W | 23 | 5.7 | 42 | 22.8 | Y |
| 37S | 3W | 24 | 6.1 | 42 | 0.0 | Y |
| 37S | 3W | 25 | 4.5 | 23 | 0.0 | Y[1] |
| 37S | 3W | 26 | 7.0 | 33 | 5.8 | Y[1] |
| 37S | 3W | 35 | 3.0 | 22 | 16.1 | N |
| 37S | 3W | 36 | 7.6 | 30 | 0.0 | N |
| 38S | 2W | 6 | 12.0 | 6 | 0.0 | N |
| 38S | 3W | 1 | 5.7 | 16 | 26.9 | N |
| 38S | 3W | 2 | 4.5 | 13 | 8.0 | N |
| **Willow Creek Analysis Subwatershed** | | | | | | |
| 36S | 2W | 28 | 9.0 | 10 | 0.0 | N |
| 36S | 2W | 29 | 11.0 | 5 | 0.0 | N |
| 36S | 2W | 32 | 8.0 | 3 | 0.0 | N |
| 37S | 2W | 6 | 4.7 | 17 | 0.0 | N |
| 37S | 2W | 7 | 5.1 | 31 | 0.0 | N |
| 37S | 2W | 18 | 10.0 | 21 | 0.0 | N |
| 37S | 3W | 11 | 14.0 | 3 | 0.0 | Y |
| 37S | 3W | 13 | 4.7 | 4 | 42.9 | Y |

1/ Granitic soils are only found along the section’s edge.

# APPENDIX I
# Fifteen Percent (15%) Late-Successional Retention Areas

The Northwest Forest Plan (NFP) recognizes the value of remnant late-successional (mature/old-growth) forest stands for their biological and structural diversity and for their function as refugia for old-growth related species. The 15 percent Standard and Guide (S&G) in the Record of Decision (ROD) for the NFP addresses the retention of these forest stands on a 5th Field Watershed scale (USDA and USDI 1994a:C-44). The S&G basically states that at least 15 percent of the forested landbase in the watershed should be comprised of late-successional forest. The NFP federal executives, with the assistance of the Regional Ecosystem Office (REO), developed a process to assess what action(s), if any, should be taken to meet the 15 percent S&G.

As part of the Third Year Review of the Medford District Resource Management Plan (RMP), all 5th Field watersheds in the district were assessed using the process developed by the NFP federal executives. For the analysis of the 5th Field Bear Creek Watershed, which includes the West Bear Watershed Analysis Area, and other watersheds within the administrative boundary of the Ashland Resource Area, late-successional forest was defined as that which is greater than 80 years old and provides suitable habitat for northern spotted owls. Suitable northern spotted owl habitat provides for nesting, roosting, or foraging by owls, and generally has the following attributes: high degree of canopy closure (approx. 60%+), multilayered canopy, presence of large snags and coarse woody debris.

The results of the late-successional forest analysis for the Bear Creek Watershed (5th Field) follow:

| Federal Ownership | Forested Landbase (Acres) | Existing Late-Successional Forest (Acres) | Late-Successional Forest Available for Harvest (Acres) | Late-Successional Forest to be Retained (Acres) | Percent of Forested Landbase Comprised of Late-Successional Forest to be Retained |
|---|---|---|---|---|---|
| BLM | 18,107 | 10,438 | 3,367 | 7,071 | 39 |
| USFS | 16,590 | 11,310 | ≈13 | ≈11,297 | 68 |
| **Total** | 34,697 | 21,748 | 3,380 | 18,368 | 53 |

As shown in the table above, there are 34,697 acres in the federal forested landbase in the watershed, and of that, 21,748 acres are existing late-successional forest. Of the 21,748 acres of existing late-successional forest, 3,367 acres are available for future timber harvest on BLM managed lands, and approximately 13 acres are available for harvest on U.S. Forest Service (USFS) lands. Fifty-three percent (18,368 acres) of the existing forested landbase is comprised of late-successional forest that will be retained under existing land-use allocations; therefore, in the Bear Creek Watershed the 15 percent S&G is being met.

Although the 15 percent S&G is applicable at the 5th Field scale, for informational purposes the same analysis used for the 5th Field watersheds was applied to the BLM portion of the West Bear Creek Watershed Analysis Area to evaluate the 15 percent late-successional S&G at that scale.

The results of the late-successional forest analysis for the BLM portion of the West Bear Creek Watershed Analysis Area follow:

| Federal Ownership | Forested Landbase (Acres) | Existing Late-Successional Forest (Acres) | Late-Successional Forest Available for Harvest (Acres) | Late-Successional Forest to be Reserved (Acres) | Percent of Forested Landbase Comprised of Late-Successional Forest to be Resrved |
|---|---|---|---|---|---|
| BLM | 7,838 | 3,142 | 1,249 | 1,893 | 24 |

As shown in the table, there are 7,838 acres in the BLM forested landbase in the watershed analysis area, and of that, 3,142 acres are existing late-successional forest. Of the 3,142 acres of existing late-successional forest, 1,249 acres are available for future timber harvest. Twenty four percent (1,893 acres) of the existing forested landbase is comprised of late-successional forest that is reserved under existing land-use allocations.

# APPENDIX J
# Guidelines for Use of Native/Non-Native Grass for Site Restoration

The retention of native vegetation types within watersheds should be regarded as a long-term management priority. These sites should be carefully managed to retain native species. Management should embrace two guidelines: (1) to reduce ground disturbing activity of native species habitats to prevent invasion by non-native species, and (2) to promote aggressive integrated weed control programs to prevent encroachment into native species habitat.

The West Bear Creek Watershed Analysis Area occurs in what is termed a Mediterranean climate. These climates are characterized by cool, wet winters and hot, dry summer months. The lower elevation sites often contain heavy clay soils with high shrink/swell characteristics. Introduced noxious weed species from countries with Mediterranean climates are often “superior competitors” when introduced into native habitats previously not exposed to aggressive competition for moisture and nutrients.

A major portion of the low-elevation habitats in southwestern Oregon are no longer considered native habitats. It is unlikely that these sites will be reclaimed and converted back to native species in the near future, if ever. Higher elevation native habitats should be protected from invasion by limiting ground disturbance and possible exposure to non-natives through aggressive integrated noxious weed control.

Although reclamation using native species is preferred, some sites invaded by non-native species may require intermediate steps in the reclamation process prior to attempting to plant native species. These “site-adopted” non-native grasses would act as an “organic pump” to restore nutrient and soil productivity as well as prevent the “banking” of noxious weed seed in the soil. The long-term goal would be conversion from productive introduced grasses to native species when and wherever feasible.

# APPENDIX K
# BLM Roads of Concern

**Objectives:** To reduce wildlife disturbance, road density, compacted area, peak flows, sedimentation, and/or roads adjacent to or in Riparian Reserves.

**Recommendation:** Waterbar and block or decommission the following roads.

Road Numbers
38-2-25.1
38-2-26.1 (Block at the junction with road 38-2-25)
38-2-35.0
39-2-1.0
39-2-1.1
39-2-12.1
39-1-17.0
39-1-21.3
39-1-21.1