

Chapter 3

Affected Environment

Introduction

Central Oregon is a land of rapidly growing communities amid vast tracts of BLM administered lands and privately owned agricultural and range lands. Except for the population centers, the land is sparsely settled and largely undeveloped. Because the Cascade and Ochoco Mountains are cold and snowy and the high desert between the communities and to the east and southeast of the developed areas are arid and rocky, development of the region has been limited. The recent rapid growth of the developed communities is partly a function of the attractive recreational opportunities available on Forest Service and BLM administered lands, coupled with the improvements in transportation and communication that have reduced the isolation of Central Oregon from the rest of the world.

This chapter describes the current situation on the planning area, starting with the history and social setting, and the physical and geographical setting. The remainder of the description of the affected environment focuses on the elements of the environment that are the foundation of the issues addressed by the alternatives and analyzed in the environmental consequences. These elements are discussed in the same sequence as established in the issue statements in Chapter 1 and carried through each of Chapters 2, 3, and 4.

Physical Setting

Climate

The climate within the planning area is controlled primarily by air masses that move eastward across western Oregon, and into Central Oregon. What happens to these air masses in Central Oregon is largely the function of two geographical variables. The first is elevation. As elevation decreases from the southern part of the planning area near La Pine to the northern part of the area near Madras, average temperature increases while precipitation decreases. The second is the rain shadow effect of the Cascade Range, which diminishes precipitation rates moving west to east, with the western part of the planning area averaging 15 inches per year. The eastern part of the planning area averages 10 inches per year. The La Pine area averages 15-20 inches per year (Taylor, 1993). Most of the precipitation occurs as snow during winter months, and thunderstorms during summer months. The summer thunderstorms are often high intensity and relatively short in duration. The amount and duration of snowfall in winter is variable, but the southern part of the area receives the highest amounts for the longest duration (USDA, NRCS, 1998). Average high air temperatures generally range in the low 40s in the winter to mid-80s in the summer, with extremes around 107°F. Average low temperatures range in the low 20s in the winter to high 40s in the summer, with the coldest temperatures plummeting to -34°F in the winter.

Air Quality

Most of the planning area has relatively high air quality. A steady trend toward improved visibility has been observed in the Bend and Redmond areas in the past 10 years, largely attributed to the phasing-out of older wood stoves and the use of cleaner methods for heating homes.

Some wilderness areas have been designated Class I Areas for air quality management. No class I areas lie within the planning area, although the Mt. Jefferson, Mt. Washington, and the Three Sisters Wildernesses all lie 15 to 30 miles to the west, and the Strawberry Mountain Wilderness is 70 miles to the east.

Particulate emissions are regulated for some counties in Oregon. No regulation exists for Deschutes, Jefferson, or Crook Counties. Klamath and Lake Counties are partial non-attainment areas for PM-10, which is airborne particulate material in smoke that is less than 10 microns in diameter. The portions of Klamath and Lake Counties with this designation are the populated areas around Klamath Falls and Lakeview, some 80 miles south of the planning area.

Physiography and Drainage

The planning area includes parts of the two major ecologically based land provinces—the Mazama, and the John Day. The physical characteristics of the different provinces of Oregon are based on geography, geology, and soil (Anderson *et al.*, 1998). The planning area resides in the Deschutes Basin, primarily within the Lower Crooked, Upper Deschutes, and Little Deschutes, Sub-basins (See Map S-14: Sub-basins, Watersheds, and Sub-Watersheds; and the Aquatic/Riparian/Water section for more discussion on hydrologic units). Numerous miles of perennial, intermittent, and ephemeral streams dissect the area.

The highest point in the planning area is West Butte with a summit elevation of 5,840 feet. The lowest points are in the Deschutes and Crooked River canyons, which drop to just under 2000 feet at the northern boundary of the planning area.

The Mazama province is represented in the western three-quarters of the planning area. It is covered by a continuous mantle of wind blown deposits of pumice and other volcanic materials spewed over the countryside when Mt. Mazama erupted about 6,500 years ago. Other volcanic activity and eruptions, as well as glacial actions, have created areas consisting of basaltic, andesitic, rhyolitic, and tuffaceous deposits and cinders and glacial till.

The John Day province is represented in the northeastern quarter of the planning area. Long, generally north-to-south, mountain ranges and valleys with ancient lake terraces and fans characterize the area.

The geology of the planning area is characterized by relatively young extrusive volcanic materials and volcanic derived sedimentary materials. For the most part the rocks are flat lying, being interrupted by a few rounded piles of volcanic material, small displacement faulting and an occasional topographic extreme, including Smith Rocks and the canyon of the Crooked River. Relief is moderate throughout the planning area. The topography of the Deschutes and Crooked Rivers is the product of numerous volcanic eruptions within and around the basin. These have contributed to a diverse section of lava flows, pumice air-fall deposits, and ignimbrites. Erosion of these volcanic materials have supplied large volumes of fragmental material to form the volcanoclastic sediments found in the basin. Interesting geologic features found in the area include cinder cones, lava flows, pressure ridges and lava tubes (caves).

The La Pine sub-basin in the southwest portion of the planning area lies between the High Cascade Mountains and Newberry Volcano, and has served as a catchment for the materials eroded off the sides of the volcanic piles. The basin has filled with stream and lake deposits composed of volcanic derived silts, sands, gravels with minor amounts of diatomite.

Most of the planning area is drained by the Deschutes River and its tributaries, which include the Little Deschutes River, Tumalo Creek, Dry River, Squaw Creek, Metolius River, Crooked River, and Willow Creek. Water is a limited resource in the agricultural areas of the survey area because of the limited precipitation, high infiltration rate, and moderate or high permeability of the soils.

Three important fault zones are present in the planning area, the Brothers, Sisters and Walker Rim fault zones. The Brothers fault zone consists of numerous NW-SE trending right-lateral faults with displacements generally less than 50 feet (Orr and others, 1992). This fault zone extends 130 miles NW from Steens Mountain and merges with the Sisters fault zone near Bend. The Sisters fault zone trends NE from just south of Bend and extends 40 miles to Black Butte (Sherrod and others, 1997b). Approximately 50 faults ranging from 0.3 to 30 miles in length have been mapped in the Sisters fault zone. The Walker Rim fault zone extends southwest from the Newberry volcanic complex through the La Pine portion of the planning area toward Crater Lake.

Geological History

The geologic history of the planning area consists primarily of varied volcanic events and processes beginning 44 million years ago and continuing to the present. These processes resulted in a complex assemblage of volcanic rocks including flows of basalt, andesite, rhyolite, and welded tuff and various tephra deposits of ash, pumice, cinders, and volcanic bombs. Prominent geomorphic features in the planning area include lava tubes, pressure ridges, columnar basalt, cinder cones, shield volcanoes, and deep canyons. Rivers in the region were often overloaded with volcanic materials and the subsequent erosion, transport, and re-deposition of these materials produced various volcanoclastic sedimentary rocks.

The oldest rocks in the planning area comprise the Clarno Formation. Emplacement of these rocks began approximately 44 million years ago during the Eocene with the opening of a chain of volcanic vents in eastern Oregon (Orr and others, 1992). The Cascade Mountains were not present at this time and the Pacific Ocean shoreline was east of the modern day location of the Cascades. With no topographical barrier to moisture-laden air from the ocean, a wet tropical climate prevailed and supported lush woodlands interspersed with open grasslands. The Clarno volcanoes erupted large quantities of ash, rhyolite, and andesite. Thick, loose ash deposits on steep volcano slopes frequently mixed with water to form large mudflows known as "lahars" due to the wet climate. These viscous flows moved like molasses over the landscape, entombed both plants and animals, and preserved them as fossils. Plant fossils found in these deposits include petrified wood and leaves, nuts, fruits, and seeds of tropical hardwoods (Retallack and others, 1996). Fossilized remains of prehistoric rhinoceroses and horses are also found. The Clarno Formation crops out along the northeastern and eastern boundaries of the planning area.

In the early Oligocene (about 36 million years ago), the climate shifted from tropical to temperate, Clarno volcanism ceased and a short period of erosion ensued (Orr and others, 1992). Then, a new episode of volcanic activity commenced, producing the rocks of the John Day formation. The volcanoes of the John Day produced explosive ash eruptions and flows that blanketed much of the region. Dense clouds of hot ash swept across the landscape and fused into tuffs under heat and pressure when deposited. In addition to ash deposits, basalt, andesite and rhyolite lavas issued from the volcanoes. Rapidly deposited ash and mud from volcanic activity provided ideal conditions for fossilization of the semi-tropical plants and animals living in the region at the time. Preserved foliage from dawn redwood (metasequoia) and alder are common in these deposits (Retallack and others, 1996). Animal fossils include various prehistoric cats, dogs, horses, camels, rodents, and rhinoceroses. Rocks of the John Day Formation crop out in the northern and eastern parts of the planning area including Smith Rock and Powell Buttes (Brown and others, 1980; Smith and others, 1963).

During the Miocene and Pliocene, successive volcanic flows built Cascade Mountains high enough to become a topographic barrier to moist air from the Pacific, transforming the eastern Oregon climate into the dry climate of the present (Orr and others, 1992). Volcanic activity during the Early Miocene (16-12.5 million years ago) in the Western

Cascades delivered large quantities of volcanic material into the Deschutes basin and overloaded rivers with sediments. The Simtustus Formation was deposited in the northwest part of the planning area as rivers reworked these sediments into volcanoclastic sandstone and mudstone deposits up to a total thickness of 250 feet. During this time, about 15.7 million years ago, the Prineville basalt erupted from vents believed to be near Bowman Dam (Hooper and others, 1993). This succession of flood basalts is present throughout the northeastern part of the planning area and beyond with some flows extending to Portland, Oregon. The Prineville basalt sequence crops out in the Crooked River canyon with relatively numerous and thick flows near Bowman Dam. The Deschutes Formation was created when another phase of volcanism began 8 million years ago. Early High Cascade volcanoes erupted andesite, basalt, and hot clouds of tuff-forming ash into the Deschutes basin over a period of 4 million years. The Deschutes and other rivers reworked some of these volcanic materials into coarse conglomerates that are lithologically distinct from the fine-grained sedimentary rocks of the Simtustus Formation (Orr and others, 1992). The Deschutes formation has a thickness of 2000 feet on the western margin of the basin and thins to 50 feet at the eastern margin near the Ochoco Mountains.

Throughout the middle to late Pliocene and into the Pliocene (beginning 4.0 million years ago), the Deschutes Basin was subjected to more waves of volcanism (Orr and others, 1992). Numerous cinder cones appeared within the basin and the area was flooded by large basalt flows from local vents. The most extensive basalt flows during this time originated from the Newberry shield volcano south of Bend beginning about 600,000 years ago (Sherrod and others, 1997a). These flows blanket much of the western half of the planning area between Bend and Powell Buttes and extend north to Smith Rock and Lake Billy Chinook.

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Water

Groundwater flow that originates in the Cascade Range is the major source of streamflow for the Lower Deschutes and Lower Crooked Rivers, and Lower Squaw Creek (Gannett, *et al.*, 2001). Substantial ground-water discharge occurs along the lower 2 miles of Squaw Creek, the Deschutes River between Lower Bridge and Pelton Dam, the lower Crooked River, and in Lake Billy Chinook. The discharge of groundwater is controlled by geology, where the low permeability of the John Day Formation forces groundwater from the overlying Deschutes Formation to be discharged into the rivers. Discharge of groundwater is demonstrated by the numerous springs that emanate from the canyon walls of the lower Crooked River and lower Deschutes River gorges. The flows for Upper Squaw Creek, Little Deschutes River, Tumalo Creek and Crescent Creek originate as spring flows in the Cascades. Snowmelt from the Ochoco and Maury Mountains, as well as springs from the South Fork Crooked River, provides flow to the Upper and Middle Crooked River. Natural flows of the Upper Deschutes and Crooked Rivers have been modified by 5 major reservoirs and diversions of water from the rivers for irrigation.

Social Setting

First Nations of the Region

During the first half of the 19th century, when Euroamericans began exploring Central Oregon in pursuit of fur bearing animals and political objectives (Robbins 1997:40; Clark 1981:16- 17; Oetting 1997:8), they occasionally encountered small groups of Indian people involved in seasonal activities throughout the BLM administered lands now included in the planning area. According to observations by those outside travelers, the native people they contacted spoke numerous languages or dialects and were members of various tribal groups. A partial listing of those tribal groups included the following: Snake; Hunupui Eaters; Shoshone, Paiute; Northern Paiute; Juniper-Deer-Eaters; Warm Springs; Tygh; Molalas; Shahala; Wasco; Upper Chinook; Tenino; Celilo; Wyam; Wanapum; Sahaptin; and Klamath (LeBow 1990:19). In an attempt to alleviate some of this historical confusion, ethnographers and linguists doing studies in the late 19th and early 20th centuries, as well as reorganization during the establishment of reservations, concluded that native people living in the Central Oregon region at the time of white contact consisted of three primary tribal groups: the Wasco and Warm Springs; Northern Paiute; and the Klamath.

During historic times, the Wasco and Warm Springs people occupied portions of the lower Columbia River and segments of the Deschutes and John Day Rivers (Confederated Tribes of Warm Springs 1992:2). The Northern Paiute were based in the Harney Valley but used resources along the upper Deschutes and John Day Rivers as well as throughout the High Desert (Burns Paiute Tribe 1992, personal communication). In contrast to that, the Klamath lived beside the lakes and marshes of the Klamath basin in southCentral Oregon, but used resources on a seasonal basis along the upper Deschutes River and in the adjacent High Desert area (Zucker *et al.*, 1983:11). Conflicts between those groups over lands and resources did occur periodically (Oetting 1997:8) leaving it largely unknown which group may have held the territory on a consistent basis. Yet despite those ambiguities, at least three assumptions about pre-contact land tenure can be made from both the archaeological and ethnographic evidence: changes in environmental conditions warranted modifying land use strategies; one group simply out-competed another for resources; or clashes between groups established new tribal territorial boundaries. What the archaeological record does confirm is that, although Indian people established many temporary camps throughout the area during the past 10,000 years (Pettigrew *et al.*, 1998:3.3), there were few if any permanent settlements in the Upper Deschutes Planning Area (Oetting 1997: 5-10). Whether early prehistoric people were culturally affiliated with contemporary Indians living in the region today is not known.

Indigenous Traditional Lifeways and the Cultural Landscape

Precontact Indians living in Central Oregon were members of hunting and gathering societies who survived by virtue of a detailed understanding about their surroundings (Hunn 1990:91). Like all groups of hunters and gatherers, through time and across space, they followed broad seasonal rounds across the landscape. With a knowledge about resources that comes only from living close to the land, those annual rounds set a schedule determined by the season and dictated by soils, water, and elevation, to put people in a particular place, at a particular time, when particular resources were available for harvesting (Aikens and Couture 1991:21). A typical seasonal round for some, but not all, groups of Indian people living in prehistoric Central Oregon might be as follows: (April) low elevations-first green shoots appear; (April-May) tuberous and globulous roots from semiarid, rocky soils at moderate elevations; (April-May) river stations for salmon; (late June) upper elevation meadows for bulbous roots; (late June-early July) rivers for blueback salmon and summer steelhead and possibly to gather various early fruits such as serviceberries, gooseberries, currants, and chokecherries; (late August-

September) mountain locations for huckleberries, deer, elk; (September-October) river stations for fall chinook and mountain locations for deer and elk; (November-March) occupation of winter villages (Hunn 1990:119-134). While in winter villages, people often took the opportunity to take waterfowl and procure non-migratory species of fish from local rivers, streams, and lakes and to hunt for various large and small game in the immediate vicinity. Additionally, at some winter village locations in Central Oregon, people would participate in communal rabbit or pronghorn drives on the high desert (Aikens and Couture 1993:16).

This discussion constitutes only a small percentage of resources used by Central Oregon native people during their seasonal round. Ethnographic and anthropological studies conducted over the past one hundred years inform us that dozens of different plant and animal resources, from scores of different locations, were used by precontact Indian people living in Central Oregon (Coville 1897; Spier 1930; Couture *et al.*, 1986; Ellis *et al.*, 1998; Hunn *et al.*, 1998). The knowledge of those resources not only provided for the procurement of many different kinds of foods and medicines but also the raw materials to produce tools, utensils and weapons, shelter, clothing, and items of personal adornment, power, wealth and prestige. Taken from that perspective, it becomes obvious that, "the totality of the regional landscape has importance" to local populations of Indian people (Hanes 1995:30).

Aboriginal patterns tethered to annual rounds have been greatly disrupted since white settlement and development in Central Oregon. With the arrival of Euroamericans, property ownership changed, private property was fenced, soils plowed under or grazed over, irrigation canals, roads and railroads constructed, forests cut, wildland fires suppressed, and rivers dammed and reservoirs impounded. Those activities have had a tremendous affect on the plants, animals, fish, and sacred places upon which native people depended. Despite those changes to the land and displacement of resources, many contemporary Indians continue to practice and follow certain aspects of the traditional way of life. Throughout Central Oregon and beyond, they gather roots, berries, various seeds, and medicinal plants, fish, hunt game, and collect numerous items for ceremonial and spiritual purposes. Although changes to the land have, in some cases, forced contemporary Native people to seek resources significant to their cultural identity at new locations, still, other locations have been visited continuously for hundreds and even thousands of years. The rights of Federally recognized Indian Tribes to maintain their cultural identity through such traditional activities on BLM-administered lands has been guaranteed to them as a result of various treaties, statutes, congressional acts, court cases, and executive orders.

Euroamerican Settlement and Development and Historic Resources

The first Euroamerican encounters with Central Oregon came by way of agents of empire and the federal government. Meriwether Lewis and William Clark skirted the northern edge, but never penetrated the hinterlands of Central Oregon during 1805 on their trip down the Columbia River to the Pacific Ocean.

During the next half century, Central Oregon was entered by fur trappers and various explorers in the employ of the Hudson's Bay Company and the federal government. Peter Skene Ogden and his fur trapping brigade penetrated the upper Deschutes and Crooked Rivers during their Snake Country travels to Harney Basin in 1825-1827 (Vaughan 1981:2; Robbins 1997:223). Ogden's excursions into Central Oregon were followed in the 1840s and 1850s by the explorations of John C. Fremont, Robert Williamson and Henry Abbot. Members of the Army Corps of Topographical Engineers, their respective missions resulted in the mapping and documentation of unknown portions of Central Oregon lands and resources. In his final report, Abbot concluded that

the region was unlikely to develop economically as it was “separated from the rest of the world by almost impassable barriers” and offered “very few inducements to settlers” (Brogan 1964:236).

Despite Abbot’s admonition, settlers did come. Most of the early immigrants of the 1840s and 1850s, however, did not stay. Most immigrants went through Central Oregon from the east on their way to the more fertile lands of the Willamette valley. But by the 1860s a network of roads and trails were beginning to form throughout Central Oregon as settlers took up lands within valley basins and miners headed to the gold camps in the John Day country. Entering the area from California to the south, miners traveled the Yreka Road to the John Day gold fields while settlers in covered wagons, often pushing herds of cattle, swine or sheep, crossed the Cascade Mountains through Santiam Pass following the Willamette Valley Cascade Mountain Military Wagon Road or over the McKenzie or Scott’s Trails. The Dalles to Canyon City to Boise Road also witnessed thousands of immigrants entering Central Oregon not only south from the direction of The Dalles but east from Boise as well (Lebow, *et al.*, 1990:74). Still another important north/south arterial, known as the Huntington Road, was developed for transporting goods from Fort Dalles to Fort Klamath after the establishment of the Klamath Indian Reservation in 1864.

Arrival of large numbers of settlers had a tremendous impact on the lifeways of Indian people living in the area. As a result of those impacts, tensions mounted between the two cultures and eventually escalated into the conflict known as the Snake Wars (Lebow *et al.*, 1990:75). With the outbreak of that conflict, in 1859, numerous military garrisons were established along the Willamette Valley Cascade Mountain and The Dalles Military Roads. In Central Oregon those garrisons included Camps Polk, Gibbs, Watson, and Maury (Preston 1977:60). Established to protect miners and settlers and keep lines of communication open, troops occupied those posts sporadically until the end of hostilities in 1868.

White settlement spread out to all areas that would seemingly support farming or ranching in Central Oregon at the close of Indian/White hostilities. Cattle and sheep herding expanded in the 1870s from the previous decade, though it would not reach large scale proportions until the end of the century (Lebow *et al.*, 1990:75). Far more important, however, was the development of towns and rural communities during the final quarter of the 19th century and continuing into the first two decades of the 20th century. It was during that period that all of the communities known to exist in the area today were established: Prineville in 1871; Bend in 1886; Madras in 1903; and Redmond in 1905 (McArthur 1982:54, 218, 606, 616; Clark 1981:37). Many other rural post office communities with names such as Haystack, Lamonta, Grizzly, and Millican were also established during that period but have all but disappeared with the passage of time.

After the turn of the 20th century, the growth and economic development of the larger, more established, Central Oregon communities were substantially secured due to the occurrence of three primary events. These were the construction of a network of irrigation canals; completion of the Oregon Trunk Railroad to Bend; and the construction of two large, Minnesota-based, sawmills in Bend.

Promoted by railroads, irrigation companies, and local land developers as a “fertile tract of land capable of high cultivation,” many people were lured to Central Oregon with the hopes of turning 320 acres of government land into a bountiful garden (Allen 1987: 34; Clark 1981:56, 112). By 1913, new communities with names like Imperial, Stauffer, Hampton, Brothers, and Fremont appeared all across the area “to serve homesteaders whose cabin lights on winter evenings glittered like fireflies in the sagelands” (Brogan 1964:143). Irrigation did enhance the agricultural potential of Central Oregon and continues to do so in the present. But most homesteaders who arrived in the area after the turn of the 20th century were forced to take up marginal lands with little access to naturally occurring water or those which were outside the reach of irrigation systems.

Many people left the area after facing short growing seasons, lack of water, hordes of jack rabbits and dry rocky soil (Allen 1987:91; Clark 1981:56-63; Coe 1939:228-237). It was fortunate for many of those ill-fated homesteaders that two large saw-milling outfits in Bend, Oregon, began operations in 1916. Those new mills, and their associated logging camps, offered many people the prospects of a new beginning at a steady job with a reliable income (Allen 1987:85, 99; Gregory 2001:44).

During the greater part of the 20th century, Central Oregon's population growth and economic development hinged upon agricultural and timber industries; industries whose activities largely depended on BLM administered lands for resource extraction. Although still important to various elements of local economies, those industries had greatly diminished by the close of the 20th century to be replaced by yet another industry tethered to use of the public domain— the recreation industry.

Current Social Setting

The planning area occupies two separate portions of Central Oregon and contains about a sixth of the geographic area of Crook County, a quarter of Deschutes County, a small portion of southern Jefferson County, and a small portion of Klamath County. This area includes or is adjacent to the most populated area in eastern Oregon, and has experienced one of the highest growth rates in the state. The population of Crook County is 19,182, an increase of 36 percent from 1990, the majority of which reside in the planning area. About half of the 115,367 residents of Deschutes County live within the planning area. The number of residents in Deschutes County has increased by 54 percent since 1990. The population of Jefferson County is 19,009, an increase of 39 percent from 1990. A small area of northern Klamath County is also in the planning area.

The descriptions of the existing conditions emphasize Deschutes and Crook Counties as representative of existing conditions in the planning area since about 93 percent of the planning area is in these two counties.

Crook County covers an area of about 1,914,200 acres in the geographic center of Oregon. While similar in size to neighboring Deschutes County (Crook County ranks 12th largest in size among Oregon's 36 counties, and Deschutes County ranks 11th largest), the population of Crook County is only about 1/6th that of Deschutes County. Land ownership in the county is evenly split between the public and private sectors, with about 48 percent privately owned and about the same amount in federal ownership. Land use in the county is primarily devoted to agriculture and forestry. According to the Oregon Employment Department (2001), Crook County's economy and employment remains heavily dependent on lumber and wood products manufacturing, which account for 24 percent of non-farm employment. A study of communities in the Upper Columbia River Basin ranked Prineville (the Crook County seat) as "high" for specialization in the category of wood product manufacturing employment (USFS and BLM, 1998). The employment and population figures help describe the local context for BLM decision-making in Crook County — a county experiencing rapid population growth but also grounded in its history of "wide open spaces" and natural resource-based economy.

Deschutes County covers an area of 1,955,200 acres, of which 80 percent is in federal ownership. Although lumber and wood products still comprise about 39 percent of manufacturing in the county (Oregon Employment Department, 2001), rapidly growing urban centers in Deschutes County, notably Bend and Redmond, are becoming increasingly less specialized as service, construction, and other employment sectors grow. Neither Redmond nor Bend ranked "high" in any employment specialization categories evaluated in the Upper Columbia River Ecosystem Management Project report (USFS and BLM, 1998). Preister (2000) reports two dominant and contradictory social themes in areas studied near Redmond, Sisters, and Bend: part of the community expressed grave

concerns about regional growth, while other community members expressed excitement about community and economic growth in the region. Observations in the planning area in southern Deschutes County near the unincorporated community of La Pine showed that residents are drawn to the area to live in a scenic, rural community in semi-seclusion, with more dispersed settlement patterns of residents scattered throughout the mountains, woods, and back country areas (Preister, 2000).

The Central Oregon Community Investment Plan (COICIP, [Central Oregon Intergovernmental Council, 2002]), was heavily relied upon to summarize population, income, and other socioeconomic data for Central Oregon counties. The data presented from this and other sources show the changing nature of the local social and economic landscape in the planning area with:

- Population growth rates above average for the state until 2020 or beyond;
- A more ethnically diverse population;
- An older, more educated population with more disposable income;
- An increase in the average income of residents and an increase in the number of people living in poverty;
- An increase in the diversity of jobs; and
- An increase in the cost of housing.

Social and Economic Overview

Population, Demographics, and Growth

According to the 2000 Census data, the population of Crook County had reached 19,182, and the population of Deschutes County had reached 115,367 (Table 3-1). During the previous 10 years, Deschutes County had the highest overall percentage population change in the state (53.9 percent increase), steadily adding an average of 4,041 people per year. Crook County ranked 5th in the state for percentage of population change (36 percent increase), and has added an average of 507 people per year in the last 10 years (Central Oregon Intergovernmental Council, 2002). People moving into both counties accounted for about 90 percent of this population growth (Oregon Employment Department, 2001).

Prineville and Redmond are the only two incorporated cities located within the planning area, although the City of Bend is located immediately adjacent to the planning area. Both Redmond and Bend are among the 20 fastest growing cities in Oregon. Bend, the Deschutes County seat, has a population of 52,029, making it the largest city in eastern Oregon.

The Central Oregon region is expected to continue to grow at a faster rate than the rest of the state through 2025 (Table 3-2). Based on data from the Center for Population Research and Census at Portland State University (Portland State University, 2003), about 75 percent of the area-wide population increase through 2010 will be due to in-migration.

The planning area will also be affected by nearby fast-growing cities outside of the planning area, such as Bend, Madras, and Sisters, as well as developing, but as yet unincorporated, areas within the planning area. Powell Butte, O'Neil, Terrebonne, Tumalo, Wickiup Junction, La Pine, and Alfalfa have all been designated "Rural Service Centers" by the counties and are areas of anticipated future growth, as are many of the developed and developing residential communities within the counties.

Table 3-1. Population Profile

Population	Crook	Deschutes	Both Counties	Oregon
1990	14,111	74,958	89,069	2,842,321
2000	19,182	115,367	134,549	3,421,399
2000 Race / Ethnicity Distribution*				
White	93.0%	94.8%	94.5%	86.8%
Black	0.0%	0.2%	0.2%	1.7%
American Indian	1.3%	0.8%	0.9%	1.2%
Asian / Pacific Islander	0.4%	0.8%	0.7%	3.1%
Hispanic	5.6%	3.7%	4.0%	8.0%
Other	3.8%	1.4%	1.7%	4.2%
2000 Age Distribution				
0 – 17	26.6%	24.8%	25.1%	24.8%
18 – 64	58.7%	62.1%	61.6%	62.8%
65+	14.7%	13.1%	13.3%	12.8%

*NOTE: The six percentages may add to more than 100 percent because individuals may have reported more than one race / ethnicity.
SOURCE: Portland State University (2003) and U.S. Census Bureau (2001).

Table 3-2. Population Forecast

State/County	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040
Oregon	3,132,000	3,406,000	3,631,000	3,857,000	4,091,000	4,326,000	4,556,000	4,776,000	4,988,000	5,193,000
Both Counties	109,800	130,014	151,491	171,445	189,123	205,126	216,279	224,571	231,129	236,641
Crook County	15,700	17,168	18,662	20,215	21,892	23,678	25,582	27,567	29,634	31,752
Deschutes County	94,100	112,846	132,829	151,230	167,231	181,448	190,697	197,004	201,495	204,889
State/County (% Growth)										
		95-00	00-05	05-10	10-15	15-20	20-25	25-30	30-35	35-40
Oregon		9%	7%	6%	6%	6%	5%	5%	4%	4%
Both Counties		15%	14%	12%	9%	8%	5%	4%	3%	2%
Crook County		9%	9%	8%	8%	8%	8%	8%	7%	7%
Deschutes County		20%	18%	14%	11%	9%	5%	3%	2%	2%

SOURCE: Oregon Department of Administrative Services (2003).

Ethnicity

The racial composition of the population in the counties is relatively homogenous compared to the state population (Table 3-1). Data from the 2000 Census show that about 93 percent of the residents of Crook County are white, as are almost 95 percent of the residents of Deschutes County. Since 1990, the relative percentage of white residents has decreased slightly as the percentage of minority groups has increased, with the highest increases being Hispanic or Latino (2 to 3 percent) (Oregon Employment Department, 2001; BLM, 2001a).

Age

About 61 percent of the population of Crook and Deschutes Counties is working age (age 18 to 64), 25 percent is age 17 and under, and 13 percent is age 65 and over (Table 3-1). The median age is 38.6 for Crook County and 38.3 for Deschutes County, both higher than the median age in Oregon (36.3) and the nation (35.3). This may be due to the attraction of the area to retirees (such as La Pine, where the median age is 44.7 [BLM, 2001a]) and the general trend of population growth due to in-migration rather than an increase in area births over deaths (Deschutes County Community Development Department, 2003).

Income

The U.S. Department of Commerce, Bureau of Economic Analysis (BEA) estimates that earnings (such as wages and salaries) and dividends accounted for 60.3 percent and 26.5 percent, respectively, of the region's total personal income in 2000. By comparison, statewide earnings and dividends accounted for 65.7 percent and 21 percent of total personal income. Transfer payments (such as unemployment or social security payments) were about the same for the region and the state (Bureau of Economic Analysis, 2003). The higher proportion of dividend income by regional residents may reflect a relatively wealthy retiree and in-migrating baby-boomer population in the region as compared to the state as a whole.

According to the COCIP, inflation-adjusted per capita personal income experienced an increase equal to that of the overall Oregon economy for the last 10 years in Deschutes and Crook Counties (COIC, 2002). Deschutes County has the highest per capita income in the region, and in 2000, Deschutes County had the 5th highest per capita income in the state (\$26,594 for the County compared to \$27,836 for the state). Crook County dropped from 22nd statewide in 1990 to 29th in 2000 (\$20,264), due in part, the COCIP reports, to the decline in the wood products industry (COIC, 2002; Bureau of Economic Analysis, 2003). The COCIP projects that, with the national economic downturn, per capita income rates in Central Oregon are in danger of showing a decline for the first time since the early 1980s.

Housing

According to the COCIP, Deschutes County is the most expensive area in which to purchase a new house in or adjacent to the planning area. The average sales price for a residential house in 2000 was \$194,953 in Bend; \$122,982 in Redmond; \$100,517 in La Pine; and \$99,196 in Crook County. The COCIP also reports that Crook County experienced a notable increase in the number of building permits issued in 2000 (after decreasing by 13 percent the previous year); but that new permits slowed in 1999 and 2000 for Deschutes County, where new permit acquisition was strong in 1997 and 1998.

While the exact dollar value may be difficult to quantify, open lands have been shown to boost property values for surrounding developed areas and:

- Provide agricultural jobs and sales;
- Form a link to an historic past;
- Offer recreation opportunities;
- Provide habitat for native plants and wild animals;
- Replenish groundwater and act as a filter to improve water quality;
- Offer a scenic backdrop for a tourist economy; and
- Enhance the quality of life of area residents.

Proximity to BLM administered lands is used in advertising for many of the newer residential areas and resorts in and near the planning area. Local real estate agents report that properties adjacent to BLM lands sell for higher prices than similar properties that

are not located next to BLM land (Korish, personal communication, 2003). Responses to a recent BLM survey indicate that residents felt that proximity to public land increased the value of their property, and 76 percent of survey respondents living immediately adjacent to BLM expressed this opinion (Community Planning Workshop, 2002).

Amenity Values

Amenities can be defined as qualities of a locality that make it an attractive place to live and work (Power, 1988). Examples include wildlife and flora, recreational areas, pristine or undisturbed wilderness, unique settlement patterns, agricultural or cultivated landscapes, historic sites, and social and cultural traditions — all of which can be found on BLM-administered lands within the planning area. Amenities provide utility to people through the direct consumption of specific aspects of land, natural resources, and/or human activity (OECD, 1994). Amenities are linked to a particular region and are immobile.

Amenity values provided to Central Oregon residents by proximity to BLM-administered include qualitative, and often subjective, measures such as diverse outdoor recreation opportunities, pleasant views, privacy, seclusion, and peace and quiet. Specific amenities associated with BLM administered lands in the planning area include open vistas of distant Cascade Peaks and local buttes; a sense of historical continuity from cultural sites and ranching and agricultural landscapes; opportunities for wildlife viewing; scenic drives and highways; developed and undeveloped recreation options; and an escape and refuge from urban areas. As private lands in the area become developed, residents will increase their reliance on BLM administered lands and public land managers to provide, maintain, and protect these amenities.

Such features contribute to the overall quality of life in the planning area, and are often listed as valuable features by residential and resort communities.

Managing Change

The USFS and BLM analyzed economic and social characteristics of 543 communities in 98 counties and six states in the Columbia River basin to aid in identifying communities they may be economically and socially vulnerable to shifts in the management of USFS and BLM lands (USFS and BLM, 1998). Researchers analyzed all the communities to assess their geographic isolation from larger cities and their association with USFS and BLM-administered lands, and examined economic information for 423 of these communities to determine their degree of industry specialization. The study included Prineville in Crook County as well as Bend, Redmond, Sisters, Terrebonne, and Three Rivers in Deschutes County. The report concluded that it was difficult to establish the importance of federal land to the local economy as "...there are simply too many other variables affecting this relationship and these variables can change quickly. There are also private choices involved in how businesses plan for and rely on federal lands for materials and services."

Regional Economy

In this report, no attempt has been made to evaluate a measure of Gross Regional Product. Instead, the general economic welfare of the region is described and evaluated using secondary data, as presented below.

Revenue Sharing With Local Governments

Although public land is not subject to state or local property taxes, the state of Oregon and Crook and Deschutes Counties receive revenues from BLM-administered lands

located within their boundaries through several federal programs aimed at fairly compensating states and counties. These programs include formulas for direct revenue sharing (through commodity use or sale of natural resources on federal lands) and payment in lieu of taxes (PILT). Table 3-3 presents revenue sharing figures for all BLM-administered lands in Crook and Deschutes Counties for mineral leasing, and Section 15 grazing leases (note, however, that revenues from these activities on lands within the planning area would be less than that shown in Table 3-3 because BLM-administered lands within the planning area are only a portion of BLM-administered lands within each county).

Revenues from the PILT program compensate Crook and Deschutes Counties for the non-taxable nature of federal lands within their borders. The PILT program provides Crook and Deschutes Counties up to \$0.75 per acre for entitlement lands within their boundaries; these amounts are reduced each year to a minimum of \$0.10 per acre by payments received by the county from various natural resource revenue sharing programs (mining, grazing, timber, etc.) in the previous year (Frewing-Runyon, personal communication, 2003a). For BLM fiscal years 1999 to 2001, BLM paid an average of \$520,000 to Crook County and \$180,000 to Deschutes County under the PILT program for lands managed by the BLM in these counties. Because BLM administered lands within the planning area are about one quarter of BLM's total land base in Crook County and one half of the land base in Deschutes County, 1999 to 2001, average PILT payments associated with BLM administered lands within the planning area can be roughly estimated as \$126,000 for Crook County and \$90,000 for Deschutes County.

Industries

According to the Oregon Employment Department, Central Oregon experienced healthy job growth throughout most of its industry sectors in the 1990s. Only one sector, the lumber and wood products sector, experienced a decline (Oregon Employment Department, 2001). The region is experiencing an economic shift away from traditional commodity-based sectors such as timber, livestock, and agriculture, which have experienced substantial declines statewide. The rural community economies have resiliently shifted toward trades and service sectors fueled by recreation, tourism, and retirement incomes, and the influx of new residents is providing a diverse labor force to fuel this economic shift (Preister, 2000).

The COCIP reports that the nature of Central Oregon's wood products industry is changing, along with the statewide and regional decline in timber harvest over the last decade (Central Oregon Intergovernmental Council, 2002). What once made up the

Table 3-3. BLM Payments to Crook and Deschutes Counties, 1999 to 2001

Year	Payment	Crook County	Deschutes County
1999	Mineral leasing	\$207	\$1,987
2000	Mineral leasing	\$209	\$2,013
2001	Mineral leasing	\$104	\$1,076
1999	Sec. 15 Grazing Leases	\$273	\$1,161
2000	Sec. 15 Grazing Leases	\$272	\$304
2001	Sec. 15 Grazing Leases	\$275	\$136

SOURCE: BLM (2001b).

majority of the area’s manufacturing base (lumber and wood products) is declining in overall percentage and evolving into smaller, niche-market manufacturing companies. Lumber and wood products manufacturing accounted for 24 percent of non-farm employment in the year 2000 in Crook County and 39 percent in Deschutes County (Oregon Employment Department, 2001).

BLM employment and salaries are included in the government category in Table 3-4, but activities on BLM administered lands also directly contribute to agriculture, manufacturing, and mining sectors. Although relatively small contributions compared to other area lands and industries (as discussed in future sections of this document), BLM grazing leases, gravel pits, timber, and other forest products do contribute to the local economy. According to a recent BLM survey, 68 of the 667 survey respondents (10 percent) indicated that they relied on BLM administered lands for economic gain (grazing, craft industries, forest products, etc.). Although no distinction was made between BLM-administered lands within the planning area and BLM-administered lands outside the planning area (Community Planning Workshop, 2002). Of all respondents, 11 (1.6 percent) indicated that they rely on BLM-administered land as their sole means of income (Community Planning Workshop, 2002).

Although no distinction is made between public and private lands, IMPLAN data estimates for Crook and Deschutes Counties show that livestock (for all animals, including range-fed and ranch-fed) accounts for about \$31.2 million of the agricultural sector’s \$143.7 million in output and 944 of agricultural sector jobs. IMPLAN also estimates that the range-fed cattle sector generates about \$13.6 million dollars of output and 335 jobs are generated annually (MIG, Inc., 2000).

In both Crook and Deschutes Counties, employment in the service industry and retail trade is expected to outpace growth in other economic sectors through 2010 (COIC, 2002). Table 3-4 presents data on the relative importance of the major economic sectors on the

Table 3-4. Economic Activity by Major Economic Sector for Deschutes and Crook Counties

	Industry Output (\$ millions)	Employment	Value Added (\$ millions)
Agriculture	143.7	3,906	100.1
Mining	39.6	91	20.9
Construction	1,066.7	8,936	386.2
Manufacturing	1,360.1	8,526	501.3
Transportation/ Communications/ Public Utilities	473.2	2,897	245.2
Trade	1,015.1	19,573	722.4
Financial/Investment/ Real Estate	1,233.5	6,985	869.7
Services	1,417.4	24,603	790.7
Government	515.7	9,213	457.4
Other	-11.6	296	-11.6
Totals	7,253.4	85,026	4,082.5

NOTES: All figures adjusted into 2002 dollar terms using the Consumer Price Index – Urban. Industry output represents the dollar value of an industry’s output. Value added represents the total earnings and other income associated with a business sector (employee compensation, proprietary income, other property income and indirect business taxes).

SOURCE: IMPLAN Input Output Model by MIG, Inc. for Deschutes and Crook Counties (MIG, Inc. 2000) and Environmental Science Associates.

regional economy, both in terms of economic output, employment and value added (value added being the total earnings and other income, such as indirect taxes, associated with a particular business sector). The importance of the trade and service sector to the region's economy is shown by the fact that these sectors account for more than half of the employment in the region. The major role also played by the finance/real estate and construction industries is clearly related to the past and on-going development occurring in the region.

Over the last 20 years, there has been a substantial increase in resort development within the two-county region. The combined effect of favorable economic and demographic trends has created increased demands for second home and resort development. Fueled by demographic shifts, wealth creation, and inheritance, the resort industry is forecast to be the fastest growing real estate market over the next 20 years (Hobson Ferrarini Associates, Inc., 2000).

The growth in local resort development has had both beneficial and adverse social and economic effects on the counties and other local communities. The increased population from the new housing stock both increases the local tax base and increases the demand on county and local services. According to the Deschutes County Economic Development Department, the past resort developments have generally had a major positive economic impact on the regional economy (Lee, personal communication, 2003). According to the Deschutes County Tax Assessor's Office, the combined real market value of the Sun River Resort community in 2002 was about \$1,267 million, and it paid about \$12.1 million in property taxes to the county (Reynolds, personal communication, 2003). For the Black Butte Ranch resort community, its real market value was estimated to be about \$512 million and it paid \$5.7 million in combined property taxes to the county. Resort developments also generate many jobs for the region (although most are relatively low-paying service sector positions). The Deschutes County Economic Development Department estimates that the major resorts (including Mt. Bachelor Ski Resort) directly employ nearly 3,200 employees.

While numerous factors contribute to the location and success of destination resorts (land availability, quality of construction and amenities, etc.), the open space and scenic quality surrounding the resorts are considered to be additional factors attracting visitors and residents to the resorts. As a result, BLM-administered lands contribute toward the success of these developments. While the majority of the recreational facilities used by resort guests or residents are located within the resort property, some resort users and residents may be expected to use adjoining BLM recreational resources.

Tourism and recreation are important sources of revenue for the region. The area's magnificent scenery and clean environment, as well as varied recreation locations and opportunities, has made it a popular year-round vacation area. Dean Runyon and Associates estimates that tourism spending within the two-county region resulted in more than \$375 million of spending — with Deschutes County ranking 5th in the state in terms of highest total tourism related spending (Dean Runyon and Associates, 2002). The report also estimates that tourism accounted for more than 6,600 jobs in the region.

Deschutes County annual Transient Room Tax revenues were \$5.22 million (for incorporated areas) and \$3.0 million for the unincorporated sections of the county in 2002. Based on an average tax rate of 7 percent (and an 8 percent tax rate for Bend), it is estimated that there were about nearly \$71.5 million in total lodging sales in Deschutes County. In comparison, during the same period, Crook County collected only \$110,000 in transient room tax revenues.

According to the Deschutes County Treasurer's Office and Economic Development Department, resort developments have become an increasingly important component of the region's economy over the last 20 years and are expected to remain so for the

foreseeable future (Circle, personal communication and Lee, personal communication, 2003). The Treasurer's office estimated that more than 80 percent of the County's estimated \$3.0 million in Transient Room Tax revenues were generated from lodging on properties that were part of the Sunriver, Black Butte, or Eagle Crest Resorts. According to the Deschutes County Tax Assessor's Office, three of the top six tax payers in the County are Eagle Crest Resort, Sunriver Resort, and Mt. Bachelor, Inc. (the ski resort is considered a major recreational and resort amenity). These tourism businesses have a combined real market value estimated to be over \$121 million (not including the value of properties sold by the resort to private owners).

Labor Force

IMPLAN reports that full and part-time employees (including self-employed) equal about 85,000 in Deschutes and Crook counties.

Unemployment in Central Oregon hit a 30-year low in 2000, but as a result of the slowing economy in 2001, rose again to 7.4 percent by November of 2001 (the highest since July 1993) (COIC, 2002). The Oregon Employment Department attributes the higher unemployment rates in Central Oregon (relative to the rate for the entire state of Oregon) to three factors: 1) the decline of the lumber and wood products sector; 2) high job growth in seasonal non-manufacturing sectors; and 3) accelerated growth in the region's population (COIC, 2002).

Crook County unemployment rates are the highest and most volatile in the region, but unemployment rates for both Crook and Deschutes Counties have consistently been higher than the rates for the entire state. Despite these high unemployment rates, the actual number of people employed has grown considerably between 1994 and 2000, with 17,471 new jobs created in Deschutes County and 1,061 new jobs in Crook County (COIC, 2002).

Infrastructure

Five general aviation airports are located in Crook and Deschutes Counties. They include the Prineville Airport, Roberts Field in Redmond, Bend Municipal, Sunriver Airport, and Sisters Eagle Air. Roberts Field, owned and operated by the City of Redmond, is the only commercial airport with regularly scheduled passenger service in Crook and Deschutes Counties (and the planning area). Roberts Field is an important asset to the tourism industry in Crook and Deschutes Counties, especially for attracting out-of-area visitors. Regularly scheduled flights from Roberts Field to Portland, Seattle, and San Francisco allow travelers to connect to worldwide destinations. Enplanement data show steadily increasing numbers since 1994, except from 2000 to 2001, which may be due, in part, to the events of September 11, 2001. Total enplanements in 2000 totaled 161,680 and 158,670 in 2001 (COIC, 2002). BLM-administered lands near the airport also may be viewed as a potentially important resource to allow for future airport expansion or development of near-airport commercial, industrial, and public facilities.

Additional infrastructure is described under Transportation and Utility Corridors in this Chapter.

Issue Based Descriptions of the Affected Environment

Ecosystem

An ecosystem is a complete interacting community of living organisms and the abiotic components that make up their environment. An ecosystem can be something as small and discrete as a pond or a single log, or it can be the entire earth's biosphere. The purpose of ecosystem management is to maintain the integrity of ecosystems over time and space. Ecosystems are dynamic, and are constantly changing with or without human influence. Ecosystems have biophysical limits, which are sometimes at odds with social expectations, and there are limits to our ability to accurately predict how things may change (Haynes *et al.*, 1996).

The Interior Columbia Basin Integrated Scientific Assessment studied historical and current ecological conditions at a broad scale. At the sub-basin scale, the Upper Deschutes planning area, along with much of the Interior Columbia Basin, was shown to have "low composite ecological integrity" based on disturbance to expected vegetative patterns and composition, altered hydrologic function, presence of exotic species, and changes to historic disturbance relationships in the forestlands, rangelands, hydrologic systems, aquatic character, and terrestrial species habitat (USFS, 1996). This composite rating emphasizes ecological process and function, rating human altered systems lower, although they may or may not be productive and be meeting social expectations.

Vegetation

This section describes the broad vegetative types within the planning area, including important features and trends of each. The ecological role of disturbances, both natural and human caused, will be discussed. Special status plants and noxious weeds, although occurring in all the vegetative community types, will be described under separate subsections.

The planning area lies on the eastern shoulders of the Cascade Range in a broad vegetative transition zone, along a precipitation gradient between forested ecosystems on the west and the high, dry shrub-steppe environment common to the Great Basin. The planning area may be characterized by several major distinct vegetative community types (See Map 4: Vegetation Types, and Table 3-5). The northern area is primarily

Table 3-5. Vegetative Types in the Upper Deschutes Planning Area

Vegetative Group	BLM Acres	Total Acres in Planning Area	BLM Acres(%)	Total Acres, All Ownerships(%)
Shrub	213,654	362,362	52.3	41.0
Juniper	132,969	278,647	32.5	31.5
Pine	26,787	76,571	6.6	8.7
Grass	19,565	62,547	4.8	7.1
Ag/Riparian/Meadow	12,008	87,494	2.9	9.9
Non Vegetated	3,399	11,959	.8	1.4
Mixed Conifer	513	4,147	.1	.5
TOTALS	408,895	883,727	100	100

a mosaic of juniper woodland and sagebrush/grassland, while the La Pine area is dominated by lodgepole pine forest with bitterbrush in the understory. Ponderosa pine dominates the overstory in small areas in both the La Pine and northern portion of the planning area where the vegetation transitions between mixed conifer and juniper woodland. Riparian plant communities lining the rivers, creeks, and irrigation canals are relatively minor in terms of total acres in the planning area, but extremely important as wildlife habitat and popular for recreational use.

Disturbance Relationships

Disturbance relationships are important because ecosystem properties are often regulated by the type, severity, size, and frequency of the disturbances that occur. Individual plant communities align themselves according to soil properties and available precipitation in a moisture limited environment, but the composition and arrangement of the individual plant communities are also influenced by the presence or absence of natural and human caused disturbances.

Natural disturbances include wildland fire, drought, wind, and climate anomalies. The presence of insects and pathogens following a disturbance is also a factor in, or a symptom of, many of the forest health issues currently being experienced in the west. The La Pine area, in particular, has been severely altered by a variety of disturbance factors including insects and disease, wind, drought, fire (including fire exclusion), and human activities. The interaction of fire exclusion, insects and disease, logging, and a proliferation of lodgepole seedlings, saplings and bitterbrush has created pressing concerns for wildland fire hazard and ecosystem health in the La Pine area.

Of the human-caused disturbances, some are caused by the direct disruption of plant communities during activities such as logging, juniper thinning, prescribed fire, livestock grazing, off-road travel, and road construction. Others are caused by unplanned human activities such as wildland fire. Human ignitions have accounted for 81 percent of the 62 fires within the past 20 years in the La Pine area, and 19 percent of the 685 ignitions in the northern portion of the planning area. Finally some disturbances are caused by human activities inhibiting natural disturbances such as suppression of wildland fire. Roads also act as fire breaks, further changing the environment in which fire can burn. Grazing can reduce the amount of available fine fuel in which fire can burn, a shift in the inherent disturbance regime. These human disruptions of the natural fire regime result in increased fuel loading, shifts in species composition and abundance, and an overall increase in fire severity when a wildland fire does occur.

Shrub-Steppe Communities

Shrub-steppe and western juniper communities are the most prevalent within the northern portion of the planning area (the planning area excluding the La Pine area), as well as throughout Central Oregon. The term "shrub-steppe" refers to the complex of plant communities that are dominated by shrub and grass species in various proportions, usually occurring in the more xeric sites. The shrub-steppe and juniper woodland vegetative types comprise 90 percent (366,370 acres) of the BLM-administered lands in that northern portion of the area. The juniper woodland communities are similar in composition to the shrub-steppe communities, differing primarily only in the presence of the western juniper tree overstory. For the purposes of discussion in this section, the two communities will be described separately. The shrub-steppe discussion will focus on the shrub, grass, and forb components, while the juniper woodland discussion will focus on the tree component. The juniper woodland section will further discuss the dynamics of juniper occupation and describe the stands of old-growth juniper present in the planning area.

Sagebrush or western juniper dominate most plant communities the northern area. There are several sagebrush species in the planning area, each of which characterizes particular habitats. The two most important sagebrush communities in the planning area are the big sagebrush and low sagebrush communities.

Big Sagebrush

This plant community includes mountain big sagebrush, Wyoming big sagebrush, and basin big sagebrush as the dominant shrubs, with mountain big sagebrush as the most widespread. Big sagebrush communities dominate the shrub layer on approximately 90 percent (329,730 acres) of the shrub-steppe/ woodland vegetative type in a wide variety of mixed plant association mosaics. Big sagebrush crown cover is generally within the range of 10-30 percent. Basin big sagebrush grows on sites having moderately deep, well-drained loamy soils such as those occurring on droughty bottomlands and fans. Wyoming big sagebrush is present throughout the uplands of the shrub-steppe vegetative type on slightly more sandy or gravelly soils. Mountain big sagebrush generally occurs on higher elevations than basin big or Wyoming big sagebrush, dominating on sites above 4,200 feet in gravelly or stony soils. Mountain big sagebrush often mixes with Wyoming big sagebrush, particularly in the pumice zone on the western portion of the northern area. Mountain big sagebrush occasionally includes low sagebrush on some of the stony flat “scabs.”

Few trees occur on mountain big sagebrush sites while juniper and ponderosa pine can be common on the more mesic and lower elevation basin and Wyoming big sagebrush sites. Juniper overstories can attain up to 40 percent crown cover over big sagebrush communities. Pine occurs in isolated groups and at the northwest edge of the northern area.

Antelope bitterbrush is also often a component on the more mesic sites, particularly on the west edge of the northern area, the skeleton area, and south Millican area. In these areas, bitterbrush can be dominant or co-dominant with big sagebrush. Green and gray rabbitbrush also often occur in association with big sagebrush. Rabbitbrush is an early seral species, with the greatest occurrence on disturbed sites.

Grass and forb associations with big sagebrush vary widely, depending on the specific site. The presence of native grasses can range from a mere presence to an abundance of grass depending on soil/water relations and historical disturbances on the site. The grass component is generally dominated by bluebunch wheatgrass, Idaho fescue, or needlegrass. Idaho fescue generally increases as one moves north and west in the planning area toward a lower elevation and greater soil moisture gradient. Idaho fescue also favors north slopes and, on deeper soils, the shade of tree canopies. Western needlegrass is dominant at the higher elevations and where soils are sandier. Other grasses occurring in association with big sagebrush communities include needle and thread grass, Thurber’s needlegrass, Sandberg’s bluegrass, bottlebrush squirreltail, Junegrass, and Great Basin wildrye.

Introduced grasses are primarily cheatgrass and crested wheatgrass. Approximately 6,400 acres of public land within the planning area were seeded with crested wheatgrass in the 1950s-70s. Crested wheatgrass was seeded to stabilize soil, help displace undesirable species, and increase forage production for livestock and wildlife. Introduced from Eurasia, crested wheatgrass is well adapted to the local climate and soils and many seeded areas still support varying densities of this species. After about 10 years, big sagebrush and rabbitbrush begin to re-establish within crested wheatgrass seedings.

Forbs are a minor component in big sagebrush communities, usually comprising less than 2 percent in an area. Near Bend, where the sandy soils are deeper, there is a greater frequency of species such as Douglas’ false-yarrow, Oregon sunshine, and

lineleaf phacelia. As soils lose depth and become rockier, as is common at the higher elevations and scab flats, various milkvetches, balsamroot, and Columbia puccoon increase in frequency. Various species of buckwheat, lupine, and milkvetches are common throughout the area. Other common forbs include common yarrow, Lewis' flax, Nuttall's larkspur, granite gilia, woolly groundsel, rockcress, phlox, aster, and paintbrush. Microbiotic crusts, though inconspicuous, are important to the ecological integrity of some sites (see Soils section for more discussion of microbiotic crusts).

Low sagebrush

Low sagebrush communities occur on approximately 8 percent (29,310 acres) of the woodland/ shrub-steppe vegetative type within the planning area. This community is strongly dominant on upland shallow, stony, basalt-derived soils, but can also grow mixed with other sagebrush species on moderately deep, gravelly mountain soils. Low sagebrush typically has less than 10 percent crown cover and has a much lower growth form (4-16 inches) than big sagebrush. Low sagebrush is the dominant plant, and often the only shrub found in the community. Few trees are found on low sagebrush sites. Sandberg's bluegrass is often the dominant grass. Other common associate grasses are bluebunch wheatgrass and Idaho fescue. Common forbs include Hood's phlox, prairie lupine, lineleaf fleabane, false agoseris, bighead clover, and various species of biscuitroots and buckwheats. Low sagebrush sites usually do not form extensive landscape-level covers but, rather, are part of the larger big sagebrush mosaics. The sites have extensive areas of exposed rock with a very sparse total vegetative cover.

Most sagebrush communities are adapted to the passage of periodic fire. Fire in the unmanaged sagebrush ecosystem would have burned at intervals between 25 and 100 years, depending upon the availability of fine fuels and grasses to carry fire in this vegetative type (Wright & Bailey, 1982). The amount of grass and other vegetation to help carry fire is directly related to the amount of moisture available, and so the drier sites occupied by drought tolerant Wyoming big sagebrush and low sagebrush tend to have the least frequent fire return interval (100 years or more between fires) due to the lack of fine fuels that could carry fire in low wind situations. The more mesic mountain big sagebrush is more likely to be growing in the company of continuous grass and forb species that can carry fire. Fire return intervals in those ecosystems would be expected to be closer to 25 to 30 years.

We suspect that fire exclusion has played a role in the arrangement, vigor, and distribution of seral stage classes of these sagebrush communities, resulting in an overall loss of heterogeneity. A homogeneous ecosystem consisting of mature sagebrush across a broad area is more prone to larger fires, and the post burn environment is less apt to provide a mosaic of habitat opportunities for wildlife.

Two potential scenarios result from interruption of the natural fire cycle. One prevalent trend in the planning area is for sagebrush stands to become dense and unproductive, with few grasses in the understory and a high ratio of dead to live crown in the sagebrush. Often juniper becomes established as the loss of grasses makes fire's passage less likely. If the native perennial grass and forb component is lost and a severe fire does occur, then, lacking a native seed source, the risk for exotic species (such as cheatgrass and noxious weeds) dominance becomes quite high.

Another potential trend, less frequent but existing in the planning area, is for a non-native grass like cheatgrass to become established in the stand. Cheatgrass is extremely flammable, and some stands actually burn with much greater frequency, as often as every year or two. This cheatgrass-fire cycle is difficult to remedy once it has started.

Western Juniper Communities

The western juniper woodlands are the driest of all tree-dominated zones in the Pacific Northwest (Franklin and Dyrness, 1973). The range of western juniper extends throughout much of central and eastern Oregon and into other parts of the Great Basin. Juniper woodlands in Central Oregon are within the transition zone between the ponderosa pine forest on the east slope of the Cascades and the high desert shrub-steppe zone to the south and east. Juniper-dominated plant communities cover approximately 33 percent of the northern planning area, almost always in association with the big sagebrush shrub-steppe vegetative type. In this context, juniper “dominance” refers to areas where juniper density (crown cover) is 10 percent or greater. Juniper density on these sites generally ranges from 10-40 percent, depending on site characteristics and past disturbances such as wildland fire, prescribed burning, juniper thinning projects, old homestead clearings, personal-use and commercial firewood sales, and illegal firewood cutting. Plant species that grow between and underneath the juniper are generally the same as those that grow in the shrub-steppe (see description of shrubs, grasses, and forbs in the Shrub-Steppe section).

Western juniper is a highly competitive and invasive species (Rose and Eddleman, 1994). In the absence of fire, juniper has the ability to out-compete other plant species for limited soil moisture and nutrients. This long-lived species can transpire and grow during mild periods in the winter and early spring on unfrozen soils when other vegetation is dormant. Western juniper does not sprout (Burkhardt and Tisdale, 1976). Reestablishment is through seed that is dispersed fairly slowly by water and animals.

Western juniper has been expanding its range into adjacent shrub-steppes, grasslands, savannas, pine forests, and riparian/wetland areas during the past 100 to 150 years (Belsky, 1996), and it has doubled its range in central and eastern Oregon during the past 80 to 100 years. Western juniper expansion has been attributed to livestock grazing, which reduces the fine fuels required for effective fire spread, climatic changes (mild temperatures and above average precipitation in the late 1880s and early 1900s), and reduction in fire frequency due to fire suppression and cessation of Native American burning (Eddleman *et al.*, 1994; Miller and Rose, 1998; Miller *et al.*, 1995). These events resulted in conditions that were ideal for cone production and seedling establishment. Conditions that favor sagebrush also favors establishment of juniper since juniper uses sagebrush plants for seedling protection. Small isolated stands and groups of trees became large contiguous woodlands. Although the old-growth juniper woodlands have not expanded in range as with the post-settlement juniper, they have increased in density, mostly from in-growth of young trees (see discussion of old-growth juniper below).

Where fire returns frequently, juniper is a minor component in the plant community, existing in rocky areas or other places unlikely to burn. However, in the pumice flats of Central Oregon, fire played less of a role, and juniper is much more prevalent. Juniper is poorly adapted to survive the passage of fire. Young junipers have thin bark and are readily killed by surface fires. In general, the taller the juniper, the greater the severity of the fire required to kill it (Martin, 1978). Fire return intervals in western juniper communities range from 7 to 25 years to more than 100 years. Mean fire interval for western juniper within the Columbia River Basin is estimated at 52 years (Barrett *et al.*, 1997). European settler-induced changes to the ecosystem from fire suppression and grazing has resulted in a longer-term trend of decreasing fine fuels (grasses) and increasing woody fuels (shrubs and trees). This change in vegetative composition and structure has further reduced the natural ability of these sites to carry fire and, therefore, has lengthened fire return intervals.

Post-settlement juniper dominance of some sites can cause alterations to watershed function and ecosystem health. Local research and monitoring has demonstrated some of the implications of juniper dominance for a variety of ecological and physical processes

and values. Some of the ecosystem components/processes affected include: vegetation and wildlife species composition and diversity; bio-mass production; invertebrate and microbiotic changes; water interception, infiltration and runoff; soil temperature; and freeze/thaw processes.

Juniper is effective in using available moisture and uses water very early in the spring before other plants begin to grow. On a warm April day, individual trees can use up to 20 gallons per day. In a dense juniper stand, this water use represents a majority of the annual precipitation on a typical Central Oregon site. On juniper sites, soil moisture is often limiting for most perennial plants by June 15; whereas on sites without juniper, soil moisture is often available into August. On sites in Central Oregon, interception loss from the canopy cover was as high as 20 percent or two inches per year in a 10-inch precipitation zone (Eddleman and Miller 1991). Anecdotal information also suggests that juniper site dominance can change groundwater recharge capability; the timing, intensity and duration of stream runoff events; and total watershed water production and storage. Monitoring indicates that these kinds of effects occur in many juniper-occupied sites within the planning area.

Significant loss of shrub-steppe habitat quality has occurred from expansion of juniper and increases in sagebrush age and density. Historically, many upland sites in the north planning area were treeless grass and shrub communities or savannas containing a higher proportion of grass and widely dispersed trees. Local research and monitoring studies, rangeland health assessments, and other information dating back to the 1880s suggest a trend toward increasing dominance of woody species on formerly graminoid (grass)-dominated sites. Such woody species include western juniper, ponderosa pine, sagebrush, and rabbitbrush. Monitoring has also indicated that when post-settlement juniper and shrub cover/density is reduced (and appropriate post-treatment practices are applied), understory grass and forb cover/density, soil stability, and other desired ecological attributes can increase in quality and quantity. Shrub habitat can also improve with natural disturbance or treatment by becoming more diverse in age class, structure, distribution, and density. Successful treatment techniques that have been applied in the planning area to help reverse the trend toward expanding woody species dominance include prescribed burning, cutting, and altering livestock grazing schedules. Nevertheless, research in other areas of the west studying the effects of juniper and pinyon-juniper occupation on ecosystem health and functioning has resulted in differing viewpoints, conclusions, and recommendations.

Old-Growth Juniper Woodlands

The western juniper woodlands are often treated and discussed in general terms as a single vegetation type. In reality, there are many plant associations within the western juniper association group. Driscoll (1964) has classified nine relatively undisturbed plant associations and variants of two associations in the Central Oregon juniper zone. These juniper associations are representative of "climax" types, that is, as these plant communities approach their latter stages of successional development, western juniper is often present as a dominant component. Juniper often attains a great age on some of these sites. This stage of juniper development is often referred to as "old-growth woodlands."

Approximately 34 percent (139,000 acres) of the planning area contains old-growth juniper woodlands (see Map 4: Vegetation Types). The literature generally agrees that old-growth juniper is defined as juniper that was present before the migration of white European settlers into the region beginning in the mid- to late-1800s (i.e., trees greater than 150 years of age). This "pre-settlement" or old-growth juniper occurs in large contiguous stands in the Cline Buttes, Alfalfa, Badlands, Horse Ridge, and Millican Road areas. Many of the dominant trees in these stands are much older than 150 years, some approaching 1,000 years of age (Miller *et al.*, 1996). The oldest tree in Oregon, a western

juniper tree located within the planning area, was recently documented to be over 1,600 years old. Within the range of western juniper, it is estimated that 3-5 percent of the current 8 million acres of woodlands are characterized by trees greater than 100 years old (BLM 1990). Some of the physical characteristics of old juniper trees include: large diameter trunk (often twisted) and lower limbs, rounded or irregular crown, deeply furrowed, reddish stringy bark, broken and dead branches, heart rot, cavities, and abundant lichen growth. Old-growth stands are usually in an uneven-aged structure with younger trees occurring in disturbance areas and in interspace areas between the older trees. Central Oregon old-growth juniper has not been formally rated according to ecological significance criteria such as those developed for other tree species (i.e., USFS Region 6 Interim Old-Growth Definitions, Bill Hopkins, 1992).

Because many of these trees were already old centuries before European settlement, they are considered to be an integral part of the native Central Oregon landscape; compared to the recently established post-settlement juniper type, which is more of a manifestation of recent human and climatic influences. Therefore, old-growth juniper in this document will be considered in a different context than the younger juniper that have expanded into and adjacent to the old-growth stands. These old trees provide a variety of non-tangible values such as special wildlife habitat, interpretive/educational opportunities, high scenic values, and preservation of natural gene pools. The Central Oregon old-growth stands are unique because they are large and contiguous in area and contain a higher percentage of larger and older trees relative to other western juniper woodlands in the Great Basin.

The large size and age of juniper in Central Oregon is probably due to several environmental factors. The area has moderately deep pumice soils, more available subsurface soil moisture, and relatively few days during winter when soils are frozen compared to other western juniper sites in the high desert region. These factors allow juniper to out-compete other associated species on these sites. Fire may also play a factor on these sites. Low rainfall results in less fine fuels to carry fire. The flat to gently rolling topography also makes it more difficult for the spread of large, intense wildland fires. Larger trees have a tendency to “fireproof” themselves by creating a zone of sparse vegetation around them through competition and release of growth inhibitors. Older trees with thicker bark are described as “moderately resistant” to fire (Sowder and Mowat, 1965). Control of natural fires and overgrazing with the arrival of white settlers also limited the ecological role of fire in controlling the age and extent of juniper stands in Central Oregon (Burkhardt, 1996).

Healthy old juniper woodlands can be characterized as having a high proportion of native plants that are diverse and well distributed across the site, a healthy and vigorous understory with a low proportion of young juniper trees, low cover of non-native and annual plant species, a healthy component of microbiotic soil crusts, and a low level of physical ground disturbance. These sites contain a complementary healthy and diverse population of wildlife species. Healthy old woodlands exist within the planning area but their extent is diminishing.

Increasing urban development and human activities have fragmented old-growth juniper woodlands in Central Oregon. The removal of old-growth trees from private land makes remaining old-growth juniper woodlands on BLM administered lands more ecologically significant. Traditional public land uses such as cutting trees for firewood, off-road vehicle travel, military training exercises, clearing for road construction, and improper livestock grazing have contributed to the direct and indirect effects on these old-growth ecosystems. Hobbyists and furniture makers target these trees as a raw material source. These and other human activities, both legal and illegal, compromise the integrity of old-growth woodlands in Central Oregon.

Lodgepole Pine

Lodgepole pine plant communities are the dominant vegetative type in the La Pine Basin, comprising approximately 90 percent (36,121 acres) of the La Pine portion of the planning area. The most common plant community, by far, is the lodgepole-bitterbrush-Idaho fescue association. On some sites bottlebrush squirreltail and needlegrass are the dominant grasses, in association with lodgepole pine and bitterbrush. Other common understory plant species include wax currant, lupine, buttercup, western yarrow, strawberry, goosefoot violet, balsam groundsel, goldenweed, yellow salsify, silverleaf phacelia, kinnikinnick, and pinedrops.

The ecological status of lodgepole pine is typically that of a pioneer or invader species and is often replaced over time by other tree species such as ponderosa pine, grand fir, or Engelmann spruce. However, in much of the La Pine area, lodgepole pine is the climax tree species, meaning it persists over a long period of time and is not replaced by any other tree species in this environment. It thrives on disturbance and can establish quickly in an area disturbed by fire, windthrow, insects or disease. This relatively short-lived tree species is dependent on disturbance for its regeneration and long-term stand health and vigor. Lodgepole pine is able to become established and grow where other trees cannot compete or survive. This prolific species can germinate and grow in frost pockets, soils with high water tables, and soils with low fertility. One or more of these conditions are common on most sites in the La Pine area. Consequently, lodgepole pine dominates here in pure or nearly pure stands.

Mature lodgepole pine stands comprise 32 percent (12,843 acres) of the La Pine area. Mature stand structure varies considerably depending on the specific site. The mature stands in the planning area are typical of lodgepole pine in its latter stages of successional development. Generally, there is a remnant overstory of scattered larger trees up to 18 inches DBH and pockets of very dense understory reproduction (up to 5,000 trees per acre). Mature stand condition is generally poor, with high density of low vigor trees and a high susceptibility to insects, disease, and fire. Natural events and human activities have substantially altered stand structure and composition.

During the late 1970s and 1980s a severe mountain pine beetle epidemic occurred over vast acreage of the lodgepole pine forests in central and southern Oregon. The La Pine area is at the northern end of this affected area. Stand structure was drastically altered due to the beetle epidemic. In most of the mature stands, beetle-caused mortality of the overstory (trees 8 inches DBH and larger) ranged from 30-80 percent. High mortality has thinned the overstory, creating many openings and allowing the development of dense patches of seedlings and saplings. Most of the dead trees have fallen to the forest floor and are in varying stages of decay. A small percentage (5-10 percent) of the dead trees from this beetle epidemic are still standing but are expected to all be down within another 5-10 years.

Approximately 68 percent (27,291 acres) of the BLM-administered lands in the La Pine area have been harvested in the last 20 years, primarily with seed tree, shelterwood, or commercial thinning methods (see Map S-34: Historic Timber Sales). Machine piling and burning were often associated treatments. Commercial and public firewood harvest has removed most of the dead and down trees within 100 feet of roads. The primary objective for the treatments was to alleviate the extreme fire hazard created with the beetle epidemic. Other objectives were to salvage dead and dying trees and regenerate new stands. These harvested areas are now in varying stages of natural regeneration, ranging from a low density of remnant trees or seedlings to densely reforested with saplings 10-12 feet tall. Prior to the beetle treatments of the last 20 years, earlier harvests occurred over nearly the entire La Pine area from the 1950s to the 1970s. These logging entries were generally low-intensity salvage or single-tree selection harvest of larger diameter ponderosa and lodgepole pine.

Insects and disease continue to impact the mature lodgepole stands. Endemic levels of mountain pine beetle are still present in these stands, killing an occasional tree or small group of trees. Timber harvest and pre-commercial thinning treatments have substantially reduced the risk of another major beetle epidemic in the short-term. However, as the remaining smaller trees and new seedlings grow and stand density increases over the next 20 to 50 years, conditions could once again support another major beetle epidemic. Severe infestations of dwarf mistletoe and western gall rust are also common. These diseases generally do not kill trees directly but can have a significant effect on tree vigor and growth. These diseases typically weaken the trees and make them more susceptible to attack by insects or other fungal diseases. Wind and snow breakage of disease-weakened tree boles and branches is common throughout the mature lodgepole stands.

Prior to European settlement, fire occurred in natural lodgepole pine stands every 20 to 100 years. The La Pine basin tends to experience a longer, drier fire season than higher elevation lodgepole stands, and a shorter fire return interval. These periodic natural fires varied in intensity, sometimes thinning small trees and undergrowth, sometimes destroying entire stands. Thinning by light ground fires allowed surviving trees to grow larger. More extensive fire mortality allowed for new regeneration of entire stands. Natural fire also maintained a higher percentage of the more fire resistant ponderosa pine on some sites. The effect across the landscape was the development of a variety of vegetative types of different composition, structure, ages, sizes, and shapes. Understory plants were burned off allowing for the rejuvenation of bitterbrush, bunchgrasses, and forbs. Fires would also burn through meadows, killing encroaching tree seedlings and maintaining the extent and integrity of meadow plant communities within the lodgepole pine forest.

In the last century, public agency fire prevention and suppression policies decreased fire's influence on the ecosystem. In the absence of periodic fires, lodgepole pine, ponderosa pine, and meadow communities have changed from the composition expected under a natural fire regime. These plant communities have evolved with fire and depend on periodic natural fires for maintenance and regeneration. Consequently, lodgepole pine stands have developed into an over-mature and overly dense condition. Insects and diseases have increased and tree health and vigor have declined. Forb and grass species have declined in diversity and density. Bitterbrush density has increased and plants have become old and decadent. Meadows have declined in size and species diversity. This trend in plant community and structural changes is likely to continue in the absence of natural fire.

The residual dead and down trees, dense "doghair" lodgepole regeneration, and dense and decadent bitterbrush combine to present a high fuel loading and ladder fuels that pose a serious threat of wildfire in portions of the La Pine area. The situation is exacerbated by the rapid population growth and development in the La Pine area, which has pushed residential areas deeper into the forest. Treatments within the last five years have focused on creating fire protection zones of up to one-quarter mile adjacent to several residential subdivisions. Although extensive salvage, thinning, and fuels treatments in the last 20 years have reduced ladder fuels on 68 percent of the La Pine area, there are still several areas of concern near homes and highways. Map S-36, Fire History, shows the remaining high risk zones in the La Pine area.

Ponderosa Pine

Ponderosa pine occurs in small stands and as scattered individual trees in both the northern and La Pine portions of the planning area. Because the La Pine and northern planning area sites are so different ecologically, the discussion of ponderosa pine for the two areas will be separated.

Approximately 8 percent (3,211 acres) of the BLM administered lands in the La Pine portion of the planning area is covered with ponderosa pine or mixed ponderosa/lodgepole stands in which the ponderosa comprises at least 25 percent of the overstory. Ponderosa pine is particularly evident where there is any hill or slight rise in topography to provide cold air drainage. The largest stands of ponderosa or ponderosa/lodgepole pine mix occur in the vicinity of La Pine State Park, adjacent to Paulina Prairie, northeast of Maston Butte, and west of Wagon Trail Ranch Subdivision. Ponderosa pine also occurs as individual trees widely scattered throughout much of the lodgepole pine type. Understory species are similar to those as described under the Lodgepole Pine subsection.

Ponderosa pine stands in the La Pine area generally have a multi-layered structure with a variety of size and age classes from seedlings to large, mature trees. Dense lodgepole and ponderosa pine reproduction is common in the understory. Historically, there were greater numbers of large diameter ponderosa pine in the La Pine area. Past selective logging, intense stand competition, and mortality by western pine beetle reduced the numbers of these large trees.

Occurrence of insects and disease is far less common in ponderosa pine compared to lodgepole pine. Western pine beetle kills individual large ponderosa, especially those weakened by stresses such as competition, drought, lightning strikes, or disease. Light infections of gall rust and mistletoe occur in the ponderosa pine. A Pandora moth outbreak in the 1990s defoliated and weakened but did not kill most of the ponderosa pine on the north end of the La Pine area.

Commercial timber operations in the last 20 years harvested very few ponderosa pine trees. Salvage and thinning treatments within ponderosa pine stands focused on removing dead and diseased lodgepole pine and leaving the healthier ponderosa pine.

The northern planning area has ponderosa pine on approximately 3 percent (1,800 acres) of that area, often mixed with juniper. The Tumalo area, Squaw Creek, Fremont Canyon, and the forest fringe just east of the Bend-Fort Rock District, Deschutes National Forest contain most of the ponderosa pine in this area. These dry-site pine stands represent the easternmost extension of the east slope Cascade ponderosa pine forest. Ponderosa pine also occurs as individual trees or in small groups on Powell Buttes, West Butte, Bear Creek Buttes, Crooked River Canyon, and various other north slope and canyon bottom micro-sites where sufficient soil moisture exists. In some of these dry marginal sites, ponderosa pine is expanding into rangeland areas. Grizzly Mountain also has some Douglas-fir mixed with pine on the north and northeast slopes.

These small ponderosa pine stands typically contain a few scattered large diameter trees (20-30 inches DBH) with a mix of seedlings, saplings, and pole-sized trees in the understory. Small pockets of dense ponderosa pine reproduction occur in the stands on the west side of the planning area. There are endemic levels of insects and root disease causing light mortality in individual trees or small groups.

Understory vegetation is similar to that found in the juniper woodlands just to the east. Antelope bitterbrush dominates the shrub layer and is often co-dominant with big sagebrush or gray rabbitbrush, depending on the site. Squaw or golden currant is often present. Idaho fescue or squirreltail dominate the grass layer. Bluebunch wheatgrass is often present but is not as dominant as in the western juniper. Junegrass can be dominant in some of these pine sites.

Ponderosa stands in the northern area had very little harvest activity in the last 20 years. Most of these pine sites were entered at least once within the last 30-50 years, primarily for selective and salvage harvests of larger diameter trees. Selective harvest and stress-induced mortality of mature ponderosa pine has left few areas with late successional

or old-growth forest characteristics. These areas serve an important ecological role and provide habitat for a variety of old growth-dependent wildlife species. The occurrence, distribution, and connectivity of this type of forest community is below historic ranges.

Natural fire played a very important role in maintaining the ecological integrity of ponderosa pine stands in the planning area. Fire intervals on these sites were 4-24 years (Agee, 1993). Because fires occurred frequently, they tended to be low-intensity ground fires. These periodic ground fires usually burned in a mosaic pattern and consumed duff, needles, broken branches, shrubs, and small trees. Grasses and forbs were maintained in a denser, more vigorous, more diverse condition. Thin-barked juniper and lodgepole pine were periodically thinned by fire and kept in a subordinate position. The result was a nearly pure ponderosa pine stand with an open, one or two layer canopy, low density, and large diameter tree structure.

Fire suppression, beginning in the early 1900s, substantially altered ponderosa pine stand structure. An absence of fire allowed seedlings and saplings of ponderosa pine, lodgepole pine or juniper to establish underneath the larger trees. Current stand structure is now multiple canopy with many more trees per acre at a much smaller average diameter. Lodgepole pine or juniper are gaining dominance. Larger ponderosa pine are showing stress and mortality from understory competition and from drought conditions. Bitterbrush has become dense and stagnant with a high ratio of dead to live branches. Grass and forb density and diversity have decreased.

Riparian and Wetland Communities

Because of their proximity to water, the plant species present in riparian areas often differ considerably from species found in the adjacent uplands. The riparian areas within the planning area represent only a small percentage of the total planning area, but are important for the overall health of a system. A functioning riparian zone provides fish and wildlife habitat, protects water quality, stabilizes stream banks, aids groundwater recharge, assists in flood control, and provides visual esthetics and recreational opportunities. Poor upland vegetation or watershed conditions can disrupt riparian functioning. Noxious weeds and western juniper often occupy streamside and other riparian areas in the planning area. These plants have displaced native species in some areas, affecting riparian functioning.

Wet meadows are unique riparian habitat. They occur on areas of saturated soils where the water table varies little by season. Usually there are few, if any, areas of free standing open water. The vegetation of wet meadows consists of sedges, grasses, and forbs. Shrubs are limited in wet meadows that are in PFC (see Water section) and generally occur along the margins.

Ponds and stock reservoirs may be perennial or seasonal in nature, such as ponds fed by spring snowmelt (see Water section). Ponds or reservoirs that contain water year round generally support riparian type vegetation such as sedges, rushes, cattails, and occasionally willow. Vegetation surrounding seasonal ponds or reservoirs usually consists of upland type shrubs and/or grasses, or may not be present at all.

Within the Crooked River Canyon located downstream from Bowman Dam (Chimney Rock segment of the Lower Crooked River WSR), the riparian community type is characterized by willow, sedges, rushes, and grasses. Other shrubs, including red-osier dogwood and mock-orange, can also be found (BLM and BOR, 1992). Downstream from the Lower Crooked WSR segment, the valley bottom widens and the riparian community type is characterized more by herbaceous vegetation such as grass, sedges and rushes, and less so by shrubs and trees.

Approaching the Lower Crooked River WSR segment near Smith Rock State Park, the

river becomes increasingly confined, generally flowing through a deep, narrow canyon. The same holds true for the Middle Deschutes River downstream from the city of Bend. The riparian zone in both canyons is narrow and dominated by woody species including alder, red-osier dogwood, willow, chokecherry, rose, clematis, sedge, rush, and various grasses. There are very few broad areas containing extensive willow or sedge/rush communities. Increasingly, talus and boulders are piled onto the banks and even into the river. Often woody and emergent riparian vegetation grows between boulders. Occasionally the canyon walls recede somewhat and the flood plain widens allowing for a wider riparian zone and adjacent grassy terraces. Within the canyons a number of springs emerge from the canyon walls where there is an increase in riparian vegetation including areas of emergent and sedge/rush communities. These riparian zones associated with springs are relatively small in area, usually less than a few acres in size.

The Upper Deschutes River WSR segment is characterized by stands of lodgepole pine and ponderosa pine as an overstory; a shrub understory of spiraea, snowberry, alder, or willow, and an herbaceous layer of forbs and sedges. There are several large willow/sedge meadows scattered within the reaches (USFS, 1996).

The Little Deschutes River contains a complex mosaic of riparian habitats on broad flood plains, including broad meadow and prairie areas composed primarily of sedge, rush, and/or grass communities with scattered willows and other woody riparian species. Most of these meadows are drained and irrigated with water from the Little Deschutes River or one of its tributaries. Where these meadows are drained and irrigated, they tend to be dominated more by grass species with sedge/rush communities along the ditches and occasional willow communities. Adjacent to the Little Deschutes River and its oxbows, there are dense willow communities interspersed with wet meadows encompassing a wide variety of emergent and flood tolerant species of vegetation.

Wet meadow, forested wetlands, and shrub wetlands habitat is very limited, much of it is not yet mapped electronically (see Water section). Most of the wetland type vegetation is associated with the high groundwater table in the La Pine area. Sedges, rushes and willows are dominant species within wet meadows adjacent to the Little Deschutes River, and lodgepole pine inhabits forested wetlands.

Large floods typically reset riparian vegetation to early seral species, or set back the condition and amount of late seral species. These flood events generally occur during late winter or early spring. Large floods periodically occur in Bear, Sanford, and other creeks in the Crooked River watershed. The magnitude and frequency of flood events on the Crooked River below Bowman Dam has been reduced since the closure of the dam in 1960. Prior to the closure of Bowman Dam in 1960, average peak discharges typically ranged from 3,000-7,000 cfs. Following closure, peaks never exceed approximately 3,300 cfs. This limits the ability of the stream to rejuvenate during the landform developing process of large floods. Peak flows that used to occur on average once every 1.5 years (i.e., 2,200 cfs, approximately bankfull flow) now occur half as often, or about once every three years (See Figure 3-3, Flow Duration Curves Crooked River below Bowman Dam, in the Water Quality and Quantity section of this chapter). This reduced frequency of what was once bankfull flow likely has a significant effect on channel morphology and the resulting riparian vegetation type and composition. Likewise, stream-flows on the Deschutes River have been altered since 1922 by Crane Prairie Reservoir and since 1942 by Wickiup Reservoir.

The various hardwood trees and shrubs associated with riparian areas in several perennial streams and canyons in the planning area provide important habitat for wildlife, fish, stream ecology, and water quality. Examples of these species include alder, willow, chokecherry, serviceberry, red osier dogwood, bog birch, oceanspray, mock-range, currant, snowberry, wild rose, spirea, and aspen. Aspen occurs in only two known locations in the planning area, south of Grizzly Mountain and east of La Pine.

The bio-diversity provided by hardwoods, particularly valuable on xeric landscapes, is being reduced in the planning area by various activities such as fire exclusion, improper grazing and intensive riverside recreation.

Fire is probably relatively infrequent in the meadow and streamside habitats occupied by riparian species within the planning area. In fact, riparian areas frequently act as fire breaks. The high soil and fuel moisture content characteristic of streamside habitat reduces the chance of fire ignition and spread. However, under dry conditions, riparian habitats can burn severely (Crane, 1982). Many riparian species are fire tolerant and may even benefit from low to moderate intensity fires. Most willows in all stages of vigor resprout from the root crown or stem base following fire (Haeussler & Coates, 1986; Lotan, *et al.*, 1981; Rowe & Scotter, 1973; Zasada, 1986) and their numerous wind dispersed seeds are important in revegetating areas following fire (Miller & Miller, 1976). Sedges and rushes also can survive fire by sprouting from their extensive rhizomes (Boggs, *et al.*, 1990; Wakimoto & Willard, 1991). Golden and gooseberry currant regeneration is probably favored by low- to moderate-severity fire because germination of soil-stored seed is generally enhanced by scarification in *Ribes* spp. (Agee & Maruoka, 1994; Bradley, *et al.*, 1991; Moss & Wellner, 1953; Steele & Geier-Hayes, 1993; Steele & Geier-Hayes, 1989). Plants in the rose family, as well as serviceberry, chokecherry, bitter cherry, and red osier dogwood are all moderately fire tolerant and are usually favored by low-severity fire. They can persist after low- to moderate-severity fire because of their ability to sprout from undamaged and/or buried root crowns and rhizomes (Boggs, *et al.*, 1990; Haeussler, *et al.*, 1990). Black cottonwood and white alder are not considered fire tolerant and are highly susceptible to fire damage.

Special Status Plants

The policy of BLM is to 1) conserve listed species and the ecosystems on which they depend, and 2) ensure that actions authorized or carried out by BLM are consistent with the needs of special status species and do not contribute to the need to list any of these species. The BLM's policy is intended to assure the survival of those plants that are rare or uncommon, either because they are restricted to specific, uncommon habitat or because they may be in jeopardy due to human-caused or other actions.

Apart from law or policy, three main reasons stand out for conservation of special status species. First, each occupies a niche and has a role in its ecosystem, although we do not always know what that role is. All parts of the system are inter-related and important, even if we don't yet understand the connections. Biological diversity and ecosystem integrity are important for the economic and social, as well as the ecological environment. Second, plants offer untold potential for human benefit, especially as related to pharmaceuticals as nearly all pharmaceuticals were originally plant-based. Loss of a species may mean the loss of a future "wonder drug" or other genetic material valuable for enhancing human lives. Finally, these species add aesthetic diversity to our world.

For BLM, "Special Status" plants include those species that are proposed for listing, officially listed as threatened or endangered, or are candidates for listing under the provisions of the Endangered Species Act (ESA); those listed by a State in a category such as threatened or endangered, implying potential endangerment or extinction; and those designated by each BLM State Director as sensitive (BLM, 2001).

In Oregon, the BLM designation "sensitive" further includes two sub-categories: "Bureau Sensitive" and "Assessment Species." Bureau Sensitive species include those plant species formerly designated by the U.S. Fish and Wildlife Service (USFWS) as Category 1 and 2 candidates for listing as endangered or threatened under the Endangered Species Act and now termed "Species of Concern." This category also includes species considered by the Oregon Natural Heritage Program (ONHP) to be "endangered or

threatened throughout their range.” Assessment species include those species considered by ONHP to be “endangered or threatened in Oregon but more common elsewhere” (List 2).

No species either listed, proposed for listing or candidates for listing under the ESA are known from or suspected on BLM-administered lands in the planning area. However, for those State-listed species and sensitive species, existing factors such as declining populations, reduction in habitat, increased disturbances, small and widely dispersed populations and unique habitat requirements contribute to a need for increased management attention to these species to ensure they do not need to be listed under the ESA.

Special status plants receive priority attention for inventory, research, monitoring and management. All proposed ground disturbing activities are subject to botanical inventory prior to implementation and other inventory is accomplished as time and funding allows. All special status plant populations are monitored on a regular schedule with the intervals between visits based on the needs of each. Challenge cost share agreements between the Oregon Department of Agriculture (ODA) and The Nature Conservancy (TNC) have, and continue to provide in-depth monitoring for several species in the District.

All Bureau-authorized actions are reviewed to ensure they do not contribute to the need to list any special status species. This may include modification or abandonment of the proposed action with consideration for protection of the species’ habitat as well as the species itself.

Four special status plants are known to occur on BLM-managed lands within the planning area, as shown in Table 3-6, below.

Peck’s milkvetch is predominately found in the area southwest of Cline Buttes, between Tumalo and Plainview. Preferred habitat is open sandy soil dominated by western juniper and sagebrush, usually with a flat aspect. Sandy basins are especially preferred. While the Cline Buttes area is the area with this plant’s greatest concentration, several populations have been found on Forest Service and private land south of the planning area in pumice soils dominated by lodgepole pine, with one population located on public land at the extreme south end of the planning area.

The block of BLM-administered land south of Plainview was designated as Peck’s Milkvetch Area of Critical Environmental Concern (ACEC) in 1986 (see Map 7: Special

Table 3-6. Special Status Plants within the Upper Deschutes Planning Area

Latin Name	Common Name	Status ¹	Ownership
<i>Astragalus pekii</i>	Peck’s Milkvetch	BS, SOC, T, 1	BLM, USFS, pvt.
<i>Artemisia estesii ssp. pekii</i>	Estes’ Wormwood	BS, SOC, 1	BLM, USFS, pvt.
<i>Botrychium pumicola</i>	pumice grapefern	BS, SOC, T, 1	BLM, USFS, pvt.
<i>Castilleja chlorotica</i>	green-tinged paintbrush	BS, SOC, 1	BLM, USFS, pvt.

¹BS – Bureau Sensitive

SOC – Species of Concern

T – Listed Threatened by the State of Oregon

1 – OHNP List 1, Endangered or Threatened throughout its range

Management Areas). Since 1986, the ACEC has been intensively inventoried for the species and ongoing inventory has extended the plant's known range northeast toward Cline Buttes.

The greatest concern for Peck's milkvetch is the loss of habitat as suitable habitat on private land is developed. Habitat loss is expected to increase proportionate to the number of people living in and adjacent to the planning area. On public land, any activities that cause long-term trampling of the plants and/or soil disturbance are cause for concern as these actions will reduce the plant's vigor and ability to reproduce. This includes, but is not limited to, improper livestock grazing and recreation, but especially unauthorized vehicle use away from established routes and illegal activities such as dumping and firewood theft. Peck's milkvetch has been observed to establish on disturbed sites but only if the disturbance is short-lived and not ongoing. Both recreational impacts and impacts resulting from unauthorized activities are expected to increase along with the human population of Deschutes County. Fire, as a natural component of the ecosystem, is not considered to be detrimental to the plant. Some vigorous Peck's milkvetch populations have been found in areas which have clearly burned within recent history.

On BLM-administered land within the planning area, Peck's milkvetch appears to be stable. A long-term monitoring study, in cooperation with The Nature Conservancy, was established in 1992, and data collected again in 1993, 1994 and 2000. Based on statistical analysis of the data, it appears Peck's milkvetch increased after 1992 (a dry year) but that some populations may be returning to 1992 levels. Further monitoring will be necessary to determine the trends of these populations (Rudd, 2001).

Estes' wormwood is a perennial, herbaceous relative of big sagebrush. Its primary known habitat is sandy and gravelly soils along the Deschutes River, from near La Pine in the south to Lake Billy Chinook in the north. Additionally, an old collection of Estes' wormwood has been documented as coming from Bear Creek. While this population has not been relocated, recent inventory has found the species in the Prineville Reservoir area and at two locations along the Lower Crooked River, one just below Bowman Dam and from the area just south of Lake Billy Chinook. It is likely that other populations occur elsewhere along the Crooked River.

Estes' wormwood is affected by livestock and wildlife grazing, streamside recreation, and any activity that degrades the riparian areas along the Crooked and Deschutes Rivers. Direct impacts on the plants would result in a loss of vigor and reproductive capability, while a change in species composition of the riparian community could result in a drying of the site and a loss of appropriate habitat. Equally important, would be upstream pollution or a widely-fluctuating flow regime. As a clonal species, it is likely fire would have no effect. As the population of Central Oregon increases, it is probable that visitor use in the riparian areas along both the Crooked and Deschutes Rivers will increase as well. This would likely result in continued disturbance and alteration of Estes' wormwood habitat. Due to the relative inaccessibility of much of its habitat and the reduced amount of grazing that occurs in the canyons, Estes' wormwood appears to be stable, but there are no quantitative studies to substantiate this.

Pumice grapefern generally has a distribution from near Crater Lake to the Deschutes National Forest northeast of La Pine. Originally thought to be found only on high elevation pumice flats, more recent inventory has documented extensive occurrences in the lodgepole pine forest of the La Pine Basin and to the northeast. It grows exclusively on deep pumice soils associated with the Newberry and Mt. Mazama ash deposits and, on BLM-managed land, is found mostly south and east of La Pine.

Pumice grapefern in the planning area has been impacted through habitat change. An increased lodgepole pine canopy, as a result of fire suppression, coupled with an

abundance of dead and down trees from the recent outbreak of the mountain pine beetle, has resulted in an extremely heavy litter component in much of the La Pine Basin. While the shading resulting from the dense canopy and heavy litter concentration is most likely detrimental to the pumice grapefern, another concern relates to the potential of catastrophic fire as a result of these conditions. The pumice grapefern, no doubt, existed within a natural fire regime in the La Pine Basin, but the existing fuel loading and potentially extreme burning conditions would probably be detrimental should fire occur.

As a relatively fragile species (a fleshy plant growing in easily dislodged soils), pumice grapefern is also easily damaged by logging machinery, off-road vehicle use, and livestock grazing (trampling), although grazing isn't a major factor within its range. Although plants have been found in areas subjected to such activities, it does not appear that this is a preferred habitat, as plant densities appear to be substantially less than in undisturbed areas.

The long-term trend of pumice grapefern is unknown. It is likely that populations have declined due to an increase in the lodgepole pine overstory, but now that many of these areas have been harvested and the woody material removed, these populations could be recovering. Issues related to predation of some populations by animals, inconsistent emergence in the spring and the unknown influence of weather make this a difficult species to monitor with any consistency and, therefore, it is difficult to infer trend. The BLM is a partner in funding a project designed to determine the effects of various types of disturbance on pumice grapefern. Results should be available in 2005.

Green-tinged paintbrush in the Prineville District is at the northeastern edge of its range, and within the planning area, is known from the Horse Ridge, Golden Basin, and West Butte and Bear Creek Buttes areas. Requiring a fungal interface with shrubs, it is found most often associated with big sagebrush but also with pronghorn bitterbrush in ponderosa pine or lodgepole pine communities. Green-tinged paintbrush is more common, although still a Species of Concern, on the Deschutes and Fremont National Forests.

Identified disturbances to green-tinged paintbrush include livestock grazing, off-road vehicle use and fire. Observations indicate that green-tinged paintbrush is preferred by livestock, and in areas where livestock use is heavy during the growing season, heavy utilization of green-tinged paintbrush has been noted. OHV use is a concern since several known populations occur within or adjacent to areas used by OHV enthusiasts.

While fire may enhance most native plant communities, survival of mature big sagebrush and bitterbrush, neither of which are fire resistant, is critical for survival of green-tinged paintbrush. Green-tinged paintbrush has been effectively extirpated from burned areas, although plants survive adjacent to these areas and can likely repopulate in time. No data exists, but it appears that green-tinged paintbrush is stable within the planning area.

Noxious Weeds

There are many exotic (non-native) plant species that occur within the planning area. Most of these aggressive species have been introduced, usually from Europe, Asia, or Russia. These species were imported, either intentionally for their perceived value to humans, or inadvertently as contaminants in feed or other seed or plant products.

The term "weeds" is loosely applied to most of these introduced species. A weed is defined as any plant that interferes with the management objectives for a given area of land at a given point in time (Dewey and Torell 1991). Of the exotic species in the planning area, 12 have been classified by the counties and State as noxious weeds. "Noxious" is a legal classification rather than an ecological term. Government agencies may designate a species a "noxious weed" if it directly or indirectly imposes economic or

ecological effects to agriculture, navigation, fish and wildlife, or public health. Federal, state and county laws and ordinances require that certain actions be taken to manage listed noxious weed species.

Noxious weeds pose a threat to native biological systems and degrade all multiple-uses and other values on BLM administered lands. These plants use water, nutrients, and sunlight that would otherwise be used by native species, thus altering natural communities and ecosystems. The invasiveness of weeds is due to their genetic make-up, which enables them to exploit a resource “niche,” and the lack of natural enemies such as insects, diseases, and pathogens (Story, 1992). Some of the consequences of noxious weeds on BLM administered lands include effects on: productivity of native rangelands; diversity of native plant and animal species; range and population of special status plants; habitat structural diversity; soil biological crusts; scenic values; tourism; recreation; and in some cases, human health and safety. Noxious weeds degrade these uses and values by displacing native plant species, decreasing soil stability, and disrupting natural processes such as soil/water interactions, fire frequency and intensity, nutrient cycling, and energy flow.

Noxious weed species are well-established and spreading rapidly in the planning area. The spread of noxious weeds has been considered analogous to a biological wildfire. The local expansion of noxious weeds is part of a trend involving all of the other western states. Almost all the listed species in Central Oregon have expanded in both area and numbers of populations in the last 10 years. Weed seed is carried and spread by livestock, wildlife, wind, water, and people and their vehicles. Spread of weeds on BLM administered lands is particularly apparent where surface soils or native vegetation are disturbed. Some of the disturbance factors on BLM-administered lands are off-road vehicle travel, livestock grazing, logging, military training exercises, and construction of roads and utility lines. A majority of infestations occur adjacent to roads, powerlines, ditches, and canals; indicating that the primary carriers of weed seed are vehicles and water. Ground-based activities, particularly those involving motor vehicles or equipment, disturb surface soils which has the effect of preparing a receptive seed bed for these pioneering species.

Noxious weed management within the planning area is currently in conformance with “Vegetation Treatment on BLM lands in Thirteen Western States” (1991) and the Prineville District Integrated Weed Management EA OR-053-3-062 (1994). These plans prescribe an integrated approach involving prevention, early detection, inventory, timely control (using biological, mechanical, manual, and chemical techniques), monitoring, and site rehabilitation. The selection of control methods is influenced by land management objectives, effectiveness of the control technique on the target species, size of the infestation, environmental concerns, land uses, and economics. BLM cooperates with county, state, and other federal agencies that have jurisdiction in or near the planning area.

Following is a brief description of the most important noxious weed species found in the planning area:

Spotted and Diffuse Knapweed: Spotted and diffuse knapweed are widespread, with the Bend area having the largest infestation of spotted knapweed in the state. Spotted knapweed is expanding in all directions. Diffuse knapweed is more plentiful in the northern and eastern portions of the planning area. Both produce an abundance of seed that is easily spread.

Russian Knapweed: Russian knapweed is found in patches and is more common in Crook County along riparian areas and agricultural fields. This is a deep-rooted perennial that spreads relatively slowly. It is more resistant to control methods and has no established biological control agents in Oregon.

Hoary Cress: Hoary cress invades irrigated fields and riparian areas; it is most common in Crook County. It is a deep-rooted perennial. There are no biological control agents available for this species.

Leafy Spurge: Leafy spurge grows primarily in Crook County in the riparian areas of Mill Creek and the Crooked River. It also is present in the adjacent riparian areas of canals, ditches and irrigated fields. Its close proximity to water makes for difficult control.

Dalmatian Toadflax: Dalmatian toadflax is common in the Bend and Redmond areas and is expanding in all directions. Due to its very pretty yellow snapdragon-like flower, this noxious weed is often spread inadvertently by homeowners who cultivate it in flowerbeds.

Poison Hemlock: Poison hemlock is very poisonous to both humans and livestock if eaten. It is found in wet areas along rivers and irrigation ditches in the area. It poses a public health risk where it occurs in or near recreation areas.

Perennial Pepperweed: Perennial pepperweed is deep rooted and inhabits riparian areas and wet areas along canals, ditches and irrigated fields. The largest infestation in the planning area is at the upper end of Prineville Reservoir.

Scotch Thistle: Scotch thistle can take over large areas and render land useless for most activities. Scotch thistle, mostly a biannual, grows to 6 to 8 feet tall.

Medusahead: Medusahead is a very invasive annual grass that will replace most other native range plants. This species can dominate silty or clay soil types. It develops a silica mat of vegetation and can present an extreme fire hazard.

Yellow-Star Thistle: Yellow-star thistle is an annual that quickly dominates a site by massive growth of plants from seeds after any small amount of rain. Bees are attracted to it as it blooms all summer long. Very stiff spines around flower discourage people use in area of dominance.

Puncture Vine: Puncture Vine is a common annual in Crook and Jefferson Counties. It has spiny seed pods that cause grief for bike riders, dogs and bare-footed pedestrians.

In addition to the agency-listed noxious weed species, there are other common non-native species that are causing varying degrees of impacts to public land resources. These species include cheatgrass, tumbleweed, ragweed, and various thistles and mustards. Cheatgrass, although not listed as a noxious weed, is very prevalent in the planning area and is damaging to native landscapes. This annual was introduced from Asia. It can out-compete native grasses by its ability to germinate in the fall and early spring, by its aggressive establishment after fire or other ground disturbance, and by its production of abundant and persistent seed.

Wildlife and Fish

This section describes the current habitat conditions and unique features of the landscape that provide for wildlife species throughout their life cycles. As previously described in the vegetation section, the planning area is characterized by several major distinct vegetative community types. These major vegetative community types along with non-vegetative habitats such as caves, cliffs, and water provide a set of conditions, structure, scale, and disturbances that affect the diversity and abundance of the wildlife associated with each habitat type.

This document focuses on priority wildlife species, which includes both non-special-status species and special status species. These priority wildlife species are called “Species of Focus” and are listed in Table 3-7, Species of Focus¹.

¹ *Species of focus* are vertebrate species for which there is ongoing concern about population or habitat status. We used four criteria to develop the list of species that were the focus of our planning and assessment. For this planning effort species were included if they met any of the following:

- Species that are included in the Special Status Species Policy (6840) which includes: federally listed threatened, endangered, proposed or candidate species; Bureau Sensitive, Assessment, or Tracking Species; and State listed species.
- Species of local interest, such as deer, elk, pronghorn and golden eagles.

Table 3-7. Species of Focus²

Common Name	Scientific Name	Assessment type: Single-species or Source Habitat (Multi-species ³)
Federally Listed Species (Threatened)		
Northern Bald Eagle	<i>Haliaeetus leucocephalus</i>	Single Species
Federal Candidate Species		
Columbia Spotted Frog**	<i>Rana luteiventris</i>	Source Habitat: Riparian
Oregon Spotted Frog	<i>Rana pretiosa</i>	Source Habitat: Riparian
Bureau Sensitive Species		
AMPHIBIANS AND REPTILES – None		
BIRDS		
American Peregrine Falcon**	<i>Falco peregrinus anatum</i>	Source Habitat: Riparian
Black-backed Woodpecker	<i>Picoides arcticus</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Burrowing Owl	<i>Athene cucularia</i>	Source Habitat: Shrub – Steppe
Ferruginous Hawk	<i>Buteo regalis</i>	Source Habitat: Shrub – Steppe
Flammulated Owl	<i>Otus Flammeolus</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Lewis’s Woodpecker**	<i>Melanerpes lewis</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Northern Goshawk	<i>Accipiter gentilis</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Northern Pygmy owl	<i>Glaucidium gnoma</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Northern Three-toed Woodpecker	<i>Picoides tridactylus</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Pygmy Nuthatch (BM)	<i>Sitta pygmaea</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
Upland Sandpiper	<i>Bartramia longicauda</i>	Source Habitat: Riparian, grassland
Western Sage Grouse	<i>Centrocercus urophasianus phaios</i>	Single Species
White-headed Woodpecker**	<i>Picoides albolarvatus</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine
MAMMALS		
Fisher	<i>Martes pennanti</i>	Source Habitat: Riparian
Townsend’s Big-eared Bat	<i>Corynorhinus townsendii</i>	Single Species
Bureau Assessment Species		
AMPHIBIANS AND REPTILES – None		
BIRDS		
Black-throated Sparrow	<i>Amphispiza bilineata</i>	Source Habitat: Shrub-Steppe
Northern Water Thrush**	<i>Seiurus noveboracensis</i>	Source Habitat: Riparian
Tricolored Blackbird**	<i>Agelaius tricolor</i>	Source Habitat: Riparian
MAMMALS		
Pygmy Rabbit	<i>Backylagus idahoensis</i>	Source Habitat: Shrub-Steppe
Brazilian Free-tailed Bat	<i>Tadarida brasiliensis</i>	Source Habitat: All - general
Spotted Bat**	<i>Euderma maculatum</i>	Source Habitat: Shrub-Steppe, forest/ woodland, Riparian
Bureau Tracking Species		
AMPHIBIANS AND REPTILES		
Cascade Frog	<i>Rana cascadae</i>	Source Habitat: Shrub-Steppe
Northern Sagebrush Lizard	<i>Sceloporus graciosus graciosus</i>	Source Habitat: Shrub-Steppe
Western Toad	<i>Bufo boreas</i>	Source Habitats: All General
BIRDS		
Bank Swallow	<i>Riparia riparia</i>	Source Habitat: Riparian, Shrub-Steppe
Great Gray Owl	<i>Strix nebulosa</i>	Source Habitat: Ponderosa Pine/Lodgepole Pine forest
Greater Sandhill Crane**	<i>Grus Canadensis tabida</i>	Source Habitat: Riparian
Loggerhead Shrike**	<i>Lanius ludocicianus</i>	Source Habitat: Shrub-Steppe, Juniper Woodland
Long-billed Curlew**	<i>Numenius americanus</i>	Source Habitat: Shrub-Steppe, Riparian

Mountain Quail	Oreortyx pictus	Source Habitat: Ponderosa Pine/Lodgepole Pine
Olive-sided Flycatcher	Contopus borealis	Source Habitat: Ponderosa Pine/Lodgepole Pine
Pileated Woodpecker	Cryocopus pileatus	Source Habitat: Ponderosa Pine/Lodgepole Pine
Pine Grosbeak	Pinicola enucleator	Source Habitat: Ponderosa Pine/Lodgepole Pine
Pygmy Nuthatch (EC, HP)**	Sitta pygmaea	Source Habitat: Ponderosa Pine/Lodgepole Pine
Sage Sparrow	Amphispiza billi	Source Habitat: Shrub-Steppe
Williamson's Sapsucker**	Sphyrapicus throideus	Source Habitat: Ponderosa Pine/Lodgepole Pine
Willow Flycatcher	Empidon hax trailii brewsteri	Source Habitat: Riparian/woodland
MAMMALS		
American Marten	Martes Americana	Source Habitat: Ponderosa Pine/Lodgepole Pine forest
Bighorn Sheep	Ovis canadensis	
Long-eared myotis**	Myotis evotis	Source Habitat: Forest, Shrub-Steppe, Woodland, Riparian
Long-legged myotis**	Myotis volans	Source Habitat: Forest, Shrub-Steppe, Woodland, Riparian
Pallid Bat**	Antozous pallidus	Source Habitat: All - General
Preble's Shrew**	Sorex Preblei	Source Habitat: Shrub-Steppe, Riparian
Silver-haired bat**	Lasionycteris noctivagans	Source Habitat: Ponderosa Pine/Lodgepole Pine
Western Gray Squirrel	Sciurus griseus	Source Habitat: Ponderosa Pine Forest
Western Small-footed Myotis**	Myotis ciliolabrum	Source Habitat: Shrub-Steppe, Ponderosa Pine, Juniper
White-tailed Jackrabbit**	Lepus townsendii	Source Habitat: Shrub-Steppe, Ponderosa Pine, Juniper
Yuma Myotis**	Myotis yumanensis	Source Habitat: All General
Species of Local Interest		
Mule Deer	Odocoileus hemionus	Single-species
Rocky Mountain Elk	Cervus elaphus nelsoni	Single-species
Pronghorn	Antilocapra Americana	Single-species
Golden Eagle	Aquila chrysaetos	Single-species

Table notes: *Documented occurrence in the district does not mean the species has been documented in the planning area.

**Species to consider conducting surveys on to determine population and habitat presence/absence.

² Including Special Status Wildlife Species Inhabiting or Potentially Inhabiting the Upper Deschutes Planning Area and Species of Local Interest

³ For multi-species assessment types the animal's associated source habitat(s) is (are) named.

A list of priority animal species for the Upper Deschutes planning area is listed in the Table 3-7 Species of Focus. These animals will be discussed in four broad categories of birds, mammals, amphibians, and reptiles. In each category, species discussion will be in the order of federally listed Threatened or Endangered species, special status species, and locally important species (those recognized as being of particular interest to the public).

The Bureau of Land Management has a policy for designating special status species that is tiered to state agencies' and Oregon Natural History program designations. Currently, the BLM in Oregon uses three categories for special status species. Special Status Species are those proposed for official listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those listed by a State in a category such as threatened or endangered of extinction; and those designated by each State Director as sensitive. The Oregon/Washington BLM State Director designated sensitive species under the category "Bureau Sensitive" plus established two additional categories of plant and animal species ("Assessment" and "Tracking"). Brief definitions are as follows: Bureau Sensitive Species are generally restricted in their range and which have natural or human-caused threats to their survival; Bureau Assessment Species are species which are not presently eligible for official federal or state status but are of concern in Oregon; and

Bureau Tracking Species are species which may become threatened or endangered in the future. For a more thorough description of special status species and their management refer to Manual 6840, Special Status Species Management.

Birds

Raptors

Raptors are a group of predatory birds that includes eagles, falcons, hawks and owls. They are a common sight in much of the planning area, and use a wide range of habitats. Many raptors are viewed as species of high public interest. Raptors and their habitats are protected under the Eagle Protection Act (1963), and the Migratory Bird Treaty Act (1918). Raptors that occur or could occur in the planning area include one federally listed species, five BLM sensitive species, and two BLM tracking species.

Much of their life cycle is dedicated to breeding, nesting and raising young. Most raptors require elevated nesting sites and have historically used a variety of nesting platforms on which they construct stick nests. In the planning area nesting occurs on cliff ledges, lava rock out-crops, single large ponderosa trees, lodgepole pine thickets, juniper trees, utility poles, grasslands, wetlands and riparian associated vegetation. Foraging habits differ by species, but most raptors prey on a variety of small mammals, reptiles, birds and insects.

Except for the bald eagle, no systematic inventories have been completed for raptors or their habitats, but many species have been recognized as year-round residents of the planning area. Species present in the planning area include bald and golden eagles, osprey, ferruginous hawk, northern goshawk, Swainson's hawk, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, American kestrel, northern harrier, and prairie falcon. During winter many of these species migrate south to various wintering grounds. Central Oregon serves as a winter area for the rough-legged hawks, which are seasonally abundant throughout the northern portion of the planning area. Owls are year-round residents; however a few species do migrate in winter. Common owls in the planning area include the great horned, great gray, long-eared, short-eared, barn, western screech, and northern saw-whet.

In Oregon the northern bald eagle was federally listed in 1978 as a threatened species under the Endangered Species Act (ESA) of 1973 (as amended CFR, 1988). The eagle was placed in this status as a result of destruction of habitat, harassment and disturbance, shooting, electrocution, poisoning, a declining food base, and environmental contaminants. Recovery efforts during the past two decades have increased the population above the goals of the Pacific Bald Eagle Recovery Plan (USDI 1986).

Bald eagle nesting territories are normally associated with lakes, reservoirs, or rivers. Nests are usually located in large conifers in uneven-aged, multi-storied stands with old-growth components (Anthony *et al.*, 1982). Factors such as tree height, diameter, tree species, and position on the landscape, distance from water, and distance from disturbances also appear to influence nest selection. Additionally, eagles select trees that provide vantage points from which territories can be defended. Bald eagles feed primarily on fish during the spring/ summer but may shift to waterfowl and rodents during fall and winter.

Surveys for and monitoring of nesting bald eagles have been conducted annually since 1979 by the Oregon Cooperative Wildlife Research unit, the Oregon Eagle Foundation (OEF), BLM, and USFS. These surveys have identified three bald eagle nests on BLM-administered land, one on National Forest land, and three on private lands within the planning area. Additionally, four nests have been located on National Forest and private lands within two miles of the planning boundary.

Two of the three nests on public land occur immediately adjacent to major water sources where recreationists could influence eagle occupancy. The other nest site requires the eagles to travel longer distances for foraging, yet have been successful at raising young the past several years (Isaacs survey records, 1991-2001).

The golden eagle is a species of high public interest and is protected under the Bald Eagle Protection Act (1963), and the Migratory Bird Treaty Act (1918). Golden eagles are a year round resident and construct large stick nests mainly on cliffs and sometimes in large conifers. Golden eagles prefer open shrub/grasslands, and open woodlands where they prey on rabbits and hares, marmots, squirrels and other small to medium-sized animals.

Systematic inventories have not been conducted for golden eagles or their habitats, however, nests sites have been found in the planning area on canyon rims (rock ledges), old-growth juniper trees and large single ponderosa pine trees. The BLM Prineville District works with ODFW and volunteers to monitor some of these nests annually. Golden eagles are sensitive to human disturbances during the breeding season and they often nest in areas popular for recreational activities.

The peregrine falcon (Bureau Sensitive) was federally listed as an endangered species throughout its range and as a state endangered species. However, in 1999, the peregrine falcon was de-listed after recovery efforts helped the population achieve the recovery goals set forth in the 1982 Pacific Coast Recovery Plan for the American Peregrine Falcon.

The peregrine falcon is a cliff-nesting species, preferring tall cliffs with ledges, or small caves that are suitable for constructing a nest scrape (USFWS 1982). Nest sites are usually associated with cliffs near water with an abundant population of non-game birds, shorebirds, and waterfowl, the peregrine's primary prey. Raptor surveys conducted throughout Central Oregon have determined that suitable habitats exist, but no nests sites were found. Peregrine falcons can be observed in the planning area during winter migration.

The northern goshawk (Bureau Sensitive) occurs both in the northern planning area and the La Pine block. Goshawks, normally a forest bird, are common in coniferous forests, but will also use aspen groves, desert mountain ranges and dense juniper woodlands. Goshawk nests are usually located in the fork of a tree limb near the trunk of the tree. Diet consists of both birds and small mammals. Surveys have located several nests in the La Pine area. No surveys have been conducted in the northern portion of the planning area, but there are two known nests sites that have been active the past several years.

Prairie falcons are common in the planning area and protected under the Migratory Bird Treaty Act. They typically inhabit arid deserts and open grasslands where they use cliffs for nesting habitat. A cliff is any vertical rock face or structure that may exist as rock spires, vertical scarps, volcanic dikes, or large lava blisters. These falcons are opportunistic feeders that can take small mammals up to the size of jackrabbits but mainly forage small mammals and birds, lizards and grasshoppers.

No systematic inventories have been completed for prairie falcons but several known nest sites are monitored annually. BLM coordinates with ODFW and volunteers to monitor these nests. These nest sites mainly occur on cliff faces in river canyons but there are several known nests in lava blisters, and small rim-rock escarpments.

Little is know about flammulated owls (Bureau Sensitive) in the planning area. Flammulated owls use open conifer forests and appear to prefer ponderosa pine. It requires fairly large trees for roosting that are adjacent to patches of grassland or meadow, where it forages. This owl is mainly an insectivore, preferring grasshoppers and moths, but also eating beetles, crickets, spiders, and occasionally small mammals and

birds. A limited amount of survey has been done in portions of La Pine block with no locations found. No known nesting occurs in the planning area.

Burrowing owls (Bureau Sensitive) historically occurred in the planning area but there have been no sightings in the past several decades. They prefer open grassland habitats where they feed mainly on small mammals and insects.

The northern pygmy owl (Bureau Sensitive) is a small owl that will hunt by day and nests in tree cavities. Like most owls, the Pygmy owl does not create nesting cavities so it depends on woodpeckers, nuthatches and natural decay processes. This owl inhabits moist forest types, riparian woodlands, as well as drier ponderosa pine forests. This species will move to lower elevations during winter and will also make use of juniper and aspen stands. Past forestry practices that removed dead standing and live trees with internal decay have impacted nesting habitat for this species. Current federal land management practices include conservation measures for their nesting habitats.

The major impacts to raptors or their habitat are disturbances near the nest during the nesting season. Disturbances are usually a result of human uses such as mining, OHVs, rock or cliff climbing, equestrian rides, target shooting, boating, and hiking. In general, habitat conditions have remained relatively stable in the planning area, but human uses are increasing near known nesting areas. During the past several years, golden eagles and prairie falcons have changed nesting sites in areas of high recreational use, suggesting that increasing disturbances may effect nest locations and productivity.

Several known nests sites are monitored annually, usually related to areas of high recreational use. BLM coordinates with ODFW and volunteers to monitor these nests and seasonal closures have been put in place to protect these important reproductive habitats.

Upland Birds

A variety of upland birds occur within the planning area, using all of the vegetation types in the area. These birds are hunted for sport and regulated by ODFW. Species that occur in the planning area include native sage grouse, ruffed grouse, valley and mountain quail, and introduced ring-necked pheasant, wild turkey, chukar and gray partridge. Sage grouse and mountain quail are species of concern and will be the only ones from this group covered in detail.

Upland birds are ground nesters and construct nests in a shallow depressions on the ground concealed in thick vegetation of grasses or shrubs. Composition of the diets vary by species but upland birds forage on a variety of plant parts along with insects, such as grasshoppers, beetles and ants. Flowering plants (called forbs) are a main food source and have very high nutritional content.

Throughout its range, sage grouse (Bureau Sensitive) is a species of high public interest and may be petitioned for federal listing as either a threatened or endangered species. National interest and concerns have led BLM to work with state and federal agencies and private interest groups to develop short term management guidelines. Current efforts are now formulating on long-term management goals and objectives for sage grouse.

Sage grouse is a western bird that relies primarily on sagebrush for its nutritional and habitat needs and is considered an "obligate species" or "indicator species". This means their population success can be directly tied to the environmental conditions of the sage-steppe habitats they occupy.

Sage grouse are found throughout the range of big sagebrush, but numbers throughout the west have been declining for many years. These declines are primarily due to loss, degradation, and fragmentation of habitat (Wallestad 1975a). From the late 1800s through

1931, degradation of habitat from improper livestock grazing and excessive harvest caused severe declines of sage grouse populations (Edminster 1954). By 1940, sage grouse occupied only half their historic range in Oregon, and numbers declined 60 percent between the late 1950s and the early 1980s (Crawford and Lutz 1985). These declines led the USFWS to list the western subspecies of sage grouse as a candidate for threatened and endangered status (Federal Register, 18 September 1985).

Sagebrush is the most important plant for sage grouse because they use it for food and cover all year long. Grouse like to eat small flowering plants (called forbs) when available, usually from early spring to mid summer. Forbs grow in the sagebrush plant community, contain high nutrient levels and are easily digestible.

Sage grouse prefer large blocks of sagebrush habitat in late seral condition. Association with dense sagebrush stands typically begins in September and continues through the breeding season. Wintering areas are crucial to sage grouse because they are a major factor in determining their distribution. Elimination of winter range habitat can reduce sage grouse populations over large areas (Eng and Schladweiler 1972).

Quality nesting habitat is one of the most important factors in the success of sage grouse populations. A primary function of nesting habitat is the protection of the hen and her nest from predation, which is the primary factor influencing sage grouse nesting success in Oregon (Batterson and Morse 1948, Nelson 1955). While predation may be the most immediate cause of nest failure, the underlying cause may be a lack of adequate cover at nests that makes them easier to see and more vulnerable to predation (Gregg *et al.*, 1994).

The BLM manages approximately 90 percent of the lands currently inhabited by sage grouse (BLM, 1994). Beginning in the 1940s, the Prineville District, BLM in cooperation with ODFW has monitored sage grouse populations through annual strutting ground counts, referred to as "Leks." Approximately 19 percent of the northern planning area is currently used by sage grouse and is mapped as sage grouse range (See Map S-12: Sage Grouse Habitat). Within the planning area, grouse occur in the Skeleton fire area, Millican Valley, West Butte, Bear Butte, and Pine Mountain. This population is considered to be located on the western fringe of their range.

In the planning area, grouse numbers have varied over the years due to several factors including: drought; predation; habitat loss and degradation; and natural population fluctuations. In Oregon, the BLM Prineville District began a sage grouse study in 1988 because of declines in the number of males on leks. The purpose of the study was to define seasonal use areas and determine the overwintering population.

Studies in the planning area identified several important seasonal use areas, located new strutting grounds, and helped determine grouse distribution and suitable habitat types.

Currently, four leks are used for breeding. The largest occurs in Millican Valley. Used year after year, these sites are important to protect for future use. Studies in Wyoming indicate that disturbances on and around the lek that removes substantial vegetation could affect the local populations to the point of extinction (Higby, 1969).

The highest percentage of nesting occurred in the higher elevation areas surrounding Millican Valley where important nesting included Pine Mountain, Horse Ridge, West Butte and Bear Butte. Sage grouse nest in the mountain big sagebrush, mountain shrub, and grassland cover types, and the nest center of successful nests had taller grass and more tall shrubs than the nest center of unsuccessful nests (BLM, 1994). Habitat structure appeared to be as important to nest success as habitat type. These same high elevation areas are important for brood rearing as well, where forbs were more abundant and available throughout the summer.

Millican Valley is a very important area for the winter survival of sage grouse where over 100 birds spend their winter. Comparatively mild weather and fairly good sagebrush cover is the primary reason for this seasonal use.

Habitat quality is variable within the known use areas. The low elevation valley floors have a large component of annual plants and rabbitbrush, which is not ideal habitat for sage grouse but does provide cover during winter and forage during the early spring. The higher elevation areas are in good to excellent condition and have an abundance of important forbs.

The greatest effect on sage grouse is the destruction or adverse modification of their habitat. During the past 40 years, sagebrush valleys and foothills have been sprayed, plowed, chained, burned, disked, or cut in an attempt to convert these ranges to grasslands. Recent habitat protection and prescribed burns appear to be benefiting the sage grouse in the planning area. In the Millican and West Buttes area, a large percentage of lands are in mixed ownership between BLM-administered and private lands.

Lek viewing has become popular in the Millican area. BLM has been monitoring established viewing opportunities since 1995. Conflicts between humans and grouse viewers have prompted viewing restrictions to allow grouse to complete breeding. Recent management efforts have resulted in better viewing and less disturbance to the birds.

Vegetation management projects have been done to improve sage grouse habitat. In the Horse Ridge and West Buttes area, projects such as prescribed fire, lek mowing, and water developments have improved habitat for sage grouse.

Mountain quail (Bureau Tracking) prefer open forests and woodlands with a brushy understory (Csuti *et al.*, 1997). In eastern and Central Oregon, these quail can be found in close association with riparian areas, or meadows next to forest edges. Their preferred food consist of buds and flowers, berries, and insects such as grasshoppers, beetles and ants. During winter, seeds of a variety of plants make up most of the diet. Mountain quail are ground nesting birds and generally have very small home ranges (often staying within 1 square mile).

Mountain quail were once abundant throughout many areas in central and eastern Oregon. Numbers have been declining for several decades (ODFW, Bend), and the factors causing these declines are not fully understood. Although not common, mountain quail exist in several areas within the northern planning boundary. Small populations can be found in and near Bear Creek, Prineville Reservoir, and on scattered parcels of BLM lands north of Prineville, and north and east of Sisters. These quail exist in drainages with some amount of shrub type vegetation, brushy areas at the base of rimrock ledges, and around brushy seeps or springs. The planning area has not been surveyed for mountain quail and their population size and distribution is poorly known.

Although mountain quail are a game bird in Oregon, most populations in eastern Oregon are closed to hunting with exception of Wallowa and Hood counties.

Other Bureau Sensitive Birds

The pygmy nuthatch (Bureau Sensitive) is one of three resident nuthatches that occurs in the planning area. The pygmy nuthatch uses open coniferous woodlands. In Oregon they are believed to be tied to ponderosa pine communities. This is a cavity nesting species that creates its own nest sites and typically feeds on insects.

The Olive-sided flycatcher (Bureau Tracking) is found in several locations in the planning area. Although not found to be abundant, this flycatcher can be seen in forest habitats

near La Pine, Bend, and Redmond, and is suspected to occur on BLM lands north of Sisters. These birds like to forage on bees, flying ants, flies, small beetles, mosquitoes, and other flying insects (Csuti *et al.*, 1997). No surveys have been conducted for this species, therefore population sizes and range is unknown.

Willow flycatchers (Bureau Tracking) are less common in the planning area. Typical habitat occurs around willows at the edges of streams, meadows and marshes. This bird prefers thick vegetation around water. Except for the major river corridors and a few ponds and canals, preferred habitat does not occur in quantity or quality. No surveys have been conducted for this species, therefore population sizes and range in the planning area is unknown.

Sage sparrows (Bureau Tracking) are considered sagebrush obligates. Although sage sparrows can be found in grasslands they are usually not far from sage stands. Sage sparrows eat soft bodied insects, green foliage, and seeds usually found on the ground (Csuti *et al.*, 1997). Sage sparrows are common in the pure stands of big sagebrush near Millican and Horse Ridge area, the Badlands WSA, and west of Redmond. Sage sparrow populations are thought to be declining throughout its range. No surveys have been conducted for this species in the planning area; therefore population size and range size is unknown.

White-headed woodpecker (Bureau Sensitive), a species of concern, is found in both the La Pine block and the northern portion of the planning area. This species is closely associated with ponderosa pine or ponderosa mixed conifer stands (Csuti *et al.*, 1997). It requires large trees for foraging and snags for nesting, both characteristics of older forest stands. The woodpecker forages mostly on insects and seeds of ponderosa pine. Known occurrences of this bird have been documented around Pine Mountain, scattered BLM administered lands north of Sisters, and in the La Pine area. No surveys have been conducted for this species in the planning area; therefore the extent of the population range and size is unknown.

Black-backed and three-toed woodpeckers (Bureau Sensitive) normally occur in forests of fir, lodgepole and ponderosa pine, or mixed conifers (Csuti *et al.*, 1997). Diet consist of wood-boring beetle and their larvae, ants, spiders, and occasionally fruit, bark, seeds, and cambium. Surveys conducted by BLM personnel in the La Pine block found that the black-backed woodpeckers are common to abundant throughout the area.

Three-toed woodpeckers also occur in La Pine but in fewer numbers. These birds were found using lodgepole pine and ponderosa pine habitats. The abundance of wood-boring beetles in this area is most likely the reason these woodpeckers occur here. Potential habitat occurs in the northern planning area north of Sisters, but no surveys have been conducted. Burned areas that occur in the La Pine area provide feeding and nesting potential for three-toed and black-backed woodpeckers. Lack of fire on BLM administered lands has not allowed for habitat improvement for these species of woodpeckers.

The Lewis woodpecker (Bureau Sensitive) occurs occasionally in both the northern planning area and the La Pine block. Typical habitat is in white oak woodlands, but they are also found in ponderosa pine and cottonwood riparian woodlands in eastern Oregon (Csuti *et al.*, 1997). Their diets consist of beetles, ants, grasshoppers, flies, and spiders. Lewis woodpeckers occur around the cities of Bend, Redmond, and La Pine and along the Deschutes River corridor. No surveys have been conducted for this species; therefore the extent of the population range and size is unknown.

Yellow rail (Bureau Sensitive) occurs occasionally in the planning area. Observations have been made in the La Pine area, and in ponds and canals near Redmond. Typical habitat is freshwater marshes and wet meadows with a growth of sedges and willows,

and they utilize shallow bodies of water (Csuti *et al.*, 1997). Although this bird occurs in small numbers, pairs have been found breeding and raising young in Central Oregon (Schmidt, personal communication). No surveys have been conducted for this species; therefore the extent of the population range and size is unknown.

The Upland Sandpiper (Bureau Sensitive) has potential habitat in the La Pine block and there has been a single sighting there (Demmer, personal communication). This species occupies flooded meadows and grasslands, usually with a fringe of trees and often near high elevation sagebrush stands (Csuti *et al.*, 1997). No surveys have been conducted for this species, therefore the extent of the population range and size is unknown.

Neo-tropical Migrants

Though many of the birds previously listed are neo-tropical migrants, this discussion is on the broader species of birds that breed and raise young in the planning area in the spring and summer, then migrate south to areas in Mexico and South America during the fall and winter. These birds range from small sparrows and warblers to large woodpeckers and raptors.

Recognized as one of the most important habitats for these birds are the riparian plant communities lining the rivers, creeks, and irrigation canals. Relatively minor in terms of total acres in the planning area (only 1 percent of landscape), these areas provide breeding habitat for more species of birds than any other vegetation type in North America. Up to 75 percent of bird species breed in riparian zones (Johnson and O'Neil, 2001). Primarily in deciduous riparian woodland, abundance of breeding birds can be 10 times greater than the surrounding uplands.

As previously described in the vegetation section, the shrub zone and its associated understory vegetation provides the basic habitat needs for a vast number of wildlife species. In addition, the unique presence of the juniper woodlands, in both its natural old growth form and the younger invasive type, provides more structure to the environment, which many wildlife species find attractive.

Many species of breeding birds are dependent upon sagebrush as their primary habitat. Several passerine birds depend on shrubs for most of their life cycle. These birds nest in the fields and forage on seeds, buds, or insects in the area. Pure stands of big sagebrush occur in the Millican and Horse Ridge area, the Badlands WSA, and west of Redmond. Certain species are "sagebrush obligates", which means they depend on sagebrush for cover and forage for part or all of their life cycle. Species common in these habitats include sage, Brewer's and vesper sparrows, sage thrashers, and green-tailed towhees. Horned larks are abundant throughout the planning area in the shrub steppe zones.

The low sagebrush areas located near Prineville and the Bear Buttes area are in excellent range condition, rich in forbs and are providing important foraging areas for neo-tropical migrants.

Old-growth juniper woodlands provide valuable wildlife habitat for a diverse mix of species. As a juniper tree matures and becomes decadent, structural changes occur which result in hollow cavities and other protected niches where birds can take shelter, nest, and rear their young. Many bird species forage on juniper berries. Wildlife studies in Central Oregon have determined that old-growth juniper attracts a high diversity and abundance of wildlife, including mountain chickadees, Cassin's finches, shipping sparrows, dark-eyed juncos, house finches, mourning doves, brown headed cowbirds, ash-throated flycatchers, pinyon jays, northern flickers, and red-breasted nuthatches.

In La Pine, dead standing trees or snags are widely recognized as essential habitat for many wildlife species. Retention of snags and downed logs is needed to support cavity-

nesting species such as hairy and white headed woodpeckers, pygmy nuthatch and mountain chickadee. Grasses, forbs and shrubs typically invade in the treated forest areas. These areas provide habitat for a unique subset of wildlife species. Ongoing changes to these important plant communities, many of them caused by humans, have resulted in alterations to the habitat within the planning area. Encroachment of juniper is converting shrublands to woodlands, primarily because of changes in natural fire regimes.

The loss of vegetation reduces forage needed for wildlife and livestock, as well as habitat for ground nesting birds. Juniper dominated sites can eventually reach a point where understory vegetation is sparse and will not carry fire, and remnant grasses and forbs are not capable of repopulating the area even if the juniper were removed. Species composition has been altered in these areas throughout the planning area.

Mammals

Bats

Bats are a unique form of terrestrial animals whose consumption of a variety of insects makes them an important part of the ecosystem. There are two types of bats in Oregon, colonial type bats like the little brown bat, pallid bat, Brazilian free-tailed bat, western pipistrelle, and the solitary types, including the hoary bats, and silver-haired bats. Although, some bats use trees for roosting, most bats rely on a variety of non-tree like structures including cliffs, lava outcrops, caves, mines, bridges, and buildings (Perkins 1984).

Management of bat populations is dependent upon the availability of roosting and foraging areas (Perkins 1996). The diet of most of the bats in planning area include cutworm moths, pine bark beetles, crane flies, biting flies, and mosquitoes (Perkins, 1996). In urban areas, most bat species are found in smaller numbers and at fewer locations when compared to rural locations. This may be the result of lower insect numbers and diversity (Johnson and O'Neal 2001). Except in a number of known caves, little is known about the distribution, and species diversity of bats in the planning area.

Bats may use these habitats in several ways. The most obvious use is as a daytime resting place (roost) for these nocturnally active animals. This occurs during the warm part of the year when they are most active. Another use during this time of year is as a temporary resting place at night between foraging bouts. Such use may vary seasonally depending on the ability for year round protection from weather and predators. Sometimes, an infrequently used summer roosting site will be attractive to bats in the fall, especially at night, when they congregate for breeding. Caves provide year round habitat but are a major source for hibernaculum of dormant bats during the winter. Most species have specific habitat requirements for such use, and will use different parts of a cave depending on temperature and other factors.

In the planning area, mines, cliffs, caves, lava tubes and lava outcrops are the key habitats for a variety of bats. A mist netting survey conducted by Cross in 1976 (A Survey of Bat Populations and Their Habitat Preferences in Southern Oregon) revealed 10 species of bats found on BLM-managed lands. These species included Townsend's big-eared, big brown, silver-haired, pallid, California myotis, long-eared myotis, small-footed myotis, long-legged myotis, little brown myotis, and the yuma myotis. Perkins surveyed historical hibernacula and roost site locations in 1986 (Central Oregon Survey for Townsend's Big-Eared Bat).

Perkins (1986) pointed out that cave habitats in Oregon have not been managed specifically as habitat for bats and are subject to increasing human disturbance, which could result in a decline of available habitat for bats. Inventories to establish a complete

distribution of the Townsend's big-eared and other bat species on BLM administered lands are needed before habitat protection can be provided.

Disturbances from humans and domestic cats are major problems for bats in urban setting, because of disturbances to night roost sites, maternity sites, and hibernaculas. Bats use snags and large trees with structural defects for roosting, and typically use areas with less canopy closure and understory vegetation and are close to water.

Townsend's big-eared bat (Bureau Sensitive) has received special attention from local biologists. These bats occur in a wide variety of habitat types from arid desert shrub communities to pine forests. This species uses caves and cave-like structures, including abandoned mine shafts and tunnels for summer roosting and hibernating or wintering habitat. Caves are a critical component of this bat's habitat requirements, both as hibernaculum in the winter and as roosts for summer nursery colonies. They also require wet meadows and riparian areas where they can forage for flying insects. Habitats free from human disturbance are apparently required by this species. Surveys have been conducted in many areas within the planning boundary. More than 25 percent of the entire population of this species occurs in Central Oregon.

Eight additional bats have Bureau status including two Bureau Assessment (Brazilian Free-tailed bat) and six Bureau Tracking species (pallid and silver-haired bats, western small-footed, long-eared, long-legged and yuma myotis bats). Surveys conducted in a variety of locations in the planning area have shown some of these bats to occur. The majority of the species can be found in the area associated with caves and lava formations. The silver-haired bat is the only one that is dependant on trees for roosting (Perkins and Cross 1988). During the summer months, many of these bats can be found near persistent water sources. Surveys at Reynolds and Mayfield ponds found bats to be abundant near these sources in June through September (Perkins 1996).

Although several surveys have been conducted in the planning area, the full extent of the population range and abundance of these sensitive bat species has not been determined. Special management areas have been implemented which closed several caves to human uses and protects known populations of bats using the caves as a hibernaculum and for nursery purposes.

Mule Deer

The public has a high level of interest in mule deer for hunting and viewing (Wallmo, 1981). However, in some suburban and agricultural areas, the deer can become a pest, as it feeds in alfalfa fields, home gardens, and browses residential shrubs. Mule deer are the most numerous, adaptable, and widely distributed of the mammals such as deer, elk, and pronghorn. The majority of mule deer found on the planning resource area are part of the migratory herd that migrates through or use seasonal winter ranges. Local herds that reside year-round are usually located near agricultural areas.

Adequate food, water, and cover are essential to the survival of deer. Where food, cover, and water are close together, the range of individual deer is small. However, home ranges of resident mule deer can be large. If snow conditions make higher elevations unsuitable, deer will move to suitable range in lower elevations. In general, higher elevations are used as summer ranges and areas below 4,500 feet are considered winter range (See Map S-9: Deer Habitats). Seasonal movements and routes can be critical to maintaining migratory habitat.

The value of timberland for deer is proportional to the degree that it is broken and interspersed with openings. Deer numbers on forested lands are usually highest where openings that support low-growing palatable shrubs and forbs are scattered through the forest.

Thermal cover is critical on winter range to provide protection from wind and other adverse elements. Grassy slopes, meadows, brush fields, and other early successional stages provide the majority of deer forage. During hot summer weather thermal cover provided by late, mature, old-growth seral stage forests, and juniper/big sage/pronghorn bitterbrush shrublands provide shade and reduce heat stress on the animals.

Habitat conditions on the winter ranges within the planning area vary considerably and are site specific. It is generally recognized by wildlife biologists and range managers that it is extremely difficult to precisely measure habitat condition and productivity and even more difficult to relate these measures to herd parameters (Carpenter and Wallmo, 1981). The winter range is primarily juniper woodland and sagebrush communities with interspersed grasses. Browse is the major component of the winter diet, primarily pronghorn bitterbrush, big sagebrush, and western juniper.

While comprehensive monitoring data is lacking on browse condition and habitat condition and trend on mule deer range, it is known that the type, amount, and condition of vegetation have changed due to aggressive fire suppression. Due to fire suppression on some mule deer wintering areas, bitterbrush is old and dying and little reproduction is occurring. There is very little reproduction in the stands in the form of seedling establishment and many of the browse plants are growing out of the reach of deer. The stands are still producing some browse for wintering deer and the decaying and dead plants are providing valuable thermal and hiding cover.

A minimum cover to forage ratio of 30 to 70 was set in a Memorandum of Understanding with ODFW in 1990 to protect deer, elk, and pronghorn migratory habitat. Desired cover to forage ratios are documented at 40 to 60 by Thomas *et al.* (1979) and at 45 to 55 by Leckenby *et al.* (1982). On the mule deer migration corridor areas near La Pine State Recreation Area and south from La Pine, 51 percent and 37 percent respectively, of BLM-administered land remains as hiding cover. However, stands are deficient in meeting cover requirements because of the long distances that animals must travel between patches.

In the planning area four mule deer winter ranges have been identified by ODFW and nine winter areas that have been designated by BLM as crucial deer winter range. Mule deer winter range is established because they are unique and important to the health of the mule deer population.

Mule deer migration corridor in the La Pine management area receives use by 21,500 migrating mule deer annually (ODFW, 2001). Mule deer descend from summer range on the eastern slopes of the Cascades to their lower elevation winter ranges. Use is concentrated in the area immediately south of Lava Butte near the La Pine State Recreation Area and between La Pine and Gilchrist. Mule deer populations are presently below ODFW management objective numbers.

South of U.S. Highway 20, approximately 5,360 acres of public land lies within the boundary of the Tumalo Mule Deer Winter Range. The management objective for this area is to maintain 2,500 deer. Currently, numbers are just under the objective. Motorized vehicle use has been restricted from December 1 through March 31 annually on many roads within the winter range. Motor vehicle use disturbs wintering mule deer during this time.

The North Paulina Winter Range includes 3,750 acres of public land in the Bend-Redmond management area. The management objective for this area is to maintain 5,500 deer.

The northern portion of the Cline Buttes management area contains 9,240 acres designated as a portion of the Metolius Mule Deer Winter Range. The management objective for this area is to maintain 6,200 deer.

The Smith Rock management area is designated by ODFW as mule deer winter range. An estimated 175 mule deer use this area. However, the area is believed to be capable of supporting approximately 200 wintering mule deer (ODFW, 1994). Mule deer use a combination of both public and private lands, including the adjacent Crooked River National Grassland (CRNG) of the Ochoco National Forest.

Mule deer and elk frequent many areas around La Pine. Two major migration corridors have been identified in the La Pine area. These two corridors run for approximately 15 miles starting about 4 miles north of La Pine down to just north of Gilcrest. These corridors serve as connective habitats for the winter movement of animals traveling from the Cascade Mountains east to their winter ranges.

Harassment of deer by humans using motorized vehicles during stress periods, such as cold winters and hot summers can impact deer but it is difficult to quantify. Seasonal road closures are important to protect wintering deer from harassment and to protect wildlife habitat from trampling impacts. The road closures are in effect each year from December 1 through March 31 and have been successful in reducing harassment and poaching.

Fall transition ranges are similar in their composition of vegetation to summer ranges and include coniferous forest/shrub communities. Deer tend to remain at the highest possible elevations until forced on to winter concentration areas by snowfall.

As the human population increases in the urban interface, conflicts with wintering and resident mule deer have also increased. Developments which subdivide the land restrict passage by mule deer and Rights-of-Ways issued on public land bring humans into closer contact with wildlife. In some suburban and agricultural areas, the species can become a pest, as it feeds in alfalfa fields, home gardens, and browses residential shrubbery. In areas where public and private ownership are interspersed, BLM administered lands often serve as habitat islands for wildlife. Mule deer may forage on adjacent private alfalfa fields but retreat to BLM land for safety and cover.

Rocky Mountain Elk

Elk can be found throughout the planning area in all vegetation types. Although juniper woodlands is not considered "ideal" habitat, elk have adapted to this environment and have been rapidly expanding in this area for the past 10 to 20 years. A combination of factors has increased foraging opportunities for elk and may be contributing to their expansion in the area. The development of agriculture and small ranches adjacent to large blocks of BLM administered lands provide green forage and increase the availability of water nearly year round. Healthy populations of elk in the Ochocos have been expanding into juniper and sagebrush habitats during the past 15 years.

Additionally, habitat improvement projects on BLM administered lands have made these lands more attractive to elk. Juniper management, timber harvest, heavy fuel reductions, prescribed burns, natural wildfire, guzzler installations, native shrub and grass plantings, and increased travel management restrictions have all contributed to better habitat conditions attractive to local elk herds.

Elk are considered grazers and mainly feed on grasses. During the spring and summer, elk forage on a variety of plants including forbs and grasses, and in the winter, they use sagebrush, bitterbrush, grasses and agricultural lands.

Although elk occur throughout the planning area they are most abundant in areas east of U.S. Highway 97 and in the La Pine area. Elk tend to occur in small groups but can also be found in herds of 150 to 200 animals. Resident herds are most often found in areas around the Badlands, West Buttes, Powell Buttes, Mayfield Pond / Alfalfa area, Millican Plateau, Combs Flat / Juniper Canyon area, Ochoco Reservoir, and Prineville Reservoir.

During the winter, elk concentrate in larger herds and several wintering areas have been identified and are recognized as important by ODFW. ODFW conducts surveys twice a year, during August and early March, to determine herd composition and productivity. Elk numbers are currently at 20 percent above the management objective for this area.

In the Powell Buttes, Mayfield Pond and Alfalfa areas, disturbances such as old burns, seeded gas pipelines and military use has created increased foraging opportunities here during the past decade. Low road density, limited public access, rough road conditions, large blocks of undeveloped lands, and relatively low human disturbance are probable factors for the successful establishment of this herd.

Another large grouping of elk occurs in the northern part of the Badlands extending north through the Millican Plateau, West and Bear Buttes, and sometimes cross U.S. Highway 20 into the Horse Ridge area. These animals generally occur as two groups totaling about 250 to 300 animals. The largest numbers of animals use the Millican Plateau between Reservoir Road and Prineville. Habitat here is big sagebrush mixed in old growth and invasive juniper woodlands. Disturbances such as old burns, crested wheatgrass seedings, juniper cutting on private lands, and large powerline corridors have created increased foraging opportunities here during the past decade of elk expansion. Road densities are higher in this area than surrounding areas, but off road use is currently limited to designated roads and trails associated with the Millican OHV area. Several wildlife guzzlers occur in this area providing water year round. The area east of Millican road is designated as crucial pronghorn winter range and is used heavily during the winter.

In the Combs Flat / Juniper Canyon, Eagle Rock / Prineville Reservoir areas ownership is a mix of BLM, state and private lands. This area is mostly private ranches. The elk in this area occur in scattered groups for most of the year but congregate into agricultural fields during the summer and fall months. Only small isolated tracts of BLM administered lands occur north of Ochoco Reservoir. The habitat here is a mix of pine, juniper and big and low sagebrush.

Herd migration and intermixing opportunities are limited throughout the planning area due to increased development of private lands and the mixed ownership pattern. Elk do not tend to use distinct travel corridors but in some areas have developed trails from hiding cover to foraging areas. Increasing human development has resulted in increased density of fences on private lands designed for livestock containment or protection of structures, which forces animals around private lands.

Conflicts have started to arise with the expanding elk populations. When disturbed, elk run through fences instead of jumping over them causing property damage. Also, in the summer and fall these elk are traveling in large groups and when grazing in agricultural fields they can cause financial losses to ranchers. Elk are found using agricultural fields throughout the entire planning area.

There are approximately 200 to 250 elk using in the Clines Buttes area (west of 97 in the northern planning area). These animals often travel throughout the area between Tumalo, Cline buttes, and the Lower Bridge area. These animals use BLM and Forest Service lands for hiding, escape and resting cover, while foraging on agricultural lands. Herd sizes vary but elk generally travel in groups of 30 to 40 animals and sometimes use small local areas. Elk numbers are currently exceeding the management objectives for the area

and the number of crop damage complaints is rising in the area (Steven George, ODFW, personal communication). Seasonal use areas and important wintering areas have not been determined for these animals. Additionally, there are no distinct migration routes in this area, and the elk don't stay in one particular area for very long.

Elk numbers are increasing in the La Pine area during the past 10-12 years. The Brothers/ La Pine RMP states that in 1982 the number of elk was around 70 animals. Currently 150 to 200 elk reside in and around the La Pine and readily travel back and forth across U.S. Highway 97. Water is available but in some cases elk foraging east of 97 must cross the highway to get water from wildlife guzzlers. The Little Deschutes River, wet meadows and springs also provide year round water.

Timber cutting in the area has created ideal cover to forage ratios encouraging the elk to stay in the area. No areas have been identified as important seasonal habitats. Increasing bitterbrush, grass and forbs in the treated areas has added to the ability for elk to flourish. Elk use the same corridors as deer in areas with sufficient connective habitat.

BLM administered lands are scattered throughout the Grizzly Mountain and Grey Butte areas where elk use undisturbed private lands and the national Grasslands. Herds have been expanding in this area and crop damage is a concern.

Pronghorn

Pronghorn can be found throughout the planning area in juniper occupied shrub zones. Although juniper woodlands are not considered "ideal" habitat, like the elk, pronghorns have adapted to this environment and have been expanding in this area for the past 10-15 years. Certain types of disturbances in local areas have increased foraging opportunities for pronghorn that may be contributing to their expansion in the area. Possible features or disturbances attracting pronghorn into juniper shrublands are water availability, crested wheatgrass seedings, natural and prescribed fires, agricultural fields, forb rich disturbed areas, and large blocks of undeveloped lands.

Typical pronghorn range is an open sagebrush environment that is rich in broad-leaved herbaceous vegetation. Pronghorn forage primarily on forbs and grasses during the spring and early summer. The rest of the year, they depend upon sagebrush, bitterbrush, and grass. Low sagebrush is usually an important component of their habitat and diet but only occurs in 8 percent of the planning area.

Pronghorn are usually found in close proximity to water, which is sparsely distributed throughout the area. Climates that reflect the best habitats and productivity are in areas that receive 10-16 inches of precipitation per year (Sundstrom *et al.*, 1973). The average local precipitation levels vary across the pronghorn habitat in the planning area from 8.62 inches per year in Redmond to a high of 11.70 inches per year in Bend. Average precipitation is about 10 inches per year in the Millican and Prineville areas (State Climate Data).

In the planning area, home ranges of summer herds vary from 10 to 20 square miles and pronghorn generally form small groups of 4 to 10 animals. During winter pronghorn gather into larger herds using specific geographic areas. Several of these wintering areas have been designated as crucial winter range for pronghorn by ODFW and BLM. Winter home ranges tend to be smaller except for temporary movements. During winter, pronghorn have been seen migrating in large groups (up to 130 animals) between winter areas, but usually for short periods of time.

During the past several years, ODFW has conducted surveys during August and early March to determine herd composition and productivity. The BLM and ODFW have used this pronghorn census data and other observation data to map the potential pronghorn

habitat in the planning area, and the current known use areas. Pronghorn currently use 40 percent of their potential habitat in the planning area.

Pronghorn productivity and recruitment is low within the planning area compared to typical "open range" habitats more common to the Great Basin area to the east and south of the planning area. Common factors that can limit productivity are predation, fences, distribution of water, and low precipitation levels causing poor forage quality (Ferrel, 1952). Deming (1959) believed that climate and range conditions were possible reasons for low pronghorn productivity on marginal ranges, with noticeable increases during wetter years.

Approximately 500 pronghorn reside in the planning area and are a common sight on the landscape east of U.S. Highway 97, and occasionally occur in the La Pine area. Except during winter, pronghorn generally occur in small groups and use specific areas made up largely of BLM-administered lands. These local herds are found year round in five land areas: Redmond/Mayfield Pond/Alfalfa area; Millican Plateau; West Buttes/South Millican/Skeleton area; Combs Flat/Juniper Canyon area; and north of Ochoco Reservoir.

Pronghorn are dispersed throughout the planning area but usually occur as distinct herds using general geographic areas. The Redmond/Alfalfa herd ranges from 130 to 150 animals and uses BLM lands southeast of Redmond. There is little use north of State Highway 126 in the Redmond area but occasional movement of animals across the highway occurs.

Directly south of Redmond a herd of 50 to 60 pronghorn reside year round and occur mainly in the area between Powell Butte highway and the railroad tracks just east of U.S. Highway 97. This herd mixes with an additional 80 to 100 pronghorn that use the area extending south and east of Powell Butte highway into the Mayfield Pond and Alfalfa areas. Disturbances such as old burns and seeded gas pipelines have created increased foraging opportunities here during the past decade. Low road density, limited public access, rough road conditions, large blocks of undeveloped lands, and relatively low human disturbance are probable factors for the successful establishment of this herd.

Another large grouping of pronghorn occurs in the northern part of the Badlands extending north through the Millican Plateau up to State Highway 126 between Powell Butte and Prineville. These animals occur generally as two groups totaling about 160 animals. The largest proportion of animals uses the Millican Plateau between Reservoir Road and Prineville. Low sagebrush is a component of the Plateau that pronghorn use year round. Disturbances such as old burns, crested wheatgrass seedings, juniper cutting on private lands, and large powerline corridors have created increased foraging opportunities here during the past decade of pronghorn expansion. Road densities are higher in this area than surrounding areas, but use is currently limited to designated roads and trails associated with the Millican OHV area. Several wildlife guzzlers occur in this area providing water year round. The area east of Millican road is designated as crucial pronghorn winter range and is used heavily during winter.

West Buttes, South Millican and the Skeleton Fire area support approximately 125 pronghorn. These animals are dispersed in small groups throughout the spring, summer and fall months, but tend to congregate in a large group in South Millican during winter. Portions of their use areas have been previously designated as crucial pronghorn winter range in the Brothers/La Pine RMP.

The West Butte/Millican herd often mixes with pronghorn outside the planning area towards Brothers. The Millican and Skeleton Fire areas are open sagebrush environments that are more typical pronghorn habitat, and are connected to the Great Basin range where pronghorn occur more frequently across the landscape. Foraging opportunities

are abundant in South Millican and within the Skeleton Fire area. Water is limited in this area where pronghorn use water from guzzlers, stock troughs, snow pack, and occasional rains.

The Combs Flat/Juniper Canyon area supports a local pronghorn herd of about 75 to 100 animals. In this area, ownership is a mixture of BLM-administered, State and private lands, but it is mostly private land ranches. In this area pronghorn occur in scattered groups for most of the year but congregate into agricultural fields during the summer and fall months. Low sagebrush and early seral areas provide the main forging areas for this herd. Crucial winter range designations have been made in the Combs Flat area on both sides of the Paulina Highway.

Only small isolated tracts of BLM administered lands occur north of Ochoco Reservoir where a herd of 30 to 60 pronghorn live year round. Pete Creek, mostly in private ownership is the center of activity for this herd. The habitat here is a mixture of pine, juniper and big and low sagebrush. Little is known about the movement and local habits of these pronghorn. There are occasional sightings of pronghorn crossing U.S. Highway 26 south into the Comb Flat area, suggesting that there is some mixing of the pronghorn herds.

Herd migration and intermixing opportunities are limited throughout the planning area due to increased development of private lands and the mixed ownership pattern. Crossing structures such as roads and range fences are all common barriers to pronghorn movement, which can have a negative effect on pronghorn mobility. Increased human development has resulted in increased density of fences on private lands designed for livestock containment or protection of structures, which forces pronghorn around private lands.

Travel corridors tend to occur in condensed areas between Powell Buttes and the Millican Plateau north of Alfalfa; south of Alfalfa into the Badlands and across U.S. Highway 20 into the Horse Ridge and Skeleton Fire area. The West Butte provides a central pivot point in which pronghorn can disburse to the Millican Plateau, the Badlands, south Millican and east towards Brothers; and the Combs Flat/Juniper Canyon area to the north of Ochoco Reservoir and U.S. Highway 26.

The CRNG immediately north of the planning area towards Madras is home to 100 to 200 animals. Occasionally these animals have been seen in the Terrebonne area suggesting that these animals could intermix with the Redmond herd.

Big Horn Sheep

California big horn sheep were common throughout Central Oregon in the early 1900s when they apparently disappeared as a result of disease (from domestic sheep) and over-hunting. A healthy population once occurred in the Crooked River Gorge in the vicinity of Crooked River Ranch. Federally, the California big horns are a species of concern, but many populations in the state are thriving well in areas where they have been reintroduced.

Typical habitat for big horns is composed of sagebrush-grassland found in steep rocky mountain ranges, foothills, river valleys, canyon gorges and escarpments. These rugged areas provide escape, lambing, breeding, and foraging habitats and thermal protection. Sheep are dependant on water using any source available. Their home range varies from 7 to 15 square miles. Sheep are active throughout the year and form small dispersed groups during spring and summer and congregate in larger groups during winter. Big horn sheep's diet is primarily made up of grass especially bluebunch wheatgrass and cheatgrass. However, their diet can change seasonally, from grasses and forbs in the spring to woody shrubs in the winter.

ODFW conducted a statewide inventory of current and historic range for big horn sheep and the current habitat conditions. They prioritized suitable areas for re-introduction of big horn sheep. The Crooked River Canyon was determined to have suitable habitat for a population of approximately 75 sheep. This area is currently ranked number one for the next potential release site.

The Crooked River Canyon near Crooked River Ranch is currently occupied by feral sheep descended from mouflon, Barbados and Hawaiian sheep introduced several decades ago. Approximately 100 of these animals roam throughout Crooked River Ranch, and are loved by some residents, but a pest to others. These sheep can carry the disease *Pasteurella*, which is considered deadly if contracted in native big horn sheep. Land ownership in the area is mainly BLM-administered lands mixed with private land and CRNG lands. The feral sheep use the Crooked River Ranch area and stay mainly in the canyon on BLM-administered lands but will frequently use water and feed on private lands adjacent to the canyon.

Pacific Fisher

The fisher (Bureau Sensitive) is a medium sized carnivore found in forest lands across North America. Fisher populations are extremely low in Oregon (Aubry and Houston 1992). Typical habitat is mixed coniferous forest, and lodgepole pine forests. They prefer mature forest or late-seral forest conditions, and often occur near or along riparian areas. High canopy closure is an important characteristic of their preferred habitat.

Fishers are general predators, and will eat a variety of small to medium-sized mammals and birds. They also will readily eat carrion, fruits and mushrooms. The actual composition of the diet in fishers varies by region depending on the most abundance prey in an area. Young fishers tend to eat more fruits than adults. Snowshoe hares are a major prey item almost everywhere that fishers have been studied. Female fishers raise their young in protected den sites, usually in hollowed out trees or logs.

Ideal habitat does not occur in La Pine although potential habitat does exist. Much of the La Pine area has been set back to an early successional stage due to timber harvest and fuels reduction projects. These habitat conditions are not considered ideal for fisher and the preferred prey of fisher is not abundant in the La Pine area. The best potential habitat occurs along the Little Deschutes River.

California Wolverine

The wolverine is listed by the state as threatened by ODFW. The wolverine has been characterized as being North America's rarest and least known large carnivore. Only limited information exist on their natural history and their current population status of wolverine in Oregon is unknown.

Typical habitat includes boreal forests, but they are known to occupy a variety of habitats including sagebrush scrublands. Wolverine researchers agree, in general, that "habitat is probably best defined in terms of adequate year-round food supplies in large, sparsely inhabited wilderness areas, rather than in terms of particular types of topography or plant associations" (Kelsall 1981).

Wolverine are scavengers that are largely dependent on large mammal carrion, and usually don't kill for their own food. They depend on other predators to provide their food sources. Wolverines can move long distances and occupy large home ranges. Human presence is a deterrent to wolverine since they tend to occupy remote wilderness and other large tracts of undeveloped lands.

Populations of wolverine are not known in Oregon but they are thought to be rare throughout the state. Surveys have not been conducted on BLM lands in the planning area. Observations of wolverines have been made on private lands just of the northern planning area.

The Cascades provide more typical habitat in Oregon, but the La Pine area may provide connective habitat that allows the opportunity for wolverine to travel between the more suitable habitats of the Cascades and the Newberry Crater area.

Other mammals

Populations of the pygmy rabbit (Bureau Assessment) have been declining throughout its range over the past several decades. Potential habitat occurs in the planning area, in which typical habitat for these rabbits is described as areas supporting dense and tall clumps of basin big sagebrush, and areas with deep soils in which the pygmy rabbit use to dig their burrows (Csuti et. at, 1997). Although habitat does occur in many parts of the planning area, only unconfirmed sightings have been made in the eastern portion of the northern planning area. Only localized surveys have been conducted for this species, therefore the extent of the population range and size is unknown.

The range of the Preble's shrew (Bureau Tracking) includes the entire planning area. Typical habitat is near permanent or intermittent streams in arid or semi-arid shrub and shrub/ grassland habitats (Csuti *et al.*, 1997). There have been no studies on diet of this shrew and little is known about its range, and use of habitats. No surveys have been conducted in the planning area; therefore, the extent of the population is unknown.

Mountain lion populations have been increasing in the area for several years and interactions with human have become more frequent as urban areas grow. Mountain lions occur throughout the area and follow the movements of deer and elk which provide their main source of food. Sightings of mountain lions regularly occur in the area of Horse Ridge, Badlands WSA, Cline Buttes, Grizzly Mountain, and urban areas surrounding Bend, Alfalfa, Prineville and La Pine. Coyotes are abundant throughout the area and occur in every habitat type. Badgers, also common throughout the area, occur in much less density than coyotes but are still common in every habitat type. Badgers feed extensively on ground squirrels, and areas with high ground squirrel densities usually have a high density of badger digs.

Amphibians

Amphibians represent an important biotic component of riparian ecosystems. This group of animals includes frogs, toads and salamanders. They are important components of the riparian food chain of detritivores, herbivores, insectivores and carnivores. In some areas the largest proportion of total vertebrate biomass is made up of amphibians. Amphibians depend on water (usually for breeding), using almost all types of water sources with adjacent vegetation. Some frogs and toads spend their winter under insulating layers of leaves or woody debris, while others bury themselves in bottom of muddy lakes or ponds.

Amphibians are considered long-lived animals (life-spans up to 20 years), although most are eaten as prey within five years. Most amphibians don't breed until at least their second year of life, when they seek water sources that are warm and shallow with vegetation to support the success of egg development. Eggs are laid in clutches or singly, depending on the species, and usually on vegetation. Eggs hatch into aquatic larval stage and metamorphose into a terrestrial form (Leonard *et al.*, 1993).

Amphibians have limited mobility and dispersal capabilities, so continuous riparian zones are important pathways to colonize suitable, yet unoccupied habitats. Most

amphibians require an aquatic habitat for part of their life cycle. The exceptions to this rule are the fully terrestrial salamanders of the Plethodontidae family.

Although Central Oregon has a generally low diversity of amphibian species, there are several important species found throughout the planning area. They tend to occur in areas with water in the form of wet meadows, ponds, intermittent streams, artificial canals, and Deschutes River.

The Oregon spotted frog is a federal candidate species officially designated by the USFWS. Historically, spotted frogs were found at elevations from around 600 to 5,000 feet, and ranged from British Columbia through the Puget trough of western Washington and south through western Oregon. It was also found in the Columbia River Gorge, the Klamath Basin in Oregon and California and the Deschutes River Basin (McCallister and Leonard 1997). The latter three population centers are now all that is known to remain east of the Cascade crest, and only one population is known to remain west of the Cascade Mountains. Recent surveys indicate a disappearance level of at least 70 percent across its former range (Hayes).

Spotted frogs are most often associated with wetland plant communities dominated by sedges, rushes, and grasses in or near permanent water (Leonard *et al.*, 1993), however, McCallister and Leonard (1997) reported that they are sometimes found in riparian forests. Spotted frogs prefer relatively warm water and are sometimes found in beaver created habitat. These productive emergent wetlands provide a diverse community of invertebrates on which spotted frogs feed. They consume plant tissue, bacteria, algae, detritus, and carrion (McCallister and Leonard 1997). Spotted frogs breed in very shallow water beside ponds or streams, in flooded meadows, or in water pooled on top of flattened, dead vegetation at the edge of a pond, usually in early to mid-spring depending on the temperature.

The Deschutes National Forest and Prineville BLM have recently mapped current and historic range of spotted frogs in Central Oregon. The La Pine block of the planning area is within historic and current range for spotted frogs. Much of the occupied habitat in the planning area occurs in the Little Deschutes River and Crescent Creek.

The Cascade frog (Bureau Tracking) is found in the planning area, but only in rare occurrences, such as in the Little Deschutes River and Squaw Creek. Cascade frogs are more common in the higher elevations of the Cascade lakes and meadows. The typical habitat is large wet meadows that remain damp during the summer months, where large numbers of Cascade frogs occur in the proper habitat. The planning area contains only a few areas with suitable habitat for Cascade frogs and is limited in the quantity necessary to support large populations.

Other amphibian species that can be found in the planning area include the spadefoot toad (in the desert areas east of Bend), the western toad (Bureau Tracking) found throughout the planning area, Pacific tree frog, and the long-toed salamander. The introduced bullfrog also occurs in the planning area, and is common in irrigation ponds, canals, stock ponds and warm water rivers. Western toad populations are declining throughout their range, but this species has not yet been listed as sensitive. Future management may need to consider western toads.

Major threats to the amphibians in the planning area include conversion of wetland vegetation, changing hydrologic conditions, poor water quality, pesticides, herbicides, fertilizers, and introduction of non-native species (i.e. bullfrog).

Reptiles

Reptiles are a group of animals better known as lizards, snakes and turtles. Lizards and snakes occur throughout the planning area but are limited to few species. Turtles are not found in the planning area and there are no documented observations on BLM lands.

Many species of reptiles use riparian zones for foraging because of the high density of prey species, including insects, invertebrates, fish, amphibians, small mammals, and young birds. Snakes, such as the rubber boa, racer, ringneck snake, striped whipsnake, gopher snake, western garter snake, common garter snake, and western rattlesnake are common users of the moist habitats in the planning area. No surveys have been conducted for snakes in the planning area and only occasional sightings have been documented.

Common lizard species in the planning area include the northern sagebrush, western fence, short-horned, side-blotched, and the western skink. Less common but may occur in the planning area are the northern alligator lizard, southern alligator lizard, and the introduced plateau striped whiptail lizard (confined to the area around Cove Palisades State Park).

Typical habitat for the northern sagebrush lizard (Bureau Tracking) includes sagebrush dominated vegetation zones but can be found in open forests of juniper, ponderosa pine and lodgepole pine that has an open brushy understory (Nussbaum *et al.*, 1983). These lizards are normally ground dwellers and use rocks and crevices to escape predators. They rarely climb vegetation more than a few inches off the ground. Sagebrush lizards eat beetles, flies, butterflies, caterpillars, ants, and a wide variety of other insects (Nussbaum *et al.*, 1983).

The sagebrush lizard is found throughout the planning area but is thought to occur in higher abundance on the eastern edge of the planning area where sagebrush is a more dominant vegetation type (Demmer, personal communication). No surveys have been conducted on the sagebrush lizard or its habitats in the planning area.

Fish

The Deschutes River, Crooked River, Little Deschutes River, Crescent Creek, Squaw Creek, Reynolds Pond, and Mayfield Pond are water bodies on or partially on BLM administered lands that support fish. Currently there are no known BLM actions that are significantly affecting the fisheries resource within the planning area. Listed below are the habitat conditions, fish and population status, and management effects for those waters.

Crooked River (BLM administered lands Below Bowman Dam to Lake Billy Chinook)

The Bowman Dam to Prineville section supports a mix of native redband trout, hatchery rainbow trout, and mountain whitefish. This section also supports small numbers of small- mouth and largemouth bass, brown bullhead, and very low densities of nongame fish. Both sections of the Crooked River support several species of indigenous nongame fish including longnose and speckled dace, sculpin, northern pike minnow, chiselmouth, and bridgelip and large scale sucker. Redband trout and mountain whitefish are present in very low densities in the upstream section and abundant in the downstream section.

Fisheries habitat conditions from Bowman Dam to Prineville are mixed due to several factors. The nutrients and cold water sustain a good tailrace fishery, but nitrogen supersaturation, caused when water is spilled over the dam, a reversal of the flow regime from its natural condition, and high turbidity levels limit fisheries production.

Fisheries habitat conditions upstream from the U.S. Highway 97 bridge to Prineville is a mixture of boulder strewn riffles and long glides with a low gradient (0.2 to 1.0 percent). At river mile 28 the North Unit Irrigation District withdraws the "natural flow" an average of 70 cfs for irrigation in the Culver-Madras area. A minimum of 10 cfs is left in the river. Water quality conditions for the section of the river were reported to be moderate to severe for fish and aquatic life (ODEQ 1988).

In the lower river section below U.S. Highway 97, the remote canyon and relatively undisturbed character have resulted in a near pristine cold water fisheries environment. At U.S. Highway 97 (river mile 18), springs begin to augment flows, contributing significantly to constant water flow, cooler water temperatures, and water quality.

Deschutes River Aubrey Falls to Lake Billy Chinook

Wild fish species currently present in this section of the Deschutes River are redband trout, mountain whitefish, chiselmouth and large scale suckers found upstream to Big Falls and Steelhead Falls, respectively, and bull trout (Steelhead Falls to Lake Billy Chinook). Introduced species include brown trout, tui chub, brown bullhead, three-spine stickleback and smallmouth bass (Lake Billy Chinook to Steelhead Falls).

Fisheries habitat conditions in this section of the Deschutes River consists of a narrow canyon with many gradient drops that are barriers to fish migration. The upper end of this section experiences much lower than natural flows due to irrigation withdrawal. The lower end is supplemented by Squaw Creek and spring water that significantly increases flow and decreases water temperature. Due to the gradient of the stream and stream flow, spawning habitat is limited for a major portion of this section.

Squaw Creek

Wild fish species currently present in Squaw Creek are redband trout, mountain whitefish, long-nose dace, bridgelip and largescale sucker, sculpin, brown and brook trout (introduced), kokanee, and bull trout (lower end). There is potential for sockeye, summer steelhead, and spring chinook if fish passage plans are successful at the Pelton/Round Butte hydroelectric project.

BLM administered lands along Squaw Creek are in 5 parcels which include 1.2 miles of the creek. Fisheries habitat on the BLM administered lands above Alder Springs are generally fair to poor due to low water flows and high water temperatures. BLM administered lands below Alder Springs are generally good to excellent due to the influence of the numerous springs that supplement the stream flow with cold water.

Little Deschutes River and Crescent Creek

Fish species in the Little Deschutes River and Crescent Creek are redband trout, brown and brook trout (introduced), mountain whitefish, and sculpin. Reasons for the current low numbers of redband and brown trout are unknown at this time, but may be attributed to the high infestations of nematodes found in these fish. On BLM administered lands along these creeks, fisheries habitat conditions are in good to excellent condition with adequate instream cover, healthy riparian areas, and moderate water temperatures to support cold water fish.

Reynolds Pond

Reynolds Pond is one of two ponds in eastern Oregon where redear sunfish have been introduced. Other fish species known or suspected to occur are largemouth bass, brown bullhead, and three spine stickleback. Lack of productivity in Reynolds Pond has created a population of stunted redear sunfish that out compete the largemouth bass. Habitat conditions are poor north of the pond's small islands due to shallow water and lack of cover. This concentrates fish in the southern portion of the pond near the dike making

them vulnerable to fishing pressure. The pond was fertilized in the early to mid 1990s by ODFW to increase productivity. No studies to date have been done to determine the effectiveness of this measure.

Mayfield Pond

Mayfield Pond contains brown bullhead and largemouth bass. It appears that the population is large but the fish are small. Due to the shallowness of the pond, poor fisheries water quality, the potential is quite low to support most fish species.

Endangered Species

Currently there is only one fish on the Endangered Species list and that is bull trout, which is listed as threatened. The USFWS has proposed that some areas be designated Critical Habitat for this species, including the Crooked River from Prineville to Lake Billy Chinook and the Deschutes River below Steelhead Falls. The BLM will conference/consult with the USFWS on any plan actions that may adversely affect bull trout or their habitat.

Proposed critical habitat includes areas that provide one or more of the following functions (USFWS 2002): (1) spawning, rearing, foraging, or over-wintering habitat to support existing bull trout local populations; (2) movement corridors necessary for maintaining migratory life history forms; and/or (3) suitable and historically occupied habitat that is essential for recovering existing local populations that have declined, or that is needed to reestablish local populations required for recovery. For each stream reach, the lateral extent of critical habitat is the width of the stream channel at its bankfull elevation; adjacent floodplains are not proposed critical habitat (USFWS 2002). However, human activities that occur outside the river channels can have demonstrable effects on physical and biological features of the aquatic environment.

In November 2002, the USFWS released its draft recovery plan containing recommendations for recovering bull trout in the Columbia River Basin. The goal of the draft recovery plan for the Deschutes Recovery Unit is to ensure the long-term persistence of self-sustaining complex interacting groups of bull trout distributed throughout the species native range. The following objectives have been identified in the draft Bull Trout Recovery Plan for the Deschutes Recovery Unit:

- Maintain current distribution of bull trout within the lower Deschutes Core Area and restore distribution in previously occupied areas within the Deschutes Recovery Unit
- Maintain stable or increasing population trends of bull trout
- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies
- Conserve genetic diversity and provide opportunity for genetic exchange

Water Quantity and Quality

Natural flows to the Deschutes and Crooked River are modified by the operation of five major reservoir systems: Crane Prairie (55,300 af) and Wickiup (200,000 af), both located in the Upper Deschutes River sub-basin; Crescent Lake (91,700 af) in the Little Deschutes subbasin; and Prineville Reservoir (153,000 af) and Ochoco Reservoir (46,500 af) modify flows in the Lower Crooked River sub-basin. The magnitude and frequency of flood events on the Crooked River below Bowman Dam has been reduced since the closure (meaning completion) of the dam in 1960. Prior to the closure of Bowman Dam in 1960, average peak discharges typically ranged from 3,000-7,000 cfs. Following closure, peaks never exceed approximately 3,300 cfs, though the spring runoff in April of 1993 came close with discharge measured at 3,250 cfs (See Figure 3-1).

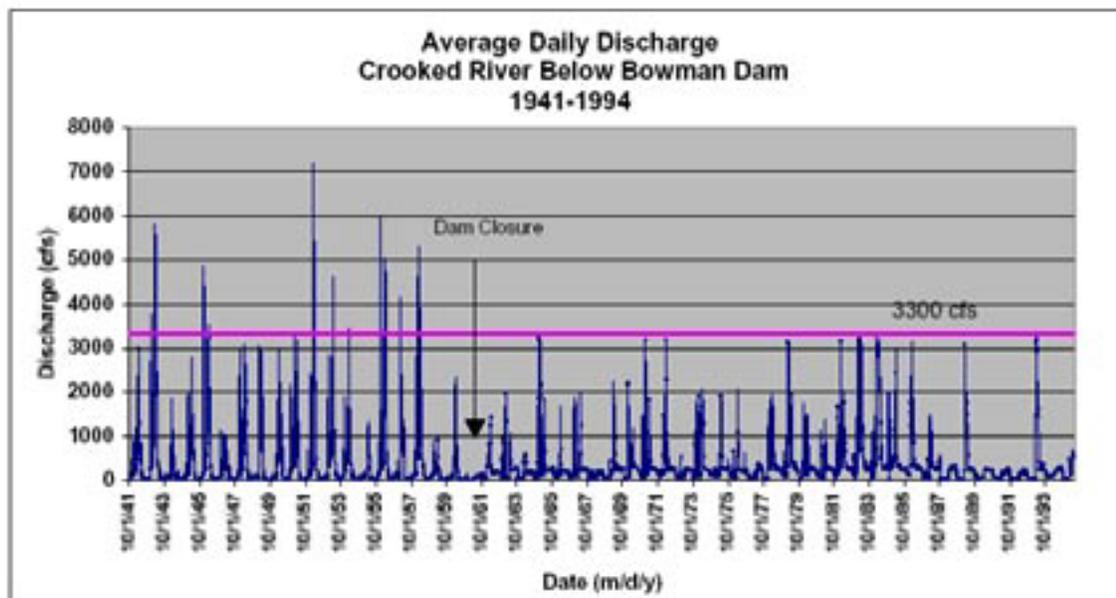


Figure 3-1. Average Daily Discharge, Crooked River below Bowman Dam.

Peak flows that used to occur on average once every 5 years (i.e., 5,000cfs) have not occurred at all since dam closure, which has likely had a significant effect on flood plain and landscape level features. In addition, capture and storage of peak streamflows have effectively increased summer low flows from pre-dam conditions, as well as decreased bankfull flows from approximately 2,200 cfs to 1,200 cfs (see Figure 3-2; and Figure 3-3). Bankfull discharge is considered to be the channel-forming or effective discharge (Leopold, 1994). A decrease in bankfull flows has likely caused the Crooked River to decrease its channel capacity through changes in channel dimension and pattern.

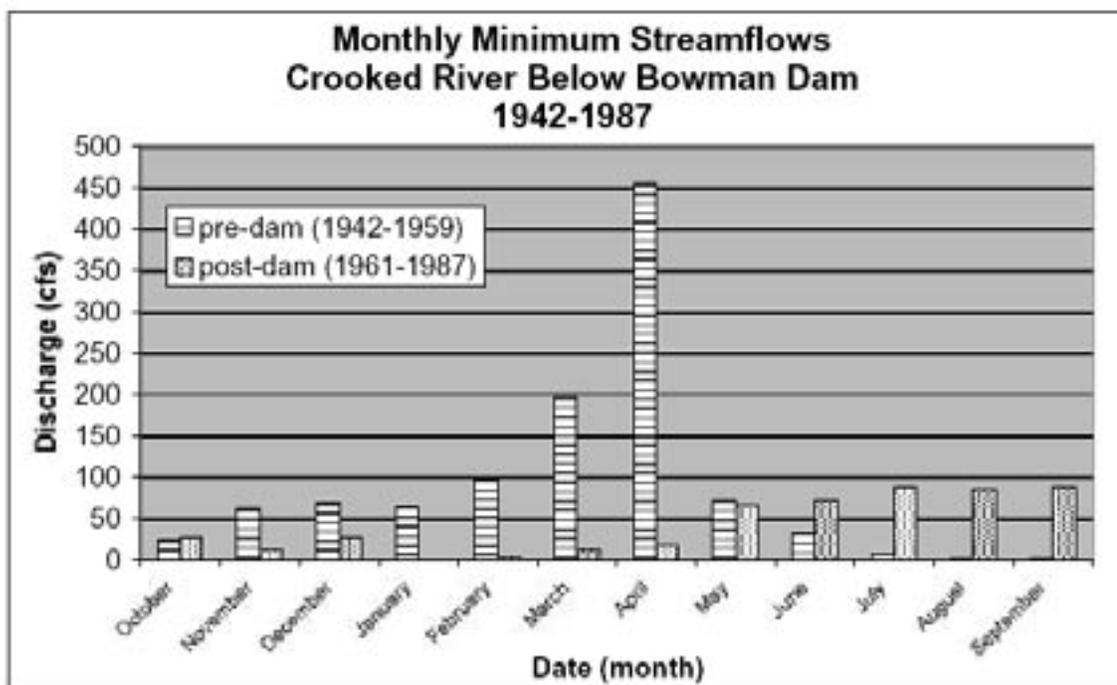


Figure 3-2. Monthly Minimum Stream Flows, Crooked River below Bowman Dam.

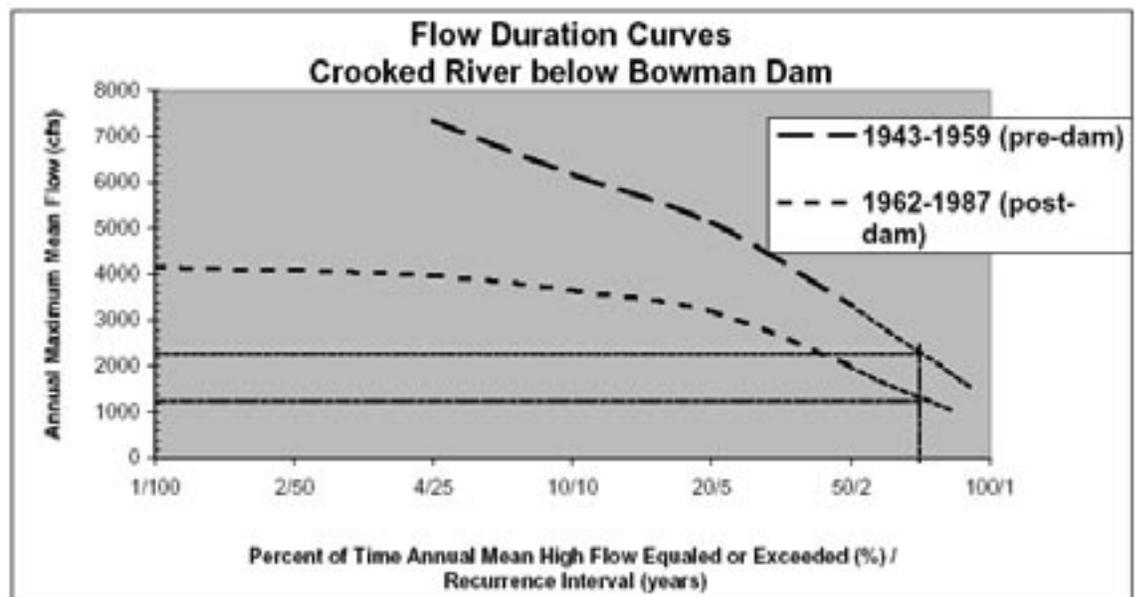


Figure 3-3. Flow Duration Curves, Crooked River below Bowman Dam.

This discharge is sufficiently frequent and sufficiently effective to be most important in forming and maintaining the channel through the erosion and deposition process. Because the Upper Deschutes River is largely spring fed, it historically has a stable hydrologic regime in which fluctuations in water flows are minimal compared to rivers dominated by surface runoff (USFS, 1996). However, streamflows on the Deschutes River have been altered since 1922 by Crane Prairie Reservoir and since 1942 by Wickiup Reservoir. In addition, six irrigation districts divert water near Bend to irrigate 115,000 acres in Jefferson, Crook, and Deschutes counties. Approximately 60 percent of the annual flow measured in the Deschutes River at Benham Falls is diverted for irrigation (Main, 2000). As a result of water storage and diversions for irrigation, the natural, stable flows of the Upper Deschutes River have been replaced by lower flows during winter storage months and higher flows during the summer irrigation season (USDA, Forest Service, 1996). Just outside and to the north of the planning area, the Pelton-Round Butte Hydroelectric Project operates a series of three dams as “modified run of the river”. Thus, average daily inflow from the Middle Deschutes, Lower Crooked, and Metolius Rivers to the Pelton-Round Butte Project is approximately equal to the average daily discharge to the Lower Deschutes River.

The planning area includes several naturally occurring ponds and numerous constructed ponds. Most of the naturally occurring ponds are seasonally flooded dry lakebeds which are located primarily in the north. Other perennial ponds are fed by irrigation canal water or are excavated material sites that have intercepted the groundwater table. Stock water ponds constructed in intermittent stream channels or within dry lakebeds acquire water during spring runoff, but are generally seasonal, drying as summer progresses. Stock ponds created in meadows are fed by groundwater and may be seasonal or perennial depending on the location. Many ponds constructed for stockwater receive water from irrigation canals.

Numerous wetland types occur within the planning area, but these areas are currently unmapped or classified electronically for most of the planning area. The USFWS has digitized various wetland types based on their national wetlands inventory (USFWS, 2001). The digital data is available for approximately the western half (47 percent) of the northern planning area. Within the area for which there is data, there are 1,011 acres of wet meadows, no acres of forested wetland, and 500 acres of shrub wetland. Wetlands

are often found along streams, old stream channels, and low lying areas. Narrow strips of wetlands exist along both sides of the Deschutes River, Crooked River, Squaw Creek, McKenzie Canyon Creek, Little Deschutes River, and Crescent Creek. Wetlands created by irrigation water, such as Mayfield and Reynolds Ponds, are human-caused and are not considered federally designated wetlands. These ponds, however, still retain riparian values. Several acres of wetlands occur adjacent to some irrigation canals due to leakage. In the La Pine area, wetlands occur in several areas. Due to the shallow water table, they are more common within the La Pine area than in the remaining planning area.

Hydrologic Units/Aquatics/Riparian

Hydrologic units can be identified according to a system developed by the USGS. This system delineates a hierarchy of geographic regions and their subparts, such as region, subregion, basin, subbasin, watershed, and subwatershed. Each hydrologic division within the hierarchy is called a "field" (see Map S-14, Sub-basins, Watersheds, and Sub-Watersheds). Surface water within the planning area flows within the Middle Columbia subregion of the Pacific Northwest region. The entire planning area is situated within the Deschutes basin. The northern portion of the planning area is located primarily within the Lower Crooked and Upper Deschutes subbasins, while the La Pine area is located mainly within the Little Deschutes sub-basin. The Interior Columbia Basin Ecosystem Management Project (ICBEMP)(USDA and USDI, 2000) has identified six subwatersheds within the planning area as Aquatic A2 subwatersheds (see Map S-14, Sub-basins, Watersheds, and Sub-Watersheds). Four are within the Upper Deschutes sub-basin, and two within the Lower Crooked sub-basin. The A2 subwatersheds are intended to provide a system of core subwatersheds that are the anchor for recovery and viability of widely distributed native fishes. These subwatersheds, located on the Lower Crooked River, Lower Deschutes River, and the Deschutes River immediately downstream of the confluence of Crescent Creek and the Little Deschutes River, were selected due to their strong populations of native redband trout.

The Interior Columbia Basin Ecosystem Management Project identified the Upper Crooked Sub-basin as a high restoration priority subbasin. In addition, the Beaver/South Fork Crooked sub-basin, which lies outside of the planning area, was also identified as a high restoration priority sub-basin. These sub-basins were chosen as high priority for restoration because they have high risk to aquatic and terrestrial species and habitats from natural disturbance, have good opportunity to reduce those risks through restoration activities, and provide employment and economic opportunities in tribal communities.

In 1991, in response to growing concern over the integrity of ecological processes in many riparian and wetland areas, the BLM established national goals and objectives for managing riparian/wetland resources (Riparian-Wetland Initiative for the 1990s). The initiative's goals are to restore and maintain existing riparian/wetland areas so that 75 percent or more are in Proper Functioning Condition (PFC) by 1997, and to provide the widest variety of habitat diversity for wildlife, fish, and watershed protection. Subsequently, the BLM established a definition of PFC and a methodology for its assessment. The BLM has adopted PFC assessment as a standard for evaluating riparian areas and uses this to supplement existing stream channel and riparian evaluations and assessments. Perennial streams and wetlands located on Public land have been assessed for condition using the PFC methodology. The PFC assessment employs a consistent approach for considering hydrology, vegetation, and erosion/deposition (soils) attributes and processes (Prichard, *et al.*, 1998). The assessment of the on-the-ground condition refers to how well the physical processes are functioning.

PFC is defined separately for lotic and lentic waters, as follows.

Lotic waters: (running water habitat, such as rivers, streams, and springs; see BLM Technical Reference 1737-9 and -15) -

Riparian/wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid flood plain development;
- Improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action;
- Develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration and temperature necessary for fish production, waterfowl breeding, and other uses; and
- Support greater biodiversity.

Lentic waters: (standing water habitat, such as lakes, ponds, seeps, bogs, and meadows; see BLM Technical Reference 1737-11 and -16) -

Lentic riparian/wetland areas are functioning properly when adequate vegetation, landform, or debris is present to:

- Dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
- Filter sediment and aid flood plain development;
- Improve flood water retention and groundwater recharge;
- Develop root masses that stabilize islands and shoreline features against cutting action;
- Restrict water percolation;
- Develop diverse ponding characteristics to provide the habitat and water depth, duration, and temperature necessary for fish production, water bird breeding, and other uses; and,
- Support greater biodiversity.

Riparian/wetland areas are classified as functional at-risk when they are in functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. These areas are further distinguished based on whether or not they demonstrate an upward, static, or downward trend.

Riparian/wetland areas are classified as nonfunctional when they clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc., as listed above. The absence of a particular physical attribute, such as a flood plain, is an indicator of nonfunctioning condition. Riparian/wetland areas are classified as being in unknown condition when the BLM lacks sufficient information to make a determination.

Because the functioning condition of riparian/wetland areas is a result of the interaction between geology, soil, water, and vegetation, the process of assessing whether or not a riparian/wetland area is functioning properly requires an interdisciplinary team, including specialists in vegetation, soils, and hydrology. The team also requires a biologist because of the fish and wildlife values associated with riparian/wetland areas. Because of unique attributes of individual riparian areas, site-specific and on-site assessments are necessary.

Riparian/wetland areas will function properly long before they achieve an advanced ecological status. The range between PFC and an area's biological potential then becomes the "decision space" for social, economic, and other resource considerations. Until PFC is attained, management priorities and options focus on reaching this threshold. Areas that meet PFC will be managed to assure a continuation of this condition, and that progress is being made toward achieving the desired condition. Table 3-8 lists the functional rating for assessed streams, ponds, and wetlands in the planning area.

Table 3-8. Proper Functioning Condition Assessment Ratings

Stream/Pond/Wetland Name	Functional Rating
Stream Name	
Deschutes River	Proper Functioning Condition
Little Deschutes	Proper Functioning Condition
McKenzie Canyon	Proper Functioning Condition
Crescent Creek	Proper Functioning Condition
Pond Name	
Mayfield Pond	Proper Functioning Condition
Reynolds Pond	Proper Functioning Condition
Wetland Name	
Linear Wetland	Functional-At-Risk, Trend Not Apparent
Jackpine Loop	Proper Functioning Condition
Hard to Find	Functional-At-Risk, Trend Not Apparent
La Pine High School	Proper Functioning Condition
Patchy	Proper Functioning Condition
La Pine Airport	Proper Functioning Condition
Round Meadow	Proper Functioning Condition
Carex Wetland	Proper Functioning Condition
Poole Allotment	Proper Functioning Condition
Pipeline Meadow-East	Functional-At-Risk, Downward Trend
Howard Lane	Proper Functioning Condition
Morgart Allotment	Functional-At-Risk, Downward Trend
Boot Creek Headwaters Spring	Functional-At-Risk, Downward Trend

Dominant Hydrologic Processes and Water Quality

Many streams within the planning area are designated as water quality limited according to the Oregon Department of Environmental Quality. Section 303(d) of the Clean Water Act requires that each state develop a list of waterbodies that do not meet water quality standards, (see Map S-14, Sub-basins, Watersheds and 303(d) Listed Streams, and Appendix E, 303(d) Listed Streams by Sub-basin) and delineate the stream segments and listed criteria for all streams within the vicinity of the planning area.

Within the planning area, most of the Deschutes River, Squaw Creek and the majority of the Crooked River are listed for stream temperature, most likely due to reduced streamflows from irrigation withdrawals or regulation from dams. Within the Upper Deschutes/Lower Crooked area, there are approximately 720 miles of canals and laterals that divert water from the Deschutes and Crooked Rivers to more than 160,000 acres of irrigated lands in the basin (Gannett, *et al.*, 2001). Water quality data collected by the DEQ on the Deschutes River at Lower Bridge has documented relatively warm stream temperatures and high levels of biochemical oxygen demand and total phosphates (Cude, 1999). As a result, eutrophication is active from April until October, as evidenced by high pH and dissolved oxygen values. Eutrophication is the process of enrichment of water with nutrients, mainly nitrogen and phosphorous compounds, which results in excessive growth of algae and nuisance aquatic plants. It increases the amount of organic matter in the water and also increases pollution as this matter grows and then

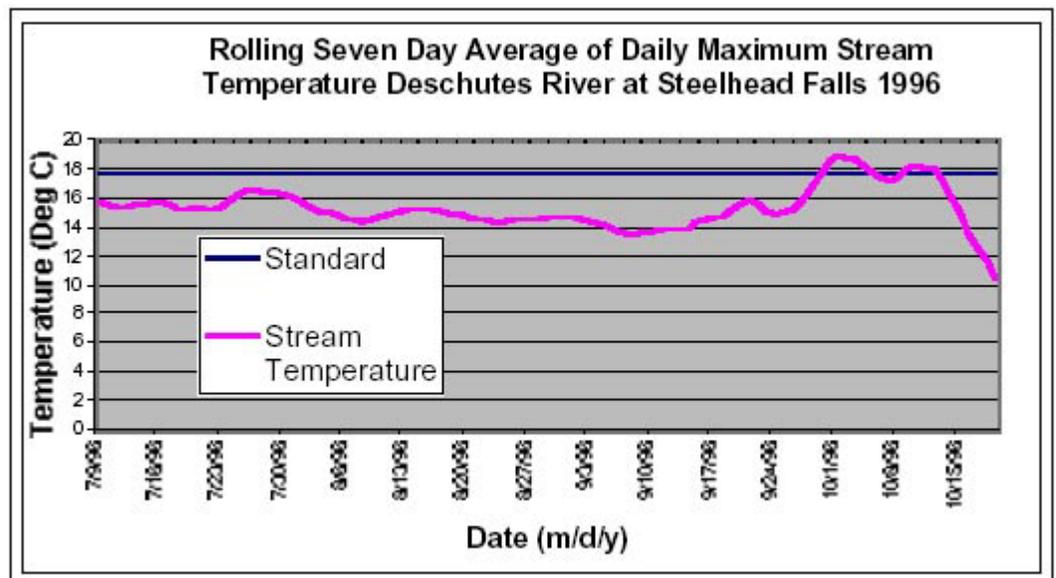


Figure 3-4. Rolling Seven Day Average of Daily Maximum Stream Temperatures, Deschutes River at Steelhead Falls.

decays. However, over the ten year period from 1990-1999, the Lower Bridge site showed a significant improvement in water quality. On the average, the DEQ considers water quality at the Lower Bridge site to be fair in the summer and good in the fall, winter, and spring (Cude, 1999 Annual Report).

Figure 3-4 shows stream temperature data collected by the BLM at Steelhead Falls, located approximately 6 miles downstream from the Lower Bridge site. Data was collected in 1996 and shows the seven-day moving average of the daily maximum in relation to the state standard, which is 17.8°C (64°F). It appears that stream temperatures do not meet the state standard late in the season, when stream-flows are at their lowest and supplemental flows from reservoir releases for irrigation purposes are reduced.

One DEQ monitoring station on the Crooked River at Lone Pine indicates eutrophication is occurring in the river as evidenced by high pH and dissolved oxygen supersaturation. At this site, high water temperatures were detected during the summer months, and high concentrations of biochemical oxygen demand, total phosphates, and total solids were detected throughout the year. Spikes in total phosphate levels, related to heavy precipitation, were also seen at this site. Results of monitoring of the Crooked River at Lone Pine Road indicate elevated levels of fecal coliforms and nitrate and ammonia nitrogen at various times throughout the year. The reduction in water quality at this site is due to land usage including irrigated agriculture that supports confined animal feeding operations (CAFOs) and grazing. These additional impacts lead to a general depression in water quality relative to upstream conditions. However, over the ten year period from 1990-1999, the Lone Pine site showed a significant improvement in water quality. On the average, the DEQ considers water quality of the Crooked River at the Lone Pine site to be poor.

Figure 3-5 depicts stream temperature of the Crooked River approximately four miles below Bowman Dam for the period 1997-1999. Due to the release of cool water from the bottom of Prineville Reservoir, stream temperatures for the three years depicted generally meet the state standard of 17.8°C (64°F). The exception is about a 1-3 day window in 1998 where the standard was exceeded. Downstream from the temperature station, stream temperatures quickly increase due to normal stream heating processes and altered stream channel and riparian vegetation conditions.

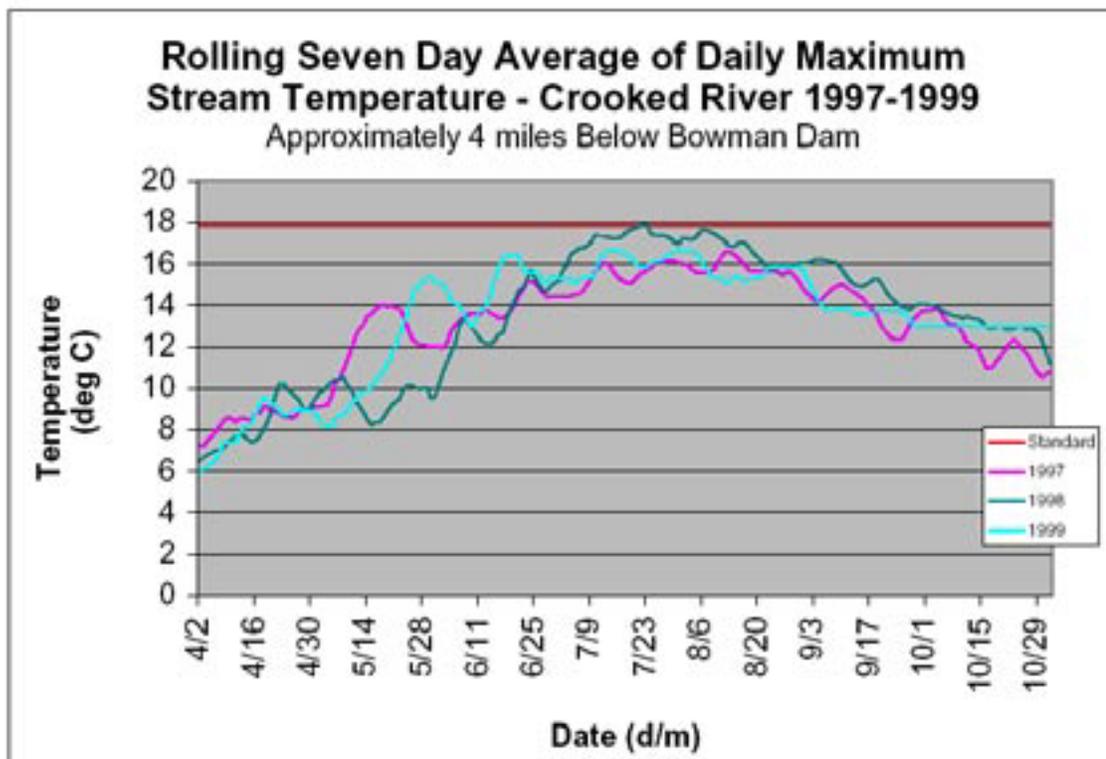


Figure 3-5. Rolling Seven Day Average of Daily Maximum Stream Temperatures, Crooked River.

Within the Little Deschutes sub-basin, stream temperature is the only listed parameter for the Little Deschutes River, Crescent Creek, and Paulina Creek, with the exception that the Little Deschutes River is also listed for dissolved oxygen. However, listings in 2002 will likely include dissolved oxygen as a limiting criterion for the Little Deschutes River (B. Lamb, personal communication). Stream temperature is also a listed criterion for many other streams within the planning area.

Residents of Central Oregon depend on a large supply of groundwater and surface water for human consumption, fish and wildlife habitat, agriculture, industry, and commercial uses. Demands on water resources have increased in Oregon over the past few decades. Although most early water rights were established for irrigation and mining, today's demand includes municipal water supplies, commercial and industrial supplies, and maintenance of adequate stream-flows for fish, recreation, and water quality. Groundwater plays a key role in providing an adequate domestic water supply for the planning area. Virtually all drinking water within the planning area depends on groundwater. Public supply pumpage is concentrated primarily in urban and major resort areas, with scattered, smaller systems in rural areas. In addition, many residents are not connected to public water supplies and rely on private domestic wells (Gannett, *et al.*, 2001). The only watersheds to provide surface water for drinking purposes are Bridge Creek within the Tumalo watershed, which provides drinking water to the city of Bend, and Pole and Upper Squaw Creeks in the Whychus watershed, which provides drinking water to Sisters. There are also thousands of groundwater protection zones currently being delineated for drinking water by the Oregon Health Department. One potable water well located on public land is at Chimney Rock campground. This well is monitored to ensure the State of Oregon's requirements for public water systems are met (OAR 333).

Although there are several developed springs and small reservoirs on BLM-administered lands, currently, there are only two reservoirs with appropriate water rights. All of these water sources were developed primarily for the purpose of domestic livestock watering, with wildlife considered as a secondary benefit.

The principal source of recharge to the groundwater aquifer is precipitation that occurs in the Cascade Range. Approximately 40 to 70 percent of the precipitation in the Cascades infiltrates to the groundwater system and moves toward discharge areas near the confluence of the Deschutes, Crooked, and Metolius Rivers near Lake Billy Chinook (Gannett, *et al.*, 2001). Virtually all of the regional groundwater in the Upper Deschutes discharges to the surface in these streams in the vicinity of Lake Billy Chinook. East of the Cascade Range, within the planning area, there is little or no ground-water recharge from precipitation. However, the groundwater is artificially recharged by leaking irrigation canals. In 1994, approximately 46 percent of the total amount of water diverted for irrigation (1,060 ft³/s), leaked through the canal bottoms to become ground water (Gannett, *et al.*, 2001).

Since surface water resources are fully appropriated within the Upper Deschutes region, groundwater must supply the water needs for all new development in the planning area (USGS, 1999). Because the ground-water system and streams are hydraulically connected, use of ground water can reduce stream-flow.

The La Pine area is characterized by shallow ground-water and rapidly draining soils. Thousands of lots one-half to one acre in size have on-site septic systems and domestic wells. Between 1982 and 1995, the DEQ has detected nitrate levels as high as 41 mg/l. The US Environmental Protection Agency (EPA) maximum contaminant level for nitrate in public water supplies is 10 mg/l. Consequently, the Deschutes County Environmental Health Division, the DEQ, and the USGS, working in cooperation, are addressing the issue of ground-water contamination from on-site systems in the La Pine region.

Soils

In general, there are five geographic areas within the planning area. The soils in these areas are described below and include 21 general mapping units documented in Upper Deschutes Soil Survey (NRCS, 1992), Crook County Soil Survey, Prineville Soil Survey, and the Brothers Soil Survey.

The La Pine area has cold (cryic soils) very deep (> 60 inches) somewhat excessively drained, loamy coarse sands to a gravelly (pumice) loamy coarse sand formed in ash and pumice over buried alluvial gravelly sandy loam and loam soils.

The Millican area has cool (frigid soils) very deep and deep (> 40 inches) to moderately deep (20 - 40 inches) excessively well to well drained loamy coarse sands, sandy loams formed in ash and pumice over buried alluvial and lacustrine gravelly sandy loam and loam soils, or basalt bedrock in basins and lava plains. In the uplands a moderately deep and shallow (10 - 20 inches) stony sandy loam and loam over varied (skeletal) subsoils, but mainly sandy loams to clay loams over rhyolite and basalt bedrock occurs on the steeper hills, buttes, and mountains.

The Bend, Redmond, Sisters and Culver area has warmer (mesic soils) moderately deep to shallow, well drained loamy coarse sands (southern portion) and sandy loams (northern portion) soils formed in ash and pumice over recent lava (blisters) flows and gravelly loams to sandy loam (Sisters area) soils formed in ash and pumice over alluvial glacial outwash. The very steep canyons of the lower Deschutes and lower Crooked River are exposed rock outcrops with mostly shallow skeletal loams and sandy loams. There are a few isolated upland buttes that have similar soils as those described in the uplands in the Millican area (Cline Buttes, Smith Rock area).

The Powell Buttes area has cool (uplands and north slopes) and warmer (alluvial terraces, fans, lava plains and southern slopes) moderately deep to shallow, non-skeletal and stony or skeletal, well drained sandy loams and gravelly loams over basalt and rhyolite bedrock or duripans (hardpans). The uplands are similar to those described above.

The Prineville area has a mix of low alluvial terraces and floodplains and the uplands to the north, east and south. The low terraces and floodplains are mainly deep to moderately deep well drained, alluvial stratified (gravels) of sandy loams, loams, silty loams and clay loams that are mostly irrigated farmlands. The uplands to the north are the shallow to moderately deep and deep loam well drained and clay loam soils of the rolling foothills to Ochoco National Forest and Grizzly Mountain. The uplands to the south are a mix of deep to shallow well drained gravelly, sandy loams, loams and clay loam soils over clay and skeletal clay loam and loam subsoils. These soils formed in colluvium and residuum from basalt, igneous and sedimentary bedrock with less ash deposition.

Continued development within the planning area may lead to activities that disturb soil surfaces by direct displacement, compaction, removal of protective vegetation and soil biological crusts resulting in increased susceptibility to wind and water erosion. Indiscriminate vehicle use off existing roads is the primary activity of concern.

Prime Farm Land

There are 33 detailed soil mapping units identified as Prime Farm Land in the Upper Deschutes Soil Survey and 27 (draft) detailed soil mapping units are identified as Prime Farm Land in the Crook County Soil Survey (draft) area. These units are usually identified with deeper alluvial soils of stream terraces, flood plains (if drained or protected from flooding) and/or irrigated lands with few restrictions to tillage practices and less than 8 percent slopes. In the urban interface areas almost all of this type of acreage are irrigated lands. In the Upper Deschutes Soil Survey about 10 percent or 168,000 acres of the lands would meet the definition of prime farmland if an adequate and dependable supply of irrigation water were available.

Biological Soil Crusts

Biological soil crusts consist of bacteria, microfungi, cyanobacteria (blue-green algae), green algae, bryophytes (short and tall mosses and liverworts) and lichens. The lichens have a symbiotic interrelationship between fungus and algae or cyanobacterium. The main components of these biological crusts are photosynthetic and most are capable of drying out and suspending respiration without negative consequences. They are also capable of almost immediately starting up again upon receiving moisture. They play important roles in soil ecosystem processes (Eldridge and Rosentreter, 1998) including soil stability and soil moisture (Belnap *et al.*, 2001). When mosses and lichens get buried they die (Belnap *et al.*, 2001). When biological soil crusts are disturbed, nutrient cycling especially nitrogen, can result in reductions in soil nitrogen or fixation in the range of 75 to 95 percent on sandy soils. This is a result in changes to species composition, burial, and reduced input and elevated losses (Belnap *et al.*, 2001). They also have direct multi-interactions with vascular plants in cool deserts (frost-heaving) like those in the planning area by "increased perennial vascular seed entrapment, germination, establishment, survival, biomass, and nutritional status" (Belnap and Harper, 1995).

Fire in pre-historic times was the largest agent of change in the sagebrush-steppe and juniper ecosystems outside of extended droughts in the planning area. Generally, the larger (less mosaic) and the more severe the fire the longer it took to re-colonize the area from the adjacent non-burn areas acting as propagules/seed/spore reservoirs. Intense fires today, natural or prescribed, can lead to the dominance of non-native species,

particularly if in the presence of non-native exotics such as cheatgrass. This increase in non-native species composition can lead to increased wildland fire frequency causing a corresponding decrease in species diversity of the soil organic crusts down to just a few species of mosses and cyanobacteria (Kaltenecker, 1997 and Belnap *et al.*, 2001).

In most of the western portion of the planning area the soils are sandy loams or loamy coarse sands, with both stony and non-stony surfaces. Some of the best and most complex biological crusts occur on the stony sandy loams and stony loam surface soils on the northern slopes (frost heaving) or in nearly all cases on the northern aspects of juniper, mountain big sagebrush and bunch grasses and amongst the blister rock outcrops. Usually the least common sites for biological crusts development are those deeper loamy sand or sandy loam areas in the lower depressional areas away from the stony or rocky blister areas. These are the mesic (warmer), deeper loamy coarse sands of the Gosney-Deskamp-Rock Outcrop or the Deschutes -Stukel Rock Outcrop mapping unit that are more susceptible to wind erosion. In the Millican area the soil unit most susceptible to wind erosion is the Stookmoor- Gardone-Borobey mapping unit and to a lesser degree Dester-Beden-Stookmoor mapping units. These are the frigid (cool) sandy loam soils at 4,000 feet or higher elevations with usually mountain big or low sagebrush / Idaho Fescue dominated rangeland communities. The stony clay and clay loam soils, more common in the uplands on the east side of the planning area or the areas north and southeast of Prineville Reservoir and north of Prineville itself, also tend to have increased biological soil crust diversity. This diversity is the result of both increased levels of precipitation at higher (4,000 to 6,000 feet) elevations and frigid (cooler) soil temperatures and where both mountain big sagebrush bunch grass and low sagebrush / Idaho fescue plant communities are dominant.

Fire/Fuels Management

Fire and Fuels Management includes two related concerns: 1) hazardous fuels in the wildland urban interface, and 2) fuels management in fire adapted ecosystems.

The wildland urban interface, that zone where the wildlands meet human communities, describes 21 percent of BLM administered lands within the planning area. There are 13 communities described as a “community at risk” from wildland fire within the planning area, and several others beyond the boundary but directly adjacent. BLM holdings represent 39 percent of the lands within the Wildland Urban Interface (WUI) zone, with private holdings accounting for the remaining 61 percent of that area. The Brothers/La Pine RMP described categories for fire’s role. The only change proposed to those existing categories described in Brothers/La Pine RMP is the inclusion of the mapped WUI, with those lands classified as Class 6, high value.

The role of fire in the wildlands beyond the WUI zone is described in terms of fire regimes and condition classes. On BLM administered lands with the planning area boundary, 74 percent of all acres have missed at least one expected fire cycle, but human caused disturbances have been pervasive.

Hazardous Fuels in the Wildland Urban Interface

As part of the population growth in Central Oregon, new neighborhoods and individual homes are being built in lands previously considered wild. That area where the edge of urban development meets the edge of federally managed wildlands is termed the wildland urban interface. This tremendous expansion of the wildland urban interface increases the problem of communities at risk from wildland fire dramatically, as well as adding a source of ignitions that can move onto the BLM administered lands.

Several large fires in the past 20 years have threatened or destroyed homes in or near the planning area. Most notably, the Awbrey Hall Fire of 1990 and the Skeleton Fire of 1996 were both fast moving, destructive wildfires.

A list of communities with the highest risk of negative wildland fire impacts has been compiled for the entire United States at the time the National Fire Plan of 2000 was developed. The listing was not complete and several other communities have been added by local fire management officers to present a more thorough inventory of communities in the WUI. There are thirteen communities within the planning area on this list (Table 3-9).

In addition to these communities inside the planning area boundary, there are several Communities directly adjacent to the area, including Bend, Sisters, Cloverdale, and Sunriver.

Within the planning area, the WUI is described as 1.5 miles from the community boundary in forested ecosystems, and 0.5 miles from the boundary in rangeland and woodland ecosystems. While the amount of area that may actually be considered for hazardous fuels management will vary according to individual project and site specific wildland fire potential, this zone is considered a starting point for analysis. Within the planning area, 21 percent of all BLM acres are within a WUI zone as described in Table 3-10. About 61 percent of the WUI zone is owned privately, and 39 percent of the entire WUI zone is managed by BLM.

Central Oregon, with its combination of hot, dry summer weather and routine lightning storms has frequent wildfire ignitions. These lightning fires combined with native

Table 3-9. Communities at Risk from Wildland Fire within the Planning Area

Community	County	Community	County
Cliffs Ranch	Klamath	Prineville	Crook
Crooked River Ranch	Jefferson	Pronghorn	Deschutes
Grizzly	Crook	Redmond	Deschutes
Jasper Point Resort	Crook	Sunforest	Klamath
La Pine	Deschutes	Terrebonne	Deschutes
Little River	Klamath	Tumalo	Deschutes

Table 3-10. Wildland Urban Interface Acres by Ownership and Vegetation Type

WUI Zone Width	Acres by Ownership			Total
	BLM	Other	Private	
Forest WUI Acres, 1.5 mile	44,701	119	31,185	76,005
Range WUI Acres, 0.5 mile	39,027	1,558	95,917	136,502
Total	83,727	1,678	127,102	212,507

burning practices to regulate vegetative growth, biomass accumulation, and species composition, and were extremely important in maintaining well-functioning ecosystems. With the human inhabitants in the area today, those frequent ignitions have become a threat where they occur near the population centers.

In the past 20 years, there have been 747 fires involving BLM fire suppression within the planning area. Of those fires, 23 percent were of human origin, and 77 percent were lightning caused. Considering the two planning area blocks separately, there are some interesting differences. In the La Pine area, which has the most fuel and possibly the greatest potential for wildfire involving homes in the wildland urban interface, there have been 62 fires within the planning area boundary in that 20 year period. Only 12 of these were lightning fires, the other 50 were human caused. The largest fire within the planning area in the past 20 years was the 120 acre Pine Forest Fire in the spring of 2001. Many large fires have burned near La Pine on private or National Forest lands, and there is a potential for large fire initiation and spread in this area. The larger northern portion of the planning area has had 685 fires in the past 20 years. Only 19 percent of those were human caused, the other 81 percent caused by lightning.

Fuels Management in Fire Adapted Ecosystems

Ecosystems within the planning area have adapted to periodic disturbance from fire. Over time, vegetative communities have evolved to survive fire. Sustainable ecosystems have adapted to the inherent frequency, size and severity of the natural disturbance cycle. In the planning area, 26 percent of the acres managed by BLM are functioning as expected in terms vegetative structure and fuel loading. The other 74 percent (294,000 acres) of the BLM administered lands within the planning area have missed one or two expected fire cycles due to suppression and other vegetation management choices in past decades and some acres may have missed three or more expected cycles. The vegetative response to this disturbance deficit is a change in species presence or prominence, and fuel quantity and continuity. The Brothers/La Pine RMP recognized fire's role in the ecosystem and established risk classes that provided guidance for fire suppression and fuels treatments.

Other disturbances, such as grazing, road building, timber harvest, and the introduction of weed species have also changed fuels conditions. Some of those changes may be short term, and others more permanent. Those changes have led to an altered fire environment. How much current conditions differ from conditions that would be found in an unmanaged ecosystem is not known.

Decisions on vegetation management for ecosystem health must include a measure of sustainability, including number of disturbance cycles missed and the departure from species composition, structure, and fuel loading found under a properly functioning disturbance regime.

Special Management Areas

Wilderness Study Areas

The Statewide Oregon Wilderness EIS was completed in December 1989, and was followed by the record of decision in October, 1991 titled "Wilderness Study Report." Two Wilderness Study Areas (Badlands WSA and Steelhead Falls WSA) were evaluated, with nearly the entire Badlands WSA being recommended suitable for wilderness designation. Steelhead Falls WSA was not recommended suitable for wilderness designation. Horse Ridge ACEC/ RNA (see ACEC section, below) is also known as the Western Juniper Instant Study Area (ISA) which was evaluated for wilderness designation in Volume II of the Wilderness Study Report. This ISA was determined to

not have wilderness characteristics and was not recommended suitable for designation. However, all three areas are managed under BLM's Interim Guidelines for Lands Under Wilderness Review (BLM, 1995), better known as the Interim Management Policy (IMP), until Congress acts on Oregon BLM's wilderness recommendations. Only Congress can designate Wilderness or release areas from further wilderness review. The total acreage and amount recommended suitable and unsuitable for designation for each WSA or ISA is shown in Table 3-11, Wilderness Study Area acreage, and on Map 7, Special Management Areas.

Motor vehicle access is extremely limited in the Steelhead Falls WSA, due to steep topography of the Deschutes River Canyon and surrounding private lands that block most access. Folley Waters Road and BLM administered lands adjacent to the WSA were closed to vehicle use through an EA in 1997. Several other locations adjacent to the WSA receive occasional unauthorized vehicle use, including off Canary Drive, River Place and Scout Camp Trail.

As the adjacent community of Crooked River Ranch grows, the use on trails within the WSA has increased. Numerous, braided, user created trails exist in the WSA. The trails are rarely maintained, which has resulted in erosion and some public safety issues.

The Western Juniper ISA is managed as the Horse Ridge ACEC/RNA under a management plan implemented in 1996 (see ACECs, below). Management of this area as an ACEC/RNA protects wilderness values since access is limited to foot traffic and any activities that would modify or impact the vegetation communities are prohibited. There is concern as mountain bike use increases in the general area and intrusions into the ISA by trail users have been noted. Field monitoring of this ISA occurs three to four times annually, for both ISA and ACEC purposes.

Wild and Scenic Rivers

Four segments of National Wild and Scenic Rivers include BLM administered lands within the planning area. Management policy for BLM administered lands within these corridors are covered under various Wild and Scenic River Management Plans adopted during the mid-1990s. The BLM administered lands within the Wild and Scenic River corridors are not being assessed in the Upper Deschutes RMP Amendment.

The Wild and Scenic Rivers which include BLM administered lands include the Lower Crooked (Chimney Rock Segment) Wild and Scenic River, the Lower Crooked Wild and Scenic River, the Middle Deschutes Wild and Scenic River, and the Upper Deschutes Wild

Table 3-11. Wilderness Study Area (WSA) Acreage

Wilderness Study Area	Acreage Recommended Suitable	Acreage Not Recommended	Total Acreage
Badlands WSA	32,030	191	32,221
Steelhead Falls WSA	0	3,240	3,240
Western Juniper WSA	0	600	600
Total	32,030	4,031	36,061

and Scenic River. The acreage of these Wild and Scenic River corridors is described in Table 3-12.

The Upper Deschutes River features primarily flatwater boating with limited whitewater and excellent trout fishing opportunities. The Upper Deschutes Wild and Scenic stretch is 54.4 miles, with 11 miles classified as “Scenic”, and 43.4 miles classified as “Recreation”.

The Middle Deschutes Wild and Scenic River is a 20 mile stretch of the river from Odin Falls downstream to the upper end of Lake Billy Chinook. This stretch of river goes through several isolated BLM parcels at the upstream (southern) end of the corridor, then through the Steamboat Rock parcel of BLM administered lands west of Terrebonne, and through BLM and Crooked River National Grasslands BLM administered lands along the western edge of the Crooked River Ranch community.

There are several access points along this stretch of river, however, most access is blocked by private development. The greatest concentration of access points to the river corridor occur from local roads within Crooked River Ranch, although the dense, convoluted road network at the Ranch makes it difficult for visitors to find these access points. None of these access points except for Steelhead Falls Campground are signed or developed. Recreational uses identified in the W&S River plan (BLM, December, 1992, BLM-OR-PT-93-11-1792) include fishing, hiking, backpacking, camping, wildlife and nature observation, expert kayaking and rafting, picnicking, swimming, hunting, and photography. Based on regional and national significance, recreation opportunities available within the river corridor were identified as being outstandingly remarkable.

The Lower Crooked Wild and Scenic River corridor is located on the east side of Crooked River Ranch, and is a 9.8 mile stretch of the river. The same outstandingly remarkable recreation opportunities are identified for this Wild and Scenic River stretch as the Middle Deschutes Wild and Scenic River. Access is almost impossible to this stretch of river, which is bordered mostly by private land and confined by steep canyon walls. Several hazardous trails do provide access to the river, and are generally used only by anglers. The one safe access trail (Hollywood Road) has been closed for several years after a private landowner installed a locked gate at their property line.

The Lower Crooked (Chimney Rock Segment) Wild and Scenic River is an 8-mile river segment located between Bowman Dam (Prineville Reservoir) and the city of Prineville. Unlike the other two Wild and Scenic River segments in the planning area, the Chimney Rock Segment has a road alongside the river for the entire 8-mile stretch. Thus, this

Table 3-12. Wild and Scenic River Acreage by Ownership

Wild and Scenic River	County	DNF	BLM	CRNG	BOR	State	Private
Lower Crooked WSR (Chimney Rock Segment)	Crook	0	2,300	0	220	0	40
Middle Deschutes and Lower Crooked WSR	Deschutes and Jefferson	0	3,645	2,535	0	210	2,915
Upper Deschutes WSR	Deschutes	11,462	79	0	0	1,474*	3,939

*Includes 1,144 acres of land leased by the BLM to the State of Oregon for the La Pine State Park

SOURCE: Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Plan (1996); Middle Deschutes/Lower Crooked River Wild and Scenic Rivers Management Plan (BLM, 1992); Lower Crooked River Chimney Rock Segment Management Plan and Environmental Assessment (BLM, 1992).

river segment has numerous access points, including 10 campgrounds and 2 day use sites. Outstandingly remarkable values identified for this river segment are similar to those identified for the Middle Deschutes and Lower Crooked Wild and Scenic Rivers, although the Chimney Rock segment also lists vehicle touring. The river corridor is popular for fly-fishing, sightseeing, camping, and to a lesser extent, kayaking. Lower Crooked (Chimney Rock Segment) recent improvements to Reservoir Road and planned paving of Millican Road may lead to increased visitation to the Wild and Scenic River from the Bend area. These road improvements may increase the use of this river corridor for auto touring and bicycling.

Areas of Critical Environmental Concern

Area of Critical Environmental Concern, or ACEC, is a special designation created by Congress in the 1976 Federal Land Policy and Management Act (FLPMA). Under FLPMA, the Secretary of the Interior and the BLM were directed to designate as ACECs: “. . . areas within the BLM administered lands where special management attention is required . . . to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards.” There are six ACECs within the planning area (6.5% of BLM administered lands), all of which were designated upon publication of the Brothers/La Pine RMP/ROD in 1989. Table 3-13 lists these areas, their acreage, and the reasons for their designation. Existing ACECs are also shown on Map 7, Special Management Areas.

Badlands ACEC includes 16,684 acres in the heart of the Badlands Wilderness Study Area (WSA), just east of Bend. The area was designated for its primitive recreation opportunities, geologic formations, a prehistoric canyon and pictographs and mature juniper woodland. The area was dual-designated within the WSA to provide long-term management of the WSA core in the event the WSA designation was lifted without wilderness designation.

Table 3-13. Existing Areas of Critical Environmental Concern (ACEC) Within the Planning Area.

ACEC Name	Acres	Special Value
Badlands	16,860	Primitive recreation, juniper woodlands, geology, and pictographs.
Horse Ridge	600	Cell #3 – western juniper/big sagebrush/threadleaf sedge community.
Lower Crooked River	2,830	Recreation, scenery, and fisheries.
Peck’s Milkvetch	3,902	Special status plant (Peck’s Milkvetch) and critical deer winter range.
Powell Butte	520	Three RNA terrestrial ecosystem cells: Cell #4 – western juniper/big sagebrush/bluebunch wheatgrass; Cell #5 western juniper/big sagebrush/Idaho fescue; and Cell #8 – western juniper/bluebunch wheatgrass.
Wagon Road	160	Remaining segments of historical Huntington Road.
Total BLM Acres	24,872	

¹High Lava Plains Province as published in the Oregon Natural Heritage Plan (NHAC, 1998)

Management direction for the ACEC is consistent with WSA management and prohibits firewood harvest, vehicle use off designated routes, new rights-of-way authorizations and vegetation manipulation. Other uses and management must be consistent with the values for which the area was designated.

Present concerns mainly relate to vehicle use off designated routes and unauthorized motorized vehicle use during seasonal route closure periods (December 1 to April 30). Management actions have included signing, blocking of vehicle routes and increased law enforcement surveillance.

Horse Ridge ACEC has the additional designation of a Research Natural Area (RNA), which occurred in 1967. The National Park Service designated this 609 acre area as a National Natural Landmark (NNL) in 1968. Its 609 acres, on the predominately northeast slope of Horse Ridge, represent cell #3 for the High Lava Plains Province as published in the Oregon Natural Heritage Plan (NHAC, 1998): western juniper /big sagebrush / threadleaf sedge community.

A management plan for the ACEC was completed in 1996. Specific, ongoing management actions include continuing plant inventory (native and exotic) and monitoring (fence maintenance, use in and adjacent to ACEC). User-created mountain bike trails attests to the increased public recreational use in the planning area. Such disturbance is likely to impact the ACEC through the introduction of noxious weeds and other non-native species.

Horse Ridge ACEC/RNA is also known as the Western Juniper Instant Study Area (ISA), as discussed in the Wilderness Study Area section, above. The restrictive management imposed by the management plan for this ACEC exceeds that required by the Interim Management Policy for Wilderness Study Areas.

Lower Crooked River ACEC encompasses 2,592 acres of canyon land immediately downstream from Bowman Dam, the structure creating Prineville Reservoir. The primary values were associated with its designation as a National Wild and Scenic River by the Omnibus Oregon Wild and Scenic Rivers act of 1988. The RMP specified that restricting OHV use, not allowing firewood cutting, and encouraging prescribed fire would protect the area and by making sure any other authorized activities are compatible with the values of the ACEC.

Since publication of the B/LP RMP/ROD, a formal management plan for the Lower Crooked Wild and Scenic River (Chimney Rock Segment) was prepared in 1992. This plan encompasses the majority of the ACEC and has, in most respects, been implemented with protective measures equal to or, in most cases, more stringent than stipulated for the ACEC.

Most impacts associated with visitor use and recreation are being managed and facilities (including campsites and trails) have been developed. There is still concern related to the effect that an increasing western juniper density is having on the plant community within this ACEC.

Peck's Milkvetch ACEC encompasses 4,073 acres in an area southwest of Cline Buttes, in the Cline Buttes Issue Area. The area was designated for its value as critical deer winter range and as habitat for Peck's milkvetch (*Astragalus peckii*) a Bureau Sensitive species also listed as Threatened by the State of Oregon. At the time, the ACEC encompassed the entire known range of this plant within the planning area.

Management direction for the ACEC, as provided for in the RMP, has been to restrict or bring into conformance all uses so they are compatible with Peck's milkvetch and

critical deer winter range. Land tenure adjustments and firewood cutting are prohibited outright. Long-term monitoring of Peck's milkvetch has been established.

Increased recreation, including OHV, horseback riding, mountain biking and hiking, is occurring within the ACEC, some of which is not compatible with the management direction. A portion of the ACEC is within a livestock grazing allotment. Several small tracts of private land lie within (but not part of) the ACEC and many of them contain residences. In addition, significant populations of Peck's milkvetch have now been found outside the ACEC and the opportunity exists to enlarge the area.

Powell Butte ACEC also has the additional designation as an RNA. Its 510 acres on the south slope of Powell Butte represents three RNA terrestrial ecosystem cells for the High Lava Plains Province as published in the Oregon Natural Heritage Plan (NHAC, 1998): #4, western juniper/big sagebrush/bluebunch wheatgrass; #5, western juniper/big sagebrush/ Idaho fescue; and #8, western juniper/bluebunch wheatgrass.

Management direction for this ACEC has been to essentially exclude all uses other than casual recreation and research. A management plan for this area needs to be prepared and long-term monitoring initiated. The steepness and distance from water have meant livestock grazing occurs only rarely. A fence is needed to exclude livestock entirely. Subdivision and resort development of adjacent private land may increase the amount of unmanaged public use in the ACEC, potentially resulting in the formation of pedestrian, equestrian and motorized trails which could fragment the existing plant communities and serve as pathways for the establishment of invasive plants.

The Wagon Road ACEC encompasses three small parcels of land totaling 75 acres. Each contains remaining segments of the historic Huntington Road, a major supply route linking The Klamath Agency with The Dalles. A public interpretive trail has been developed on the largest, southernmost segment, in cooperation with the Deschutes County Historical Society and the Oregon Trail Coordinating Council. Other uses of the area, including recreation and livestock grazing, are allowed provided the wagon traces and associated vegetation is not disturbed. The southernmost segment was fenced in an effort to protect the area from OHV use. OHV use is still a concern for the two segments in the north.

Caves

Several caves on BLM administered lands in the planning area receive regular visitation from the public. These caves are lava tube formations, some of which are located east of Bend, adjacent to the Arnold lava tube system in the Deschutes National Forest. Others are isolated lava tube formations or rockshelters scattered throughout the planning area. The public has nominated many of these caves for listing as Significant Caves, under the provisions of the Federal Cave Resources Protection Act (FCRPA) of 1988.

Of the caves nominated for listing, the two that receive the most visitation are Redmond Caves and Pictograph Cave, both located in Deschutes County. Both caves are expected to receive increased visitation as the population of Central Oregon grows. This increased visitation from a variety of recreationists has heightened concerns over cave resources. The development of sport climbing routes in Central Oregon caves beginning in the early 1990s also likely led to increased visitation. Since the early 1990s, a number of climbing routes in different locations have been developed in Pictograph Cave, protected by the placement of approximately 88 bolted anchors. Motor vehicle access to the Pictograph Cave entrances was closed by the BLM in 1990. Concerns over impacts to cultural resources and to bat populations led to a closure to all uses at Pictograph Cave in 1998. Early monitoring by volunteers, BLM, and Deschutes National Forest staff indicated that some violations of the closure were occurring. Monitoring efforts have decreased in

recent years, although Pictograph Cave is still monitored by the Archaeological Society of Central Oregon (ASCO). This closure remains in effect until the UDRMP is implemented.

Redmond Cave has also experienced increased visitation, mostly as a result of its location adjacent to the City of Redmond. Redmond Cave has suffered from many abuses over the past decade, including heavy amounts of graffiti, campfires inside the cave, excavation, human waste, abandoned automobiles, and litter. The cave is often visited by local residents who wish to explore the branched lava tube system however, the cave is also a popular place for parties and the area is often used by the homeless who are living on BLM administered lands near the city.

Since 1998, the City of Redmond has been working to lease the Redmond Cave site from the BLM under the auspices of the Recreation and Public Purposes Act (R&PP). The R&PP Act provides the opportunity to meet local needs through the lease or sale of BLM administered land. The City of Redmond envisions the site as a public park. An environmental assessment (EA) for the R&PP Act lease and subsequent development of the site has not been completed yet. The cave site is also of possible interest as a future administrative site for a proposed combining of Deschutes and Ochoco National Forests.

Land Uses

Livestock grazing

Forage allocation

Livestock grazing is currently administered on 101 allotments in the planning area. About 80 permittees are authorized to graze livestock in these allotments under section 3 and section 15 of the Taylor Grazing Act. Total active preference in these allotments is 22,612 animal unit months (AUMs). Each allotment also has AUMs allocated to wildlife. Allotment boundaries are shown on Map 30, and acres and livestock AUMs for each allotment are shown in Appendix G.

In any given year, total annual authorized use fluctuates, and is generally less than total active preference. Each permittee will use none, all, or a portion of the AUMs available on his or her permit. Using the years 1990, 1995 and 2000, the average authorized use is about 81 percent of active preference, such that actual authorized use is about 18,342 AUMs when active preference is 22,612 AUMs. Reasons for allotments (or portions thereof) not being grazed in any given year vary, and include individual operation fluctuations, rest after wildfire, prescribed fire, drought, and other factors.

An additional 22 allotments with 2,414 AUMs are available per Brothers/La Pine RMP direction, but are currently vacant (no permittees hold permits for them). The Brothers/La Pine RMP also directed that 23,509 acres with 6,800 AUMs in scattered parcels in the La Pine area be added to existing allotments or used to create new allotments, but these areas would need new fences, gates, and water sources prior to livestock turnout (the installation of these developments was previously analyzed in the Brothers/La Pine RMP). The Brothers/La Pine RMP also directed the allocation of an additional 6,800 AUMs deemed available as a result of increased forage production after timber treatments in the La Pine area. These timber-related AUMs have not yet been allocated.

Information specific to each allotment (vacant and otherwise) and scattered acres that are not allotted in La Pine is provided in Appendix G, including acres and livestock AUMs. The additional AUMs available as a result of timber treatments are not shown in the table in Appendix G, as they have not been allocated to a particular allotment or parcel.

Characteristics of livestock grazing allotments in the planning area differ from those in other parts of the Prineville District in several respects. There is a greater percentage of vacant allotments (where permittees have relinquished their permits), which is likely due to the unique pressures of managing livestock in an urban-rangeland interface. Allotments in the planning area are generally small scattered parcels (more than half of the allotments contain less than 1,000 acres of public land). Many are bordered on one or more sides by residentially or resort zoned lands, and recreation is a daily rather than a sporadically occurring activity in the allotments. Many miles of public/private boundary fall in “closed” range (see additional information below under “livestock districts”), further complicating the situation.

Trends

Authorized use has declined approximately 3 percent per year on BLM-administered land in the planning area over the last decade. Use on the Deschutes and Ochoco National Forests (including the CRNG) has declined about 2.6 percent per year since 1995 (personal communication, Byron Cheney and Don Sargent, USFS). The Draft EIS for the Interior Columbia Basin Ecosystem Management Plan estimated a 1 percent reduction per year for the Basin.

Evidence indicates that, as ranchers grow older, more leave the field than enter it. In some rural areas experiencing rapid population growth, base properties (home ranches where herds are kept for part of the year) are being converted to resort or residential developments.

In the recent past, the public was primarily concerned about the ecological effects of grazing. As grazing management and policy have adapted to address these concerns, the criticism has shifted to the economics of grazing livestock on BLM administered lands. Urbanization in Central Oregon has created an increased need for alternative uses of public land (urban expansion, increased recreational activity), and the contribution public land grazing makes to the local economy may be minimal compared to the benefits derived from other uses of the land (Holechek 1991). In some areas, public land may not be able to accommodate all user groups. The BLM has received formal and informal requests from members of the public to end grazing on specific parcels of public land within the planning area, for reasons ranging from economics to ecology to recreation.

One of the BLM’s objectives is, “to provide for the sustainability of the western livestock industry and the communities that are dependent upon healthy, productive public rangelands” (43 CFR 4180). This objective reflects a recognition that when ranchers remain in business, the private land “base properties” associated with public land grazing continue to provide open space and wildlife habitat. Public land grazing generates employment and economic activity, and is valued by some for its contribution to local culture, tradition, and sense of place.

Allotment Categorization

All grazing allotments in the planning area have been assigned to a management category (Appendix G). The three categories are improve (I), maintain (M), and custodial (C). There are seven criteria used to make the determination of allotment category (Appendix G). The categorization process is designed to establish allotment priorities so management efforts and funding can be directed to areas of greatest need. The I allotments are usually areas with a potential for resource improvement where the BLM controls enough land to implement changes. The M allotments are usually where satisfactory management exists and major resource conflicts have been resolved. Most C allotments are small unfenced tracts intermingled with larger acreages of non-BLM lands, thus limiting BLM management opportunities.

Allotment Evaluation and Management

Allotment evaluations were completed by the early 1990s for most I and M category allotments in the planning area. During these evaluations, interdisciplinary teams reviewed monitoring information and examined and proposed changes to allotment goals, forage allocation, allotment category, and grazing systems. These goals, forage allocations, allotment categories and grazing systems are shown in Appendix G. The evaluations also proposed new rangeland developments to meet allotment goals. These developments are displayed in Table 13 of the Brothers/La Pine RMP, but they are not included in this plan because they are not planning level decisions, and they would require site-specific NEPA analysis prior to implementation.

In 1997, the Oregon/Washington BLM adopted the Standards for Rangeland Health and Guidelines for Grazing Management (BLM 1997), and incorporated the Standards into existing plans. The Standards meet the intent of 43 CFR 4180 (rangeland health regulations), which contain the objectives to "...promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions...and to provide for the sustainability of the western livestock industry and communities that are dependent upon healthy, productive public rangelands."

The Standards are the basis for assessing and monitoring rangeland conditions and trend. The assessments evaluate the standards and are conducted by an interdisciplinary team with participation from permittees and other interested parties.

Based on 43 CFR 4180, if livestock are a significant causal factor in failure to meet a Standard, as soon as practical but not later than the start of the next grazing season, management will be implemented to ensure that progress is being made toward attainment of the standard(s). (BLM, 1997)

The Prineville District BLM expects to complete rangeland health assessments on all District allotments by 2008. Assessments have been completed on about ten allotments in the planning area as of this printing. Livestock were identified as significant causal factors in the failure to meet one or more Standards on all or a portion of three of these allotments. This was or will be mitigated by a change in season of use, forage allocation level, or grazing intensity, or by discontinuance of livestock grazing in all or a portion of the allotment. Allotment Management Plans (AMPs) are sometimes developed for larger I or M category allotments. An AMP prescribes the manner and extent that livestock grazing is conducted to meet multiple use, sustained yield, economic, and other objectives. A grazing system is generally incorporated into the plan. An AMP is implemented when it is incorporated into the permit and accepted by the permittee, and is operational when supporting range improvements and the grazing system have been initiated.

Livestock Districts

Livestock districts are areas where it is unlawful to allow livestock to run at large (Oregon Revised Statutes 607 and 608). Livestock districts include incorporated cities, plus additional land as designated by the county (see livestock district boundaries on Map 30, Livestock grazing allotment boundaries). Areas outside livestock districts are managed under open range policy. In open range, private landowners are responsible for fencing unwanted livestock off their land, while in livestock districts (also called closed range) livestock owners must contain livestock on their own land. Grazing permittees with allotments in closed range are likely to have higher costs for fence maintenance, and greater liability risk regarding livestock/vehicle collisions. The BLM has no control over the State's livestock district laws, and is not involved in setting district boundaries. The BLM pursues civil and/or criminal penalties for owners whose livestock stray on public

land, regardless of whether that land is in a livestock district or in open range (43 CFR 4140.1).

Minerals

The BLM administers three categories of minerals on BLM administered lands. These categories include:

Locatable Minerals

Locatable minerals are minerals for which mining claims can be located, such as precious and base metals and some non-metallic minerals that are not classified “common variety.” Presently, there are 26 mining claims and 4 millsite claims within the planning area and two notices have been filed under the BLM Surface Management Regulations (43 CFR 3809).

The potential for the occurrence of locatable minerals within the central and western parts of the planning area is generally low because of the prevalence of young non-mineralized basalt flows, ash deposits, and other volcanic materials (Map S-20, Locatable Mineral Potential). The exception to this is a small area west of Terrebonne that has a high potential for diatomite. Diatomite was mined a few miles west of Terrebonne in the 1950s and continued until the reserves were depleted (Orr and others, 1992).

The northeastern half of the planning area has a moderate potential for locatable minerals due to small pockets of mineralization in the John Day and Clarno formations. The southeast part of the planning area has a high potential because of known deposits of mercury in the Clarno Formation. Minor amounts of mercury have been produced with prospecting beginning in the late 1920s. By the late 1950s, the US Bureau of Mines had recorded 30 flasks of total mercury production from the Platner and Oronogo mines, though the actual output was probably larger (Brooks, 1963).

Mineral Material Disposal

Common variety mineral materials such as sand, gravel, rock, and cinders may be purchased or acquired by free use permits from the BLM. Most of the planning area has a moderate potential for the occurrence of mineral materials (Map S-21, Mineral Material Potential). The high potential areas are in and around existing mineral material mines. Most of the high potential areas occur in areas with cinder cones, alluvial deposits of sand and gravel and volcanic rock outcrops known to have a sufficient quality for use in asphalt. The Badlands basalt flow also has a high potential for mineral materials in the form of ropy slab lava. However, the collection of slab lava in the Badlands ACEC/WSA would not be allowed in any alternative.

Population growth in Central Oregon has led to an increasing need for mineral materials to build and maintain roads and highways. Between 2000 and 2025, the population of Deschutes County is expected to increase 96 percent from 117,688 to 231,220 people (Deschutes County 2003). The forecasted average annual demand for aggregate in Deschutes County is 1.15 million cubic yards between 2002 and 2010 with an increase to an average of 1.21 million cubic yards annually between 2011 and 2020 (DOGAMI, 1995).

According to studies by ODOT (1998), existing aggregate sources on BLM administered lands are not sufficient for ODOT to consistently offer a public source to project bidders in the Bend/Sisters/Redmond area. When ODOT is not able to offer a public aggregate source, bidding is restricted to firms that have access to private sources, resulting in less competition and increased project costs. In an effort to secure additional aggregate sources on public land and increase bidder competition, ODOT conducted exploratory

work on BLM-administered land and identified several sites for potential development. In response to public input during the site identification process, ODOT deferred formal application for any new mineral material sites until completion of the UDRMP.

Although ODOT has expressed the most interest in developing mineral material sites on BLM-administered lands, road projects account for only 30 percent of the aggregate demand in Deschutes County (DOGAMI, 1995). Local governments and private construction firms may increasingly look to BLM-administered lands for aggregate sources during the life of this plan.

There are currently 20 mineral material sites on BLM-administered lands within the planning area. Over the past 10 years, nearly 1 million cubic yards of sand, gravel, and rock have been produced from quarries and pits in the planning area for construction and maintenance of county roads and state highways. During the same period of time, cinder production varied from 200 to 1,000 cubic yards per year, mostly for sanding roads during the winter months. Sales of sand, gravel and cinders to private individuals averaged 2,500 cubic yards per year during this time period. Theft of slab lava (a decorative stone) has been a problem in the Cline Buttes area for many years. Over the past 5-8 years, the demand for decorative stone has gone from a few tons per year to several hundred tons per year and is expected to increase further.

Mineral Leasing

Fluid mineral resources including oil, gas, and geothermal and some solid mineral resources such as coal and oil shale are obtained from the BLM-administered lands by leasing. The oil and gas potential in the central and western parts of the planning area is low whereas the eastern part (Clarno and John Day Formations) has a moderate potential due to the discovery of oil and gas where these formations crop out northeast of the planning area near the John Day River (Map S-18, Oil and Gas Potential).

Owing to the prevalence of volcanic and volcanoclastic sedimentary rocks in the planning area, coal, coal bed methane, oil shale and tar sands are considered to be absent from the planning area and are not addressed.

Most of the planning area has a moderate potential for geothermal resources because of the geologically recent volcanism, except in the area around Powell Buttes which has a high potential (Map S-19, Geothermal Potential). There is a geothermal anomaly in the vicinity of Powell Buttes (Brown, *et al.*, 1980). Their work indicates a potential for boiling-temperature fluids at a depth of about 1000 meters and more work is required to prove the existence of an economically viable geothermal system.

No areas within the planning area are leased and no exploration is occurring. This situation could change as technology improves or if energy prices rise notably.

Restrictions

BLM-administered lands are generally open to mineral exploration and development under 43 CFR 3000-3800. However, some lands are closed or withdrawn from some or all mining uses and are known as "exclusion" areas. Closures to mineral leasing and mineral material disposal fall under two categories, discretionary and nondiscretionary. Discretionary closures are management-level decisions to close lands to mineral leasing and disposal whereas nondiscretionary closures are formal withdrawals by Congress or the Secretary of the Interior. Withdrawals of land from locatable mineral entry can only occur through nondiscretionary actions.

Discretionary closures may apply in ACECs, RNAs, WSAs, and where mining is incompatible with other management objectives or land uses. Nondiscretionary closures

occur in wilderness areas or areas withdrawn for other purposes. WSAs are non-discretionally withdrawn from mineral leasing (43 CFR Subparts 3100.0-3 and 3201.11) but are open to locatable mineral entry with restrictions to prevent impairment of the suitability for inclusion in the Wilderness System (43 CFR Subparts 3802.1-5).

On lands open to mineral development and exploration, additional restrictions may apply to protect natural resources and mitigate conflicts with management objectives and other land uses. Such restrictions apply in “avoidance” areas including ACECs, WSAs, and RNAs not listed as closed to mineral operations. Restrictions may also apply to protect visual resources, significant archeological sites, wildlife, and habitat components. All applicable restrictions will be attached to mining notices, plans of operations, leases, permits, and contracts.

Some areas are closed to “surface occupancy” for fluid mineral leasing operations. Under this type of restriction, drilling to explore, test, or produce fluid mineral resources may not occur. However, mineral leasing may still occur, provided that the operator slant drills to the resource from an adjacent area where surface occupancy is allowed.

Oregon Military Department Use

The United States Army, including the Oregon Army National Guard, has trained on BLM administered lands in Central Oregon since World War II. The existing BIAK Training Center is centrally located for all National Guard Units within the State of Oregon and is the only desert training site in Oregon. The current Training Center boundary is displayed in Map 35. The existing training area encompasses an estimated 29,744 acres of BLM administered lands under permit from the BLM. Under this cooperative arrangement, the Oregon National Guard does not have exclusive use of the range except for a core area withdrawn from public use.

The BIAK Training Center serves as a maneuver-training center for Cavalry, Engineer, and Infantry units within the Oregon Army National Guard. Engineering units of the Navy and Marine Corps Reserve also train at the BIAK Training Center and perform engineering and construction activities in support of the Army National Guard. Individual military units, either troops, companies, or detachments, generally range in size from 60 to 120 personnel. Most of these units use rubber tired off highway capable tactical vehicles like the HMMWV (Humvee). The Army National Guard’s combat engineer units use the tracked armored personnel carrier and there is only one troop of heavy cavalry, equipped with the Abrams tank and Bradley Fighting Vehicle that uses the BIAK Training Center.

The mean number of training days for the five-year period (1997 through 2001) is 11,092 man-days per year (Figure 3-6). A man-day of training is defined as one soldier per day

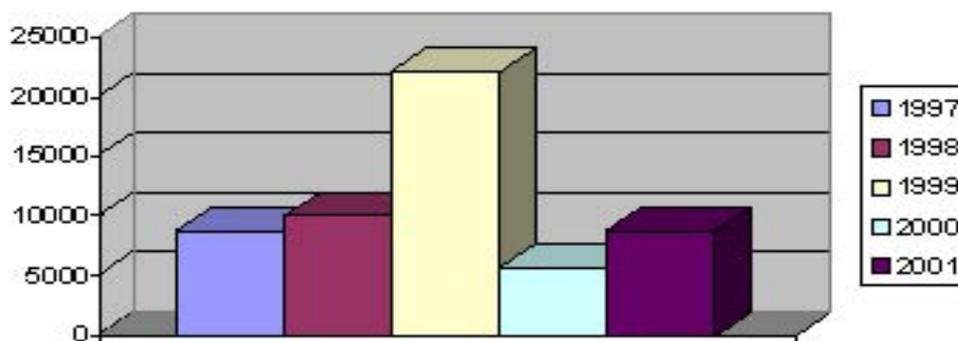


Figure 3-6. Military man-days of training per year on BIAK Training Center.

for training. The five year data for the BIAK Training Center is skewed by a high value of 22,189 man-days of training in 1999. Current training plans for Training Year 2002 project that usage for this year will again exceed 20,000 man-days. While use of the Training Center is expected to remain cyclical, the average annual training usage for the BIAK Training Center is expected to range around 12,000 man-days per year in the future.

Training activities at the BIAK Training Center exhibits an annual pattern. Currently the pattern consists of individual task training requirements in the fall. During this period units may bivouac on the Training Center, but training is usually confined to developed ranges such as the 25m rifle range and little maneuver training occurs. December is traditionally a time of home station training for military units and training rarely occurs at BIAK during that month. Units usually start their crew or collective training in January and such use increases to three weekends per month towards May. In June, field-training activities at the Training Center usually decrease as units prepare for deployment for their summer two-week annual training exercise, usually in late June and July.

Depending on available funding levels, training requirements, and scheduling at other military training centers, the BIAK Training Center may or may not be a location for significant two-week annual training exercises. Historically, Oregon National Guard units use major training areas that allow for live fire exercises for annual training and consequently most units train go out of state to training areas like Yakima Training Center, Washington, or Orchards Training Area, Idaho. Due to the lack of live fire training ranges and high wildland fire risk, the BIAK Training Center does not normally host significant training activities in July and August. In September, training activity at the Training Center again rises to two or three weekends during the month as military units close out the training year and start preparations for the fall training cycle to begin again.

Training Restrictions

Under the Use Permit issued by the BLM use of live ammunition is not permitted and there are other restrictions on the use of ordnance. There are also restrictions on use of vehicles, excavation activity, and uses near private property.

Rehabilitation

The Oregon Military Department spent \$20,000 on road improvements and gravel during summer 2002, before the training in July. In the fall/winter of 2002, \$21,190 in native grass seed was spread and the Youth Challenge Program hand crew spent 5 days doing rehabilitation work in the training areas. More road maintenance and rehabilitation work is expected during spring 2003.

Forest Products

Timber

Timber production from BLM administered lands in the planning area is relatively minor. Timber supply in Central Oregon is still primarily from National Forest lands, although sale offerings from National Forest lands have steadily declined since a peak was reached in the mid-1980s. Large industrial timber suppliers in Central Oregon include Crown Pacific LLC, which owns large timber tracts south of La Pine and northwest of Bend; and U.S. Timberlands Services, which owns a large tract just west of the Ochoco National Forest.

Timber contributes to local and regional economies by providing jobs and generating revenue. Direct economic benefits are in the form of employment from logging and

manufacturing of the raw resource. A variety of indirect benefits are generated from production of value-added products and the need for supporting goods and services. The BLM allocates 4 percent of Public Domain gross timber receipts to state governments which then re-allocates to county governments for use in building and maintaining roads and schools. Also, a state-administered forest products harvest tax is collected from all public and private timber harvest in the state of Oregon. The current rate is \$3.19/MBF. This tax helps fund state forestry programs such as firefighting, fire prevention, research, and administration of the Oregon Forest Practices Act.

On BLM-administered lands in the La Pine portion of the planning area, 40,134 acres of lodgepole and ponderosa pine are classified as commercial forestland (see Map 1, UDRMP Planning Area). This includes 1,826 acres of commercial forestland managed by the BLM within the La Pine State Park. Commercial forestland is defined as forestland that is producing, or has the capability of producing, at least 20 cubic feet of wood per acre per year of a commercial tree species. BLM commercial forestland in the La Pine portion of the planning area represents 2.4 percent and 1.1 percent of the total commercial forestland base in Deschutes County and Klamath County, respectively.

A timber inventory for the La Pine block, conducted in 1982, identified a sustained yield and allowable sale quantity (ASQ) of 3.3 MMBF/year. However, due to the extensive beetle-caused mortality, the 1989 Brothers/La Pine RMP called for an accelerated harvest program, harvesting up to 14 MMBF annually. This program had four primary objectives: 1) reduction of extreme fire hazard; 2) salvage of dead and dying timber; 3) successful reforestation; and 4) increase subsequent growth of commercial tree species. Since the inception of this treatment program, the La Pine area has become the focus of timber management for the District.

Between 1991 and 2001 timber harvested from BLM-administered lands in Deschutes and Klamath Counties ranged from a high of 27.4 MMBF in 1991 to no harvest in 1997 and 1999. In 1992 the harvest was 16.2 MMBF and in 2002 the harvest was only 0.2 MMBF. These numbers reflect the accelerated harvest of the early 1990s and sharp decline in the last few years as most of the available salvage was completed.

The silvicultural prescription applied was primarily seed tree cut with a minor amount of commercial thinning and shelterwood cuts. The treatment objectives have been achieved to varying degrees, although each of the original objectives remains as concerns in certain areas. Beyond the accelerated harvest program, current Brothers/La Pine RMP direction is to apply future timber management based on the "productive capacity of the land."

Prior to the early 1980s, timber harvest in the La Pine area was light and infrequent. Harvest of the larger ponderosa and lodgepole pine occurred with individual tree selection as the primary harvest method. Harvest records for this time period are incomplete.

In the northern portion of the planning area, 1,080 acres are classified as commercial forestland. These are low-elevation, dry-site ponderosa pine stands, located just to the east of the Deschutes National Forest, in the Tumalo, Fremont Canyon and Squaw Creek areas. There are also small stands of commercial forestland located on Grizzly Mountain and east toward the Ochoco National Forest.

The amount of the Brothers portion ASQ for the northern area is approximately 87 MBF per year. Commercial forestland in the northern area represents a small fraction of one percent of the total commercial forestland base in Deschutes and Crook Counties.

The northern portion of the planning area has received limited commercial harvest during the last 50 years and no commercial harvest in the last 20 years. The harvest that did occur was generally a broad-area selection harvest of the larger diameter

ponderosa pine with the objectives of salvage and harvest of mature trees. This practice fit the general silvicultural goal of public land forest management of that era: to remove mature and over-mature trees and to open up the stand to increase the growth of smaller understory trees. This prescription was applied to facilitate the eventual conversion of slower growing old -growth stands to younger, more productive stands.

Presently, juniper in Central Oregon is not being used consistently as a timber resource. Juniper's small size, poor form, defect, and handling difficulties are such that currently its use for conventional forest products is not economically feasible. However, juniper has attained a local niche market for a few specialty products such as paneling, flooring, and house logs. Testing and research continues in the areas of harvesting, milling, drying, and manufacturing for a variety of timber products. Refinements in processing juniper and other economic factors may lead to an increase in future demand for this resource.

Harvest and processing of timber and other wood products is still a major source of income in Central Oregon, but is declining in relative economic importance. Traditional timber sales on BLM-administered lands within the planning area are expected to be very minor for the next few decades until La Pine timber stands regenerate and grow to commercial size. However, noncommercial forest management for fuels reduction and ecosystem health are expected to increase. Treatments such as small tree thinning, pruning, brush cutting/mowing, and prescribed burning would be accomplished through contracted services or BLM personnel.

Biomass

Although there has not been a high local demand for biomass fuels, there is substantial future potential to generate this type of wood product in the planning area. Biomass, in this context, refers to woody residue produced (by grinding or chipping) from timber harvest (slash) or milling by-product (slabs, ends) or from material generated from other forest or woodland ecosystem or fuels reduction treatments (small trees). Biomass is usually used as a fuel for generating electricity or producing steam for direct heating, but can be used for other purposes too.

With the current emphasis on restoration and fuels reduction, the planning area could produce approximately 3-10 green tons per acre as a by-product of these treatments. The material would come primarily from small diameter thinnings in the lodgepole forest of the La Pine area or from juniper reduction in the woodlands of the northern area. This material could either be sold through a conventional timber sale or its value could be used to help off-set some of the contract cost of treatments. The economic feasibility of harvesting this material is questionable. Biomass would compete with other potential products such as paper chips, firewood, post, and poles, etc. Due to economic and environmental factors, an estimated 90% of the lodgepole treatment area in La Pine could be made available and an estimated 30% of the juniper treatment area in the woodlands could be made available for biomass production. In wildland-urban interface areas, removal of small diameter woody material may be required in order to reduce fire hazard and smoke concerns.

Firewood

Public firewood cutting continues to be a popular traditional use of public land in the planning area. For the period 1996-2000, the average annual harvest of firewood from the planning area was 1,062 cords.

The La Pine area, in particular, has received heavy use since the beginning of the beetle outbreak in the late 1970s. At that time, BLM began a personal-use firewood program in the La Pine Block to reduce the fire hazard and to help supply the local demand for firewood. Beetle-killed trees are still available for firewood, however, the amount of this

resource is diminishing due to heavy use, decay, and resource concerns.

The juniper woodlands in the northern portion of the planning area also have been a traditional source of juniper firewood for the public for many years. The area west of the Powell Butte Highway and north of Alfalfa Market Road has been used heavily by the public, mostly Bend residents, since 1982. Beginning in 1995, the traditional use areas near Bend were closed and new areas were designated several miles to the east. Closing of the traditional areas was done for two reasons: increasing awareness of old-growth values and recreation/aesthetic considerations. Public use of new juniper woodcutting areas designated near Millican Road and State Route 27 has been much reduced (less than 200 cords per year) due to smaller diameter trees and greater distance from Bend and Redmond.

Most of the firewood from public land is now sold through the Central Oregon Initiative Interagency Firewood Program. Firewood permits for the Deschutes and Ochoco National Forests and BLM Prineville District currently sell for \$10 per cord with a maximum purchase of eight cords per household. Commercial firewood permits are also sold by the BLM on a limited basis; usually to achieve resource objectives such as post-timber sale fuels reduction, ROW corridor salvage, or thinning for forest or rangeland health.

Economic benefits of woodcutting are realized by local communities through sale of such items as chainsaws, gas, oil, and accessories. Commercial firewood sales provide some minor employment and a firewood commodity. A small percentage (4 percent) of BLM firewood sales goes to county budgets for roads and schools. The Prineville District BLM retains 20 percent of receipts for use in BLM road maintenance and resource management.

Despite the population growth, local public demand for firewood appears to be stable or declining slightly in recent years. This trend is due, in part, to an increase in use of highly efficient heating systems such as natural gas appliances and heat pumps. Old, inefficient wood stoves are also gradually being phased out and replaced by more efficient, certified stoves. The phase-out of old stoves was prompted by a 1988 Oregon law restricting wood stove sales to cleaner-burning certified units and a subsequent 1995 Bend city ordinance requiring removal of non-certified stoves upon sale of a home.

Special Forest and Range Products

Permits are issued for a variety of other vegetative products harvested from the forest, woodlands and rangelands within the planning area. Some of these products include: posts, poles, juniper boughs, juniper berries, hobby/furniture wood, lichen, tree and shrub transplants, and pine cones. Of these, permits for juniper boughs are the most common. Most of the permits to harvest juniper boughs are sold to large commercial operators. The boughs are used to make Christmas wreaths, which are then sold at retail throughout the country. Annual harvest of juniper boughs fluctuates with the berry crop. In the period 1996-2000, an average of 170,112 pounds of juniper boughs were sold on the BLM Prineville District. Of this total, an estimated 75 percent came from within the planning area.

Demand for forest and range vegetative products is increasing in direct proportion to the local population increase. Permits for landscaping products (i.e. snags, tree and shrub transplants) are increasing as the use of xeric plants and natural materials becomes more popular. The economic benefits of vegetative material sales comes mostly from the commercial harvest of juniper boughs and a few other materials used to make medicinal products, furniture, and craft items, which are then sold at wholesale and retail outlets.

Visual Resources

Visual resources are the combination of land, water, vegetation, structures and other features that make up the scenery on BLM administered lands. While the high peaks of the Cascades are the most dominant visual element in the planning area, BLM administered lands do possess important visual elements, in large part because they provide an open space view from residences throughout the planning area. Key visual elements of the planning area include landforms that provide both a backdrop to views, and in some cases, home-site locations with panoramic views. These include Cline Buttes, Powell Buttes, Horse Ridge, the Smith Rock area, and West Buttes. River canyons such as the Crooked and Deschutes River, Squaw Creek, and several dry river canyons with dramatic cliff faces are also key visual elements that are sought out for recreational use as well as for home-sites. In addition to these larger elements, many other features are valued for their scenic quality. These elements include old growth juniper stands, clearings in juniper stands that allow for long-distance views, wildlife viewing opportunities throughout the area, ranch or agricultural lands, and historical features.

A portion of State Route 27, adjacent to the Crooked River, was designated as a BLM National Backcountry Byway in 1988. The other State Scenic Highways in the area consist of various routes in the cascades, including one loop west of Sisters and another southwest of Bend. Many other state and county roads in the area are identified as scenic tour routes by a variety of sources, including tourism boards, chambers of commerce, or recreational guides.

In rapidly growing Central Oregon, visual resource concerns are being voiced by many citizens concerned about highly visible developments, including buildings, cell phone towers, and golf driving ranges. In many of these cases, area residents' concerns are about the level of contrast of these new developments and the views they detract from or block. These same concerns have been expressed for a number of proposed projects on BLM administered lands, and will likely continue to be concerns in the future.

Recreation

The BLM has traditionally managed recreation to provide a primitive and dispersed recreation experience, consistent with the large, wide-open landscapes that BLM manages. The planning area includes this traditional BLM recreation setting offered by BLM administered lands situated further from the cities of Bend, Redmond, and Prineville. However, the planning area also includes BLM administered lands located within and adjacent to these rapidly growing cities. These "urban interface" lands are currently accessible from a variety of State Highways, County Roads, local roads, and directly from subdivisions and private property.

With the exception of the Lower Crooked WSR corridor, there are few developed recreation opportunities on BLM administered lands in the planning area. Special Management Areas that attract specific recreation uses include: 1) Badlands WSA, 2) Steelhead Falls WSA, 3) Lower Crooked River WSR, 4) Middle Deschutes WSR, and 5) the Millican Valley OHV area.

Because of the wide variety of recreational opportunities that BLM administered lands provide, these lands receive daily visitation, not only from local residents, but from other areas of the state, as well as out of state. For example, while nearly all visitors to the small, isolated BLM parcels west of Redmond are nearby residents, visitors from Eugene, Portland, and other areas of the Pacific Northwest may visit the Millican Valley OHV system or the Badlands WSA. Climbing opportunities on BLM administered lands

adjacent to Smith Rock State Park attract out-of-state and international visitors.

Community Recreation Demand

Most of the BLM-administered lands within the planning area are located in close proximity to the rapidly growing cities of Bend, Redmond, Sisters, and Prineville as well as the large unincorporated communities of La Pine and Crooked River Ranch. As cited in the 1994 - 1999 Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP), the lack of time and distance from recreational resources were frequently cited as barriers, especially among younger households with children. For local recreation participation, there is an inverse relationship between frequency of participation and distance to facilities. As distance to facilities increases, participation declines.

The location of BLM administered lands in the urban core reflects a need to consider different types of recreational opportunities than those typically found on larger blocks of public land further removed from urban development. These lands may increasingly be used for local or community activities such as walking, running, picnicking, bicycling, and various sports and games, etc. Few of these activities are supported by BLM management or facility development in the urban interface area. Some of these activities, such as trail use, depend on the large blocks of public land in the urban interface. Other activities, such as historical interpretation, depend on the cultural and historic resources found on BLM-administered lands.

Developed Recreation

The planning area contains relatively few developed recreation sites on BLM administered lands. Nearly all BLM sites are campgrounds along the Lower Crooked River and the Chimney Rock Segment WSR Corridor between Prineville and Prineville Reservoir. The remaining BLM recreation sites are staging areas at the Millican and Rosland OHV areas, primitive campgrounds, such as Steelhead Falls Campground on the Deschutes River, or picnic areas, such as Reynolds and Mayfield Ponds east of Bend.

Reynolds and Mayfield Ponds receive regular visitation from the public. Reynolds pond supports a better fishery, is in better condition and has more picnic tables than Mayfield Pond, and therefore receives more visits. Reynolds Pond is located on the perimeter of the Badlands WSA.

While Reynolds Pond was created to provide a recreation opportunity, Mayfield Pond is created as a result of irrigation canal overflow and has historically been used as a water source for cattle grazing. The pond has been fenced to eliminate mud-bogging by four-wheel drive vehicles, however, the fence typically gets cut several times a year. Mud-bogging and cattle grazing has limited the growth of riparian vegetation at the pond. Although Mayfield Pond is used for fishing and picnicking, other popular uses include target shooting, hunting, and dog training. Both ponds are popular sites for horseback riders, and both sites receive evening use, including late night parties.

These undeveloped sites do not have running water, paving or maintained roads. A few of these sites (Rosland OHV play area, ODOT Pit OHV play area and Steelhead Falls campground) have portable toilets. Many of these sites are difficult to access, some are located in residential areas, and few, if any, have directional signs or improved or designated parking areas.

No sites have been designed or maintained for group use, RV camping, picnicking, or day use activities on BLM-administered lands in the planning area. For the most part, camping and picnic areas or other developed recreation opportunities are provided by National Forest facilities, State Parks, or Bend Metro Park District areas. With the rapid

population growth in Central Oregon, many communities are finding a shortage of developed parks for picnicking, trail use, and for sports. As Central Oregon continues to grow, the demand for recreation sites, for a variety of recreation opportunities, and access to outdoor recreation opportunities due to distance and poor public transportation will continue. Communities have expressed desires to use BLM-administered lands to develop park facilities. In addition, BLM has received requests for Special Recreation Permits to accommodate a wide variety of group uses, including outdoor concerts and large group camps. These permit requests are difficult to accommodate due to the lack of designated or developed sites.

Motorized Recreation Use

The generally flat terrain and open juniper forest vegetation throughout the planning area allows for relatively easy access for motor vehicles. The BLM administered lands in the planning area have been historically used for a variety of motorized recreation, including OHV trail riding, four-wheel drive use, hunting, and sightseeing. This use has included a variety of organized group events, including motorcycle and four wheel drive vehicle races and hill-climbs.

With the exception of a few select parcels, such as the BLM-administered lands adjacent to Smith Rock State Park, or the isolated Airport Allotment parcel at the Dodds Road/Alfalfa Market Road intersection, and certain smaller urban interface parcels, all BLM administered lands in the planning area are currently either designated as Limited (travel limited to existing or designated routes, or limited seasonally) or Open (cross-country motorized vehicle travel permitted). These lands include the Millican Valley area, lands east of U.S. Highway 97 between Bend and Redmond, the Cline Buttes area, and the Steamboat Rock area west of U.S. Highway 97 between Redmond and Crooked River Ranch.

OHV Use

Most OHV use occurs in the fall, winter, and early spring, when trail conditions favor riding. During the summertime, riding opportunities on most of the BLM-administered lands are restricted by the softness of trails and the dusty riding conditions. OHV use occurs from both local and out-of-area visitors. Many recreationists travel from communities on the west side of the Cascades to participate in OHV activities, partly because Central Oregon offers riding opportunities when areas in western Oregon and Washington are too muddy for OHV use.

There has been an increase in quad (Class I) use in Central Oregon (personal conversation, Dick Duford 202). This may be part of a larger demographic trend of more recreationists aging, and possibly reflects more family use.

Millican Valley is the only designated OHV system on BLM-administered lands within the planning area (although several designated play areas also exist). Many other non-designated areas are popular for OHV use, including the Cline Buttes area, the Steamboat Rock area, and lands immediately east of Redmond. In addition to BLM-administered lands, several other designated OHV areas exist in Central Oregon. These include the East Fort rock Trail System (DNF), Henderson Flat Trail System (CRNG), and the smaller Edison Butte and Green Mountain Trail Systems. Each of these OHV areas is different, and the differences in season of use, vegetation, topography, and views offer recreationists a variety of riding options. Winter riding opportunities are somewhat limited. Areas, like East Fort Rock, are often closed due to snow depth, while others areas (e.g., North Millican and South Millican) are seasonally closed to minimize impacts to deer. This has led to increased use at areas such as Cline Buttes as OHV enthusiasts

seek a place to ride relatively close to town.

The current designated and maintained OHV riding areas in Central Oregon are shown on Map 8, Travel Management Areas. The Christmas Valley area (located on BLM Lakeview District lands to the southeast of Bend) is the only place in Central Oregon that has dunes, and therefore is another attraction for both area and out-of-area recreationists. Generally, people who visit Christmas Valley don't visit other Central Oregon OHV opportunities during their trip (Personal conversation, Dick Duford 2002).

Play Areas

Seven material sites (pits) are listed as OHV play areas in OHV opportunity guides prepared by the BLM and USFS. These include four pits at East Fort Rock (two major pits and two smaller pits), one at Rosland in La Pine, and another in North Millican, and the ODOT pit. Pits are beneficial components of a larger trail system, because it provides an alternative to a trail system ride. During periods of extreme fire precaution these pits provide the only OHV opportunities on public lands.

The Millican Valley OHV area is located east of Bend and covers a north-south area extending roughly from U.S. Highway 20 north towards Prineville. The current boundary encloses 82,886 acres, of which 60 percent is located within Deschutes County and 40 percent is in Crook County, Oregon.

Three areas have been designated for OHV use: Millican Plateau; South Millican; and North Millican. Each area includes a designated road and trail system and different seasons of motorized use (See Table 3-14). In addition, the "ODOT Pit," owned by Deschutes County and the State of Oregon, is managed by BLM for OHV use. The ODOT pit is a large play area (10 acres) near the old town of Millican directly off of U.S. Highway 20, and provides a large percentage of the "pit" riding opportunities in the OHV area.

In FY 2000, OHV visitor use was approximately 15,000 user days. Road and trail riding at the Millican OHV area occurs year round but approximately 80 percent of the use is concentrated from November to May. In FY 2000, January through April was considered the main use period where approximately 60 percent of the total use for the year was during this period. During the months of May and June, OHV riding opportunities increase throughout the state and there are more attractive areas for the remainder of the year. This directs much of the OHV use away from Millican.

Approximately 75 percent of the riders come from the Portland, Salem and Eugene areas. The amount of use varies in each area and for each vehicle type. Only a small percentage (less than 5 percent) of the use occurred in the Millican South Area. The low use in the south area is due to the limited season of use and during summer when desert-type riding is not as attractive as other areas (e.g., forested, or higher elevation areas). The

Table 3-14. Designated Road and Trail Systems Seasons of Use

Activities	Millican Plateau	Millican North	Millican South
Number of Acres	29,212	35,423	18,251
Season of Use	Year Round	May 1 to November 30	August 1 to November 30
Road Miles	48	27	29
Trail Miles	63	61	12

greatest percentage of use comes from motorcycle (Class III vehicle types) in all areas.

Non-Motorized Dispersed Use

A wide variety of non-motorized dispersed recreation uses occur on BLM-administered lands in Central Oregon. These include mountain bicycling, horseback riding, hiking, running, rock climbing, fishing and hunting, target shooting, rock-hounding, wildlife viewing, visiting historic sites, and other educational activities. Although no user surveys have been done, much of this use is focused on specific areas, such as the Deschutes and Crooked River Canyons, several Dry River Canyons, the Badlands and Steelhead Falls WSAs, BLM-administered lands adjacent to Smith Rock State Park, and Horse Ridge. Several irrigation canals and ponds in the planning area receive regular visitation and use by recreationists.

Equestrian Use

Along with OHV use, equestrian use is one of the major dispersed recreational activities on BLM administered lands in the planning area. Equestrian use is dispersed throughout the planning area. Often, adjacent residents ride directly from their houses or rural subdivisions onto BLM administered lands.

Areas of concentrated equestrian use include the Cline Buttes area, particularly the Dry Canyon area south of State Highway 126 and west of Barr Road; the Badlands WSA, and BLM administered lands adjacent to Crooked River Ranch, adjacent to Smith Rock State Park, around the community of La Pine, and west of Tumalo. BLM administered lands are used to access longer trail ride opportunities on adjacent National Forest lands. Large, group rides are relatively commonplace on BLM-administered lands, although no designated or maintained trails exist on BLM administered lands for equestrians, and no staging areas have been developed for their use. The lack of developed trailhead parking areas has led to the development of roads and disturbed areas at popular, informal use staging areas such as State Highway 126 at Deep Canyon (between Redmond and Sisters). In other locations, the lack of developed or maintained trails has created unsafe conditions for riders, or has resulted in erosion and resource impacts as existing trails degrade or new trails are created. Conflicts are occurring between equestrians and other trail users, including mountain bicyclists and OHV users. This has led to requests from equestrians to have trails or areas designated only for non-motorized, non-mechanized use.

Hiking/Running

Areas with the most significant scenery or topography provide for interesting hikes or runs. These areas include BLM-administered lands near Smith Rock State Park, the canyon complex at the western edge of the Cline Buttes area, the Dry Canyon located adjacent to U.S. Highway 20 east of Bend, the Badlands WSA, Horse Ridge, Smith Canyon (North Millican area), and the Steelhead Falls WSA. Hikers and runners also visit the Horse Ridge and Skeleton Fire area east of Bend and the North Unit and other canals on BLM administered lands close to developed areas. Evening walks and hikes by adjacent residents are popular on BLM administered lands.

Trail hiking opportunities on BLM administered lands in the planning area are limited by the lack of identifiable, designated and signed trails. Only a few developed and maintained hiking trails exist on BLM administered lands in the planning area, including short trails at Steelhead Falls WSA and at Chimney Rock on the Lower Crooked WSR. Many user created hiking trails lead from parking areas to the Deschutes or Crooked River within the planning area. However, these trails are not marked, and most are difficult or dangerous access routes to the rivers. The steep slopes and trail conditions surrounding Crooked River Ranch typically result in several accidents each year

(personal conversation, Pat Reitz, Crooked River Rural Fire Protection District). In many cases, the access roads leading to these trailheads are rights-of-way roads that lead to residences on riverfront inholdings within larger BLM parcels. There have been conflicts at these locations as adjacent residences seek to limit access to visitors who park near their private property, arrive and leave late at night, light bonfires, party, and sometimes trespass on private property.

Mountain Biking

The opportunity to bike ride year-round makes Central Oregon an emerging mountain biking hotspot. Mountain biking is popular on adjacent National Forest lands, the CRNG, BLM administered lands, and lands managed by the Bend Metro Park and Recreation District. However, there are no trails designated for this use in BLM's transportation system. The BLM has no trail maps or recreation information specifically related to mountain biking.

Although no use figures are available, the demand for mountain biking opportunities on BLM administered lands is increasing. In the last five years, many guide books and maps have been published that show mountain bike routes on BLM-administered lands. Unauthorized trail construction by mountain bike enthusiasts has occurred over this period on east of Bend (particularly at Horse Ridge and Dry Canyon) and on lands adjacent to Smith Rock State Park. Over this period, the number of bike shops in Bend has also increased. The demand for mountain bike opportunities was projected in the Recreational Needs Bulletin, Oregon State Comprehensive Outdoor Recreation Plan (SCORP, 1991). SCORP data projected a 40 percent increase in demand for mountain bike opportunities in Central Oregon.

The use of BLM administered lands by mountain bicyclists occurs primarily in the fall, winter, and early spring, as snow levels in the Deschutes National Forest close those trails to cyclists. During the summer, many of the trails on BLM administered lands become too soft and dusty for mountain bike use.

The Horse Ridge area is considered the newest and best area for mountain bicycling on BLM administered lands in Central Oregon. However, private lands in the Cline Buttes, Horse Ridge, and other areas make development of designated trail systems more complicated than many National Forest system lands in Central Oregon. As the private lands at Cline Buttes, Horse Ridge and other areas are developed the ability to create longer trail loops for mountain bikes and other uses will decrease on BLM administered lands.

While the maintained trails in the Millican Valley OHV system are open to mountain bike use, most riders prefer to use trails that are not shared by motor vehicles (pers. conversation: Phil Hammerquist, Central Oregon Trails Alliance). Trails in the East Fort Rock OHV area (Deschutes National Forest) are also used by mountain bicyclists, and organized, competitive events have been held there. However, there is a concern among mountain bicyclists that many of the trails they have constructed will be found by motorized users, and the resulting motorized use will widen these single-track trails and ruin them for mountain bike use.

Rock Climbing

Rock climbing is an extremely popular activity at Smith Rock State Park and on adjacent BLM administered lands. These lands include some of the routes in the Upper Gorge area, where the columnar basalt columns along the river provide climbing opportunities. In general, these routes are not as heavily used as the routes in the Lower Gorge area that are on the west side of the river and close to the parking area at Smith Rock State Park. BLM administered lands also include the Marsupial Crags, rock spires located east of the

road locally known as “Burma Road”. Because this area is more difficult to access from the State Park center, it likely receives fewer visitors. At one time, these routes were more accessible, but the Burma Road was closed to motor vehicles in 1994, and this climbing area must now be reached by foot.

The level of use and lack of maintenance on user trails on BLM administered lands adjacent to Smith Rock State park has resulted in vegetation disturbance and soil erosion in some areas. At Marsupial Crag, the access trails are located on steep and loose slopes, and have resulted in erosion, which is visible from a considerable distance.

Another climbing area of note within the planning area is the Sisters Bouldering Area, a 120-acre parcel of BLM administered lands northeast of Sisters in Fremont Canyon. Although this area is designated as “Open” in the 1989 Brothers/La Pine RMP, some roads into the parcel have been blocked with logs that define a parking area near the main climbing boulders. The Fremont Canyon area has a combination of BLM, State, County and private land ownership. Land exchange proposals for blocking up federal lands have been considered in the past, as Deschutes County has sought to sell county holdings in the area. These efforts have been unsuccessful, and the sale and residential development of lands adjacent to this climbing area is likely.

Pictograph Cave was developed with sport climbing routes in the early 1990s. Many routes were developed in the cave, with a total of about 80 bolt placements (drilled holes with expansion bolts and small metal plates or hangers) to protect climbers. Climbing route development in Pictograph Cave occurred about the same time as route development in other caves managed by the Deschutes National Forest. The development of climbing routes in these caves has resulted in conflicts between climbers, cavers, and others interested in cave management and cultural resources. Specific cave management strategies on the Deschutes National Forest have been assessed in the Road 18 Cave Management Strategy EA. Pictograph Cave is currently closed to all uses, pending completion of the UDRMP.

Target Shooting

Target shooting is a longstanding and widespread activity on BLM administered lands throughout the planning area. In addition to dispersed use on BLM administered lands, target shooters also use National Forest lands and several shooting ranges. Shooting ranges include the Redmond Rod and Gun Club and the Central Oregon Shooting Sports Association Range, which is located on BLM-administered lands along U.S. Highway 20 at Millican Valley.

Over the past decade, the increase in the number of subdivisions located adjacent to BLM administered lands has increased the number of target shooters and the number of complaints about unsafe target shooting practices. Concerns have included safety, litter, poor choice of shooting areas, noise, juniper tree damage, and disturbance to wildlife. The population growth of Central Oregon has resulted in increased numbers of recreationists on BLM-administered lands, some of which object to the amount of gunfire in areas that they use for hiking, horseback riding, mountain bicycling, walking pets and other activities. While many target shooters are highly conscientious about leaving no trace, the intense use of an area for target shooting often leaves the area strewn with garbage and with juniper trees cut in half by repeated gunfire.

Areas where resource damage or social conflicts occur include: an area south of Prineville and east of the Millican Road; an area along Lower Bridge Road south of Crooked River Ranch; the power-line corridor near the Redmond sewage treatment plant; areas near Alfalfa Market Road; a material site pit near the 61st/Young Avenue intersection in Redmond; and BLM administered lands immediately east of Bend along U.S. Highway

20 (see Public Health and Safety for a related discussion)

Rockhounding

Central Oregon is widely known for its recreational rockhounding opportunities. Quartz, calcite, and chalcedony including jasper and various types of agate are abundant in locally mineralized zones of the John Day and Clarno Formations inside and adjacent to the planning area. These formations also hold an abundance of petrified wood in volcanic ash and debris flow deposits. Large quantities of gem-quality obsidian occur at Glass Buttes east of the planning area and this location is a popular destination for flint knappers. On Forest Service lands in the Ochoco Mountains adjacent to the eastern boundary of the planning area, deposits of thundereggs, agate, and other semi-precious gemstones can be found.

Within the Upper Deschutes planning area, the Brothers/La Pine RMP designated five rockhounding sites. Inventories of rockhounding sites during the summer of 2002 showed that the Prineville Reservoir and Reservoir Heights sites had very little material of rockhounding significance and that petrified wood was essentially depleted from the portion of the Fischer Canyon site that lies west of Hwy 27. Moreover, this part of the Fischer Canyon site has paleontologic resources that need to be evaluated for scientific importance. Therefore, the sites listed above would be removed from designation in Alternatives 2-7. The North Ochoco Reservoir, Eagle Rock, and the portion of the Fischer Canyon site east of Hwy 27 will continue to be managed for rockhounding uses. A new site, the Carey Agate Beds, would be designated as a rockhounding site in Alternatives 2-7 (See Map 1).

Rockhounding areas (public and private, designated and non-designated) are being actively promoted by individuals, groups, internet sites, rock shops, publications, and the media. Moreover, the Crook County Chamber of Commerce estimates that 80% of their information requests are related to rockhounding in Central Oregon (USDI BLM, 2001). At some collecting sites, rock collectors have left numerous holes unfilled, undermined trees, excavated unsupported tunnels into the earth and have disturbed stream channels and riparian zones. Other impacts include OHV use, trespass, dense road networks, camping with no sanitation facilities and illegal removal and/or damaging of archaeological resources. Moreover, some collectors are taking large amounts of rock materials for illegal commercial use. Large scale collection threatens to deplete some sites of material and could result in the loss of future recreational opportunities.

Water Based Recreation

In addition to Reynolds and Mayfield Ponds irrigation canals that cross BLM administered lands provide a source of recreation. The Central Oregon and North Unit Irrigation Districts, together with the Bureau of Reclamation, operate and maintain several canals in the planning area. In the summertime, these canals have abundant water flows, and the North Unit canal in particular gets used by kayakers looking for a place to paddle close to Bend and Redmond, though it is viewed as trespass by the irrigation district.

Hunting

Hunting is a major recreational activity in the planning area, generally occurring in the late summer and fall. Hunting opportunities range from the more mountainous areas on the Ochoco and Deschutes National Forest to the lower sage and juniper woodlands areas on BLM-administered lands, including areas close to Bend, Redmond, and other communities and subdivisions. The variety of terrain and vegetation in Central Oregon provides good diversity and opportunities for hunters. The planning area receives

visitation from local, statewide and out-of-state hunters.

Mule deer, elk, and pronghorn are regularly hunted in the planning area. In addition, a variety of predators, including bobcats, cougars, and coyotes, are hunted. In particular, winter coyote hunting is popular in Central Oregon. There is no Bighorn Sheep season within the planning area. There is also no open season authorized for exotic sheep (e.g., Mouflon Sheep) on BLM administered lands in the planning area, although private landowners can authorize hunts on private lands.

Special Recreation Permits

Special Recreation Permits (SRPs) are issued by the BLM for commercial recreation use of BLM administered lands. Typically SRPs are issued on an annual basis for outfitter/guide activities such as hunting guides, commercial horse trail rides, rock climbing and hiking guide services, mountain biking guides, and for single-day events such as motorcycle races or endurance horse rides.

The BLM currently issues two annual use permits, both of which are for equestrian trail rides. One permit is held by Equine Management, which operates out of the Eagle Crest Resort, west of Redmond. The other is held by Rock Springs Guest Ranch, which operates from private land near Tumalo. In addition to these permits, several other fishing and hunting guide permits are issued in the planning area.

There has been a marked increase in the number of permits requested over the last several years, and in the number of commercial entities who are operating without a permit on BLM administered lands. Permit requests have come from many groups, including mountain bike guide services, equestrian guide services, schools and recreation districts, and race organizers. The Deschutes National Forest currently has about 27 recreation Special Use Permits (SUPs) for outfitter/guide services (personal conversation, Mark Christianson, USFS). The BLM currently manages very few permits. Many new permit requests are for activities in the Steelhead Falls WSA and Badlands WSA. The issuance of these permits for commercial use within a WSA requires that the BLM conduct an environmental assessment (EA). The time and staffing requirements to prepare EAs has led the BLM to deny such permit requests.

Transportation and Utility Corridors

Transportation Systems

Within the planning area, especially around Redmond and La Pine, the boundary of urban development extends to adjacent BLM administered lands. Therefore, growing communities rely on the adjacent BLM administered lands for expansion needs. In the future, BLM administered lands may be needed to provide for expanding infrastructure including new highways and by-pass roads around urban areas.

There are a variety of roads on BLM administered lands, ranging from primitive roads or ways to arterials such as major highways. A primitive road or way is not maintained to guarantee regular and continuous use. Resource roads carry very low volumes and are normally spur roads that provide point access. Local roads serve a small area, receive low traffic volumes, and generally serve only a few uses. Many of these roads in the planning area were not constructed and are considered user created travel ways.

Generally, user-created roads do not provide connectivity to specific destinations. Collector roads normally provide access to large blocks of public land and connect with or are extensions of public road systems. Collector roads receive moderate traffic

volumes and accommodate mixed types of traffic and uses. Arterials are State highways or major county roads designed to accommodate mixed types of traffic and serve many uses. They receive high volumes of traffic and safety, comfort and travel times are primary road management considerations.

BLM administered lands are currently accessible from a wide variety of roads including, state highways, county roads, local roads, and public ways. The network of BLM collector roads provide widespread access to BLM administered lands provides administrative access for authorized uses, various casual uses, and opportunities for dispersed recreation throughout the area.

Maintenance/Jurisdictions

There are no interstate highways in the project area. The ODOT has responsibility for the following highways in Central Oregon that cross BLM administered lands:

- U. S. Highway 97, the main north/south route through the center of the state is designated as an expressway. An expressway is a multi-lane highway that is designed to provide for safe and efficient high speed and high volume traffic movements for both inter-urban and intra-urban travel. Expressways are a subset of Statewide Regional and District Highways. Segments of this highway are currently being considered for expansion or relocation, which may affect adjacent BLM administered lands.
- U. S. Highway 20, the main east/west route through the center of the state, is designated as an expressway within the project area. It is currently being considered for widening between Bend and Sisters.
- State Route 126, the connector between Sisters, Redmond, and Prineville, is considered for expressway status. ODOT is planning to install passing lanes on segments between Redmond and Prineville. A two-mile segment of the highway located east of Redmond may have to be relocated through the adjacent BLM administered lands to avoid the runway protection zone for the Redmond Airport.
- U. S. Highway 26, from Madras through Prineville, does not cross BLM administered lands except for one parcel located near Ochoco Reservoir.
- State Route 27, from Prineville to Bowman Dam to U.S. Highway 20 near Millican, is the only remaining State Highway with segments of gravel surface. It maybe considered for exchange of jurisdiction with Crook County for the Millican – West Butte Road.
- Powell Buttes Highway is a State Highway from State Route 126 to the Crook county line, and a Deschutes county road to U. S. Highway 20.

Recent legislation has provided for a transfer of the West Butte Road (BLM Road 6520), to the respective county jurisdictions. The road extends south from the “Four Corners” area to Highway 20, a distance of approximately 14.7 miles, with segments in both Crook and Deschutes County. Four Corners is the intersection of the subject road with the Prineville Reservoir road. The counties plan to improve the road to a paved highway standard and may eventually convey jurisdiction to the State.

There are approximately 151 miles of BLM roads in the planning area that are maintained for administrative purposes. Roads are maintained at various levels, depending on maintenance needs and funding. Maintenance levels reflect Transportation Management Objectives for planned management activities.

Maintenance levels and standards on individual roads vary from a minimum standard road such as a local or resource road that is not maintained on a regular basis, to a surfaced road. Road surfaces include native soil, cinders, crushed rock, pit run gravel, oil applied to crushed rock, and asphalt paving.

County jurisdictions have identified so-called "Historical roads" from research gathered from historical records. These roads provided a transportation network for early settlers and continue to be recognized by the county as public roads. Historical roads are not necessarily improved or maintained by the county. A formal vacating process is necessary if the county chooses to abandon the road. It is assumed that these roads were developed on un-appropriated public land before 1976, under the authority of Revised Statute (RS) 2477. By this law Congress provided, "The right of way for the construction of highways over BLM administered lands, not reserved for public uses, is hereby granted." These rights were to have been established in accordance with State law. It was not necessary at the time to obtain further review by the federal government. Records about historic roads are usually found in state or county records or other historical documents.

Transportation planning is accomplished as an inter-regional coordinated effort between federal, state, and local governments to support links between communities. Crook, Deschutes, Jefferson, and Klamath Counties have roads on public land throughout the planning area. County roads are public roads that are maintained by the county and accepted by the County Commissioners. A public way is dedicated by the county to the public but is not necessarily maintained by the county. County roads and certain county public ways have been authorized to extend through BLM administered lands with a right-of-way grant under the provisions of FLPMA.

Commercial development in Redmond has extended along both sides of Highway 97 and a highway interchange has been constructed at Yew Avenue. Because of increasing traffic and development, this and other intersections along Hwy 97 near Redmond are expected to fail in the next few years.

The Yew Avenue interchange was constructed approximately ten years ago to address congestion problems at the intersection of US 97 and Yew Avenue. Since then, the Deschutes County Fairgrounds, a large retail center, two motels, a restaurant and a car wash have located near the interchange increasing demand and congestion in the interchange area. The congestion that occurs at the Yew Avenue interchange during a medium to large event held at the Deschutes County Fairgrounds is a concern. Another concern is traffic congestion that may cause motor vehicle back up over the at-grade railroad crossing on Airport Way, just east of the Yew Avenue interchange.

ODOT in conjunction with the South Redmond Collaborative Planning Team is evaluating several proposals for highway improvements in the south Redmond area. In January 2003, ODOT completed the "Yew Avenue to Deschutes Market Road Analysis for the City of Redmond." The preferred alternative includes the extension of 19th Street south to a proposed interchange at the US 97/Quarry Road intersection with an extension four miles south to the existing Hwy 97/Deschutes-Market road interchange.

Utility and Road Rights-of-Way

The BLM grants federal, state, and local governmental agencies, companies, cooperatives, and private individual's rights-of-way to develop necessary transportation, utility systems through BLM administered lands. A right-of-way grant is an instrument that authorizes the use of BLM administered lands for specified purposes, such as roads, utility lines, communication sites and energy development sites (See Section 501, 43 USC 1761).

Regional Right-of-way Corridors

A right-of-way corridor is an existing alignment that has been identified as a preferred location to accommodate similar or compatible projects. Public land law directs BLM to minimize adverse environmental impacts by avoiding the proliferation of separate rights-of-way and using rights-of-way in common, to the extent practical (Section 503 (43 U.S.C. 1763).

At the present time there are approximately 200 miles of regional corridors identified by the Western Utility Group that extend through BLM administered lands in the planning area. Corridor routes identified by the Western Utility Group are designated in this land use plan and include routes for electric transmission lines and natural gas pipelines. Future development of these corridors would be subject to environmental review based on a specific proposal.

Rights-of-way for Communication Sites

There are three existing communication sites located in the planning area, shown in Table 3-15. Uses at these communication sites include government agencies that provide emergency services and two-way radio communications, commercial telecommunication providers, and multiple user facilities that are independently managed by a right-of-way holder. These sites are exclusively for low power use and high power broadcasting is strictly prohibited. There is adequate space available at these sites to accommodate additional users during the next 10 to 15 year period. There is currently space available within existing facilities, as well as land area for additional new construction, if necessary.

As the population of the region grows, it is anticipated that the demand for high elevation sites may increase slightly, however the demand for low elevation sites, especially cell phone towers, is expected to increase significantly. The demand for cell tower locations along transportation corridors will increase to provide improved coverage for cell phone users. Antennas for cellular telephones can co-locate on existing utility structures and are capable of sharing structures with multiple providers.

Rights-of-way for Energy Development

A right-of-way is used to authorize sites for wind and solar energy projects. The President's National Energy Policy requires that BLM increase and diversify the sources of both traditional and alternative energy resources, improve the energy transportation

Table 3-15. Communication Sites

Site Name	Legal Description	Elevation	Designation
Grizzly Mountain	T. 13 S., R. 15 E., S. 17, SE $\frac{1}{4}$	High	Low Power – Broadcast
Cline Buttes A	T. 15 S., R. 12 E., S. 21, SW $\frac{1}{4}$ NE $\frac{1}{4}$	Low	Low Power
Cline Buttes B	T. 15 S., R. 12 E., S. 21, SE $\frac{1}{4}$ NW $\frac{1}{4}$, N $\frac{1}{2}$ SW $\frac{1}{4}$	Low	Government Only Air Navigation Site FAA Withdrawal

network and ensure sound environmental management. This integrated policy approach requires BLM to ensure that there is a sufficient means to both develop energy resources and transport energy supplies in an effective manner while still maintaining current environmental standards and good stewardship principles. It is BLM policy to consider the need for the production and distribution of energy and to encourage the development of renewable energy sources in acceptable areas (USDI-BLM, Washington Office Instruction Memorandum No. 2002-196).

BLM and the National Renewable Energy Laboratory (NREL) have established a partnership to conduct an assessment of renewable energy resources on BLM administered lands. The objective was to identify planning units with the highest potential for development of renewable resources. A team of BLM and NREL representatives have established screening criteria to use in identifying suitable locations and have classified the wind and solar resource potential of lands in the eleven western states (USDI, Bureau of Land Management and U.S. Department of Energy. 2003).

According to NW Sustainable Energy for Economic Development (NWSEED), the resource potential for wind energy development in the planning area is rated as poor to marginal with the exception of the upper portions of Grizzly Mountain, Horse Ridge, Powell Buttes and West Butte, which are rated as fair. Regional utility corridors are located in the immediate vicinity of these topographic highs and could provide the necessary infrastructure to market the resource. At this time, there are no pending applications or wind energy developments on BLM administered lands within the planning area.

Solar energy is used to produce electricity in two ways. Photovoltaic systems produce electricity directly from sunlight whereas solar thermal technologies collect heat energy from the sun on a large utility-scale to generate electricity. The National Renewable Energy Laboratory (NREL) created a solar assessment for the U.S. with a resolution of approximately 40 km x 40 km. According to this assessment, the Concentrating Solar Resource (CSR) in the planning area averages 5 kWh/m²/day, which is higher than the national average of 4 kWh/m²/day (Oregon Office of Energy, 2003). This is more than enough for operation of individual residential photovoltaic systems. No solar energy developments are present on BLM administered lands within the planning area and no applications have been filed for any developments.

Summary

During the period the Brothers/La Pine RMP has determined the management of BLM-administered lands in the planning area, 1989 to the present, an average of about 25 new rights-of-way per year were granted. There are approximately 742 local utility and transportation right-of-way grants in the planning area that extend 780 miles through public land. These include rights-of-way corridors and communication sites that may contain more than one project. Most rights-of-way were granted to provide access or utility service through BLM administered lands and include roads/driveways and electric/telephone service. There has been no interest expressed by industry for solar or wind energy development in the planning area.

Land Ownership

In the past, Central Oregon land patterns contained centralized urban areas where locally produced forest and agricultural products were collected, processed, and distributed. For example, trees were logged and shipped from the forests to the towns where they were processed into lumber. Ranches were large and for the most part self-contained. Many of

the larger ranches have been broken-up. Modern transportation systems provide for fast transition from the agricultural lands to the urban lands and have blurred the rural/urban distinction. People often hobby farm or use their rural lands to supplement income from their city jobs.

Where once small towns were surrounded by agricultural lands, the perimeters of some towns and cities are surrounded by subdivisions and hobby farms with limited amounts of large scale agriculture taking place between the urban settings and BLM administered lands (see Map 1).

Adjacent or in close proximity to most of the towns and service centers are subdivisions, collections of 2, 5, 10, and 20 acre lots with homes and mini-farms or ranches. The density of dwellings have increased adjacent or in close proximity to all the towns and service centers. One such subdivision is Crooked River Ranch in southern Jefferson County.

Large blocks, about 4,000 acres or larger, of BLM-administered lands are located within the planning area, which are often adjacent to larger blocks of BLM administered lands also administered by BLM or USFS lands that are outside the planning area though still within the counties.

Crook County comprises about 1,914,240 acres, of which about half is BLM administered lands. Deschutes County is about 1,955,200 acres, of which about 80 percent is federal land. The BLM manages 54 percent of the federal land in Crook County, and 31 percent of federal land in Deschutes County.

Larger blocks of BLM administered lands, either BLM or Forest Service, are within a few miles of all the cities and communities, thus, readily available to the public. Smaller blocks of BLM administered lands are often closer to these cities and often adjacent to the communities.

Smaller blocks of BLM administered lands administered by BLM are scattered throughout the planning area; however, there are concentrations located near Grizzly Mountain north of Prineville, between Prineville and Prineville Reservoir, northwest of Redmond, and around La Pine/ Wickiup Junction. These concentrations of smaller blocks may be part of a larger block of BLM administered lands, for example, all BLM administered lands around Crooked River Ranch. Otherwise, the concentrations may be isolated parcels amid private lands, for example, the parcels southeast of Prineville. These isolated parcels were often located in agricultural areas, as part of a larger open rangeland, but these pockets are becoming surrounded by subdivisions now, and, as a consequence, they are becoming isolated from availability to the general public.

Withdrawals

Some lands managed by the BLM have been withdrawn within the planning area. Withdrawals have occurred in order to transfer total or partial jurisdiction of federal land between Federal agencies, and to segregate (close) federal land to some or all of the public land laws or mineral laws, or to dedicate land for specific public purposes.

The planning area has existing withdrawals for military training activities at a site 2 miles southeast of Redmond and at a site 8 miles east of Bend, for two exchanges, and for numerous public water reserves and power development purposes primarily along the Deschutes and Crooked Rivers. Under a withdrawal, the future uses of the lands would be determined by the entity for which the land was withdrawn. That entity (e.g. Army Corps of Engineers for the Oregon Military Department) has control over the land until they relinquish the use of the lands or BLM determines that the use of the lands requested in the withdrawal were no longer being used for the intent described in the withdrawal.

Leases and Permits

Temporary land use permits or leases may be used to authorize such activities as trespass prior to resolution, access, storage, apiary sites, National Guard or military reserve training, engineering feasibility studies, and other miscellaneous short-term activities.

Two to four permits are issued annually for photography and film, although the number of requests is typically greater.

Military training has occurred on 31,000 acres southeast of Redmond since the late 1930s (See Oregon Military Training Use under Land Uses). The BLM and the military are discussing the option of permitting training under a long-term lease. Temporary authorizations differ from withdrawals in that the permitted use is short term, the BLM retains administrative responsibility for the lands, and few or no permanent facilities are permitted.

The Recreation and Public Purposes Act

The Recreation and Public Purposes Act (R&PP) authorizes the sale or lease of BLM administered lands for recreational or public purposes to State and local governments and to qualified nonprofit organizations. In the planning area, R&PP has been used for sewage treatment facilities in Bend, Redmond, and La Pine; golf courses, libraries, parks, and shooting ranges. In the future, it is anticipated that R&PP will be used for sewage treatment facility expansions, municipal parks, expansion of state parks, and public buildings such as fire stations or schools.

In 1995, Central Oregon Shooting Sports Association (COSSA) leased approximately 450 acres of public land for use as a public shooting range. The range is located immediately north of U.S. Highway 20 near the Millican town site. The site is managed as a shooting range by COSSA, with BLM oversight. While the site remains open to the public, and is extremely popular for organized group events, it generally does not draw casual, daily use from surrounding populations, such as Prineville, Redmond, Terrebonne, or Crooked River Ranch.

The Bend Aero Modelers Club was granted an R&PP lease in 1999 for a 5.75 acre site northwest of Dry Canyon and immediately north of U.S. Highway 20. This site is used for operation of gas powered model airplanes.

Public Health and Safety

Firearm Discharge

Over the past decade the increase in residential development adjacent to BLM administered lands in Central Oregon has multiplied the number of people shooting firearms, the total number of people recreating, and the number of people living near BLM-administered land. It has also increased the number of complaints about firearm discharge. While both target shooting and hunting occur throughout the planning area, many site-specific conflict areas have been identified through complaints from adjacent landowners, and other BLM land users. In other cases, target shooting areas have become a problem due to the amount of debris left behind by target shooters, including shell casings, plywood, paper targets, bottles, metal debris, and miscellaneous trash. While many target shooters are highly conscientious about minimizing their impact on public land, the intense use of an area for target shooting often leaves the area strewn with garbage and with juniper trees cut in half by repeated gunfire. These conditions do not facilitate appropriate recreational opportunities.

Illegal Dumping

Illegal dumping in the planning areas has, and continues to be, a serious management issue. While abandoned vehicles are perhaps the most noticeable debris being dumped, the dumping includes residential, commercial, industrial and hazardous waste. Additionally, large quantities of animal remains can be found on Central Oregon's BLM administered lands, left by pet owners, ranchers and area hunters. The foremost danger from this waste is the risk to human health, especially in relation to hazardous wastes. BLM has already conducted hazardous waste responses to paints, used fuel/oil, asbestos, batteries (lead), medical wastes (needles and sharps), wire burns and methamphetamine lab waste within the planning area. These have averaged about two per year, but are expected to increase in frequency with an increase in human populations. Other concerns include degradation of visual resources, and recreation opportunities. Indirectly, the existing waste is contributing toward the dumping of additional wastes because violators feel dumping is more acceptable in areas with existing waste. Discarded trash is commonly used as a target by target shooters, further breaking the existing waste up into smaller pieces, and lowering expectations of all BLM land users. The illegal dumping is more prevalent where there are numerous dirt access roads and it is relative easy to drive out of sight and dump debris. These sites are usually within a quarter to one-half mile off the pavement. Concentrated areas of public land dumping occur outside Redmond, Bend, La Pine, Prineville and Terrebonne/Crooked River Ranch. Particular problem areas include the following BLM administered lands (See Map S-17, Illegal Dumping Areas):

1. South of Prineville along Millican Road;
2. South of Prineville at Juniper Canyon;
3. South of Prineville off Remington Road;
4. South of O'Neil Highway and west of the North Unit Canal
5. East of Redmond and west of the North Unit Canal;
6. South of Redmond along Airport Avenue;
7. Northeast of Bend off Powell Butte Highway;
8. Immediately north and south of Alfalfa Market Road;
9. Barr Road in the southern portion of Cline Buttes
10. Lands at the State Highway 126/Barr Road/Buckhorn Road intersection;
11. Steamboat Rock area west of Terrebonne and South of Crooked River Ranch; and
12. Numerous locations in La Pine.

Campfires

Campfires are a concern because they increase the risk of wildland fire. The tremendous population growth in Central Oregon has magnified the risks of wildland fire, both to communities at risk, and to BLM administered lands. Undesired effects of these fires include threats to human life, property, and natural and cultural resources. These threats are especially significant in urban interface areas synonymous with much of the planning area, where high densities of people and residences can be found (See Fire Section).

From a recreation opportunity perspective, campfires are not appropriate in specific areas within the planning area. Special areas, including RNAs, ACECs, and other highly visited, highly developed sites, are generally managed for research and interpretation. In addition, trailheads and staging areas are not appropriate for campfires because they are inherently congested areas where any additional activities have an increased likelihood of resulting in increased user conflicts.

BLM Law Enforcement Authority

Currently BLM law enforcement rangers can only enforce limited Oregon state and local

laws. This limited authority reduces BLM law enforcement's effectiveness, hampering efforts to efficiently and effectively address violations on BLM-administered land. These limitations also require increased time and support from state, county, and city law enforcement officers, and diminish the level of public health and safety on BLM-administered lands.

Archaeology

Prehistoric/Historic Resources

Archaeological resources are fragile, non-renewable resources. Many natural processes and human activities have an adverse effect on the condition and integrity of archaeological resources. However, most processes, with the exception of wildfire, flooding, or where initiated by human activities, generally result in slight to moderate damage. In these cases, most impacts can be mitigated before substantial damage occurs. In contrast, human activity can rapidly and irreversibly damage archaeological resources, contributing to the diminishment of the resource base (BLM, 2000:6).

Cultural resource surveys have been conducted over approximately 22 percent of the total planning area. Those surveys have resulted in the documentation of hundreds of prehistoric and historic sites that represent a broad spectrum of past human activity within the area. Documented sites include, but are not limited to: lithic scatters; rock features; temporary prehistoric camp sites; rock art; remnants of homestead cabins; segments of historic trails; roads and canals; and landscape settings linked to ranch houses, corrals, barns and animal husbandry. Despite what is known about the number of documented sites, few of those recorded sites have been evaluated for their significance or their eligibility to the National Register. Evidence indicates that numerous other sites remain within the planning area remain to be discovered and recorded.

The integrity of these resources is currently threatened by a variety of causes. Some causes, such as natural weathering and erosion, gradually deteriorate archaeological resources. Others, such as natural or human caused fire or vandalism and theft, can destroy archaeological resources in a matter of minutes.

Human activities that can directly or indirectly affect the archaeological resource base include urban development, authorized commercial activities, recreational uses, military maneuvers, livestock grazing, and target shooting. Efforts to increase public awareness about the significance of archaeological resources and laws protecting them have failed to eliminate illegal artifact collecting and vandalism of these resources. Despite some convictions for violations, present law enforcement efforts aimed at stopping the vandalism at prehistoric/historic sites have not eliminated intentional removal or destruction of archaeological resources. It is expected that the incidence of illegal artifact collecting and vandalism will increase as the population in the area grows and increasing numbers of individuals make use of BLM administered lands.

Despite the many ways human activities can diminish the archaeological base, sites also exist across the planning area that maintain good to excellent integrity (Hall, 1994: 118; Oetting, 1997a: 105; Oetting, 1997b: 80; Ellis, et. al., 2000). Some are associated with historic events, important persons, contain engineering features and/or could yield significant information to our understanding about past human lifeways (Ellis et. al, 2002:48). Research questions that information from such sites could answer include those related to settlement and subsistence, demography, technology, exchange and external relations, chronology, paleo-environments, or site formation processes (Houser, 1996:37-48).

Cultural Resources (National Register Sites /Historic Properties)

National Register Sites, or historic properties, are defined as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register of Historic Places, including artifacts, records, and material remains related to such a property or resource” [16 U. S. C. 470w(5)]. Eligibility for inclusion to the National Register is determined by criteria established by the National Historic Preservation Act of 1966 as amended. Historic properties that are included, or eligible for inclusion, in the National record are those that are considered unique, provide information important to the study of history or prehistory, and/or are associated with important events or persons that have made contributions to the broad patterns of our history.

Currently, none of the cultural resource sites identified and evaluated within the planning area are listed on or considered eligible for inclusion in the National Register. However, many of those sites have not been fully evaluated to determine their eligibility potential. Furthermore, evidence indicates that numerous other undocumented sites exist in areas that have not been surveyed yet. Therefore, evaluations of known sites, combined with additional surveys and/or site testing, are necessary to provide more complete information about the prehistoric and historic use of the area, as well as National Register site eligibility.

Traditional Cultural Property (Traditional Uses)

A Traditional Cultural Property (TCP) is a place that is eligible for inclusion to the National Register of Historic Places because of the significant role the property plays in a living community’s historically rooted beliefs, customs, and practices (Parker and King 1994:1). Currently, there are no traditional cultural properties that have been identified within the planning area. However, identification of those properties cannot be effectively accomplished without consulting with the groups and individuals who have special knowledge about, and interests in, the history and culture of the area. In view of those considerations, the existence of traditional cultural properties within the planning area will remain unknown until the appropriate level of background research, fieldwork and tribal consultation has been completed.

Plants of Cultural Significance to Contemporary Indian People

Three federally recognized Indian tribes reside in Central Oregon; the Confederated Tribes of the Warm Springs Reservation of Oregon, the Klamath Tribes, and the Burns Paiute Tribe. The federal government, through treaties, congressional acts, court cases and executive orders has acknowledged its role and responsibility in consulting with Indian Tribes when federal actions may affect areas of traditional cultural significance (Hanes 1995:27-29). In keeping with the spirit of that obligation, the BLM recognizes that local Indian Nations have recognized interests to harvest a broad range of plant species found on BLM administered lands. Access to, and availability of, those species is considered by Indian governments a trust responsibility of the federal government. A number of “cultural plant” species occur within the planning area. Cultural plants are defined as those plants which are used by Native Americans for subsistence, medicinal, utilitarian, economic or ceremonial purposes (Hunn *et al.*, 1998:526- 536). See Table 3-16: Cultural Plants, for a list of culturally used plants that occur in and around the planning Area.

Table 3-16. Cultural Plants Occurring In and Around the Upper Deschutes Planning Area

Scientific Name	Common Name	Habitat
<i>Allium</i> species	Wild onion	Dry hillsides.
<i>Amelanchier alnifolia</i>	Serviceberry	Open woods; hillsides; riparian
<i>Apocynum cannabinum</i>	Dogbane (Indian Hemp)	Wet hillsides; riparian
<i>Archilea millefolium</i>	Yarrow	Sandy, lithic soils
<i>Artemesia tridentata</i>	Sagebrush	Numerous
<i>Balsamorhiza</i> species	Balsamroot	Dry hillsides
<i>Calochortus macrocarpus</i>	Sego Lily or Mariposa Lily	Sagelands, volcanic soils
<i>Camassia quamash</i>	Camas Meadows	moist areas; riparian
<i>Cerearpus ledifolius</i>	Mountain Mahogany	Dry hillsides and ridge tops
<i>Cornus stolonifera</i>	Red Osier Dogwood	Riparian
<i>Elymus cinercus</i>	Great Basin Wild Rye	Damper soils in sagelands
<i>Fritillaria pudica</i>	Yellowbell	Lithic or sandy soils
<i>Juniperus occidentalis</i>	Juniper	Hillsides, ridges, riparian
<i>Lewisia redivia</i>	Bitterroot	Lithic soils
<i>Lomatium canbyi</i>	Canby's Desert Parsley	Lithic soils
<i>Lomatium cous</i>	Biscuitroot	Lithic soils
<i>Lomatium macro.</i>	Gray-leaf Desert Parsley	Lithic soils
<i>Lomatium nuducauli</i>	Desert Celery	Lithic soils
<i>Perideridia</i> species	Yampah or Ipos	Meadows, grasslands, scabflats
<i>Prunus virginiana</i>	Chokecherry	Moist areas
<i>Rosa</i> species	Rosehips	Sunny openings, riparian, talus slopes
<i>Ribes</i> species	Golden Currant, Rock Currant	Riparian, moist areas on hillsides
<i>Salix</i> species	Willow	Riparian
<i>Sambucus canadensis</i>	Elderberry	Riparian

(Plants of cultural significance courtesy of The Burns Paiute Tribe and the Confederated Tribes of Warm Springs, Ordinance 68)

At-Risk Significant Archaeological Resources

At least six At-Risk significant archaeological resources have been identified within the planning area. These are Horner Road, Tumalo Canals, Redmond Caves, Bend-Prineville Road, Pictograph Cave, and Steelhead Falls. Three of those sites, Horner Road, Tumalo Canals, and the Bend-Prineville Road are considered eligible to the National Register for their association with events that have made significant contributions to the broad patterns of local history. Although the other three sites have not been evaluated for their significance, it is likely that they would yield important information about prehistoric lifeways or are significant to local Indian tribes for their sociocultural values. It is likely that other significant archaeological resources that have not yet been discovered, documented or evaluated are at risk from various natural and human caused threats.

Human Activities

Human activities that are currently affecting and have the potential to impact identified “at-risk” resources are as follows:

Horner Road and the Bend-Prineville Road are historic roads located between the communities of Redmond and Bend that were developed during the late nineteenth and early twentieth centuries. In total, the roads have over one hundred historical elements that contribute to their integrity and significance. The roads are currently at risk from permitted military activities, adjacent road development, and unmanaged recreational uses. Those activities have contributed to soil compaction and displacement, damage to minor engineering features, and vandalism. Disposal of trash along the roads has also become a problem. During the early 1990s an area along one of the roads was opened to woodcutting and an unknown number of historic features were destroyed.

Redmond Caves are five lava tube openings on a 40-acre parcel administered by the BLM but located within the boundaries of the City of Redmond. Evidence indicates that the location may contain important information about prehistoric lifeways. Local Indian tribes have also implied that the area may be significant to them for its sociocultural values. The area is a popular location for teenage parties and unmanaged recreational uses such as OHVs, mountain bikes, camping, cave exploration, paintball competitions, and geocaching. Disposal of trash is a problem in the area. Those activities have resulted in soil compaction, erosion, surface disturbance, vandalism and artifact collecting. Illegal use of campfires within caves is causing a build-up of soot on cave walls and ceiling areas.

Tumalo Canals are a segment of historic canals located between the communities of Redmond and Sisters that were developed during the first decades of the twentieth century. The irrigation system includes berms and troughs, raceways, diversion structures and other engineering features that contribute to the system’s integrity and significance. The canals are currently being impacted by livestock grazing and unmanaged recreational use such as horseback riding and OHV use. These activities have caused canal sidewalls to collapse and erode and soil in berms to be displaced and compacted. In some instances, historic features have been used as shooting targets.

Pictograph Cave is an unevaluated, collapsed lava tube cave that may possess important information about prehistoric lifeways. Local Indian tribes have also implied that the area may be significant to them for its sociocultural values. Currently unauthorized motorized vehicle access, rock climbing and improper cave uses are affecting the site. Unauthorized motorized use has compacted soils and displaced artifacts, visitors to the site have developed a number of user created trails, and climbers and their climbing apparatus threaten cave resources. It is likely that artifact collecting has also occurred.

Steelhead Falls is an unevaluated rock art panel between the communities of Redmond and Sisters that may possess important information about prehistoric lifeways. Unmanaged public use of the area has contributed to vandalism and user created trails.