4 REFERENCE CONDITIONS

4.1 AQUATIC SPECIES AND HABITAT

4.1.1 Water Quality

4.1.1.1 Water Temperature

No information is available on natural or reference water temperatures for streams within the Canyon Creek watershed. As discussed in *Chapter 3*, several streams within the watershed are listed as water-quality limited for water temperature, including the East Fork Canyon Creek within the Strawberry Mountain Wilderness. Current water temperature standards are based on the biological requirements of cold-water fish, not on the physical processes (e.g., elevation, groundwater influence, geomorphic stream characteristics, potential stream shading) that control water temperature. Consequently, current water quality standards are poor indicators of reference conditions with respect to water temperature. The U.S. Geological Survey is currently working on models that will help estimate natural, or reference, maximum water temperatures in small streams in western Oregon (USGS 2003). The current work involves developing neutral network models that are capable of describing the complex nature of natural systems. Similar studies are needed for Eastern Oregon streams to better understand reference water temperatures.

One of the principal factors affecting water temperatures is riparian shading. Current shade levels are reported in *Chapter 3* of this report. Based on estimated historic or reference riparian vegetation conditions (reported elsewhere in this chapter), it is reasonable to assume that historic riparian shading was probably higher.

One final factor that undoubtedly had a strong historical influence on stream temperatures in the Canyon Creek watershed is beaver. Anecdotal evidence suggests that beaver were abundant in the watershed prior to the arrival of fur trappers in the area. The hydrogeomorphic effects of beaver ponds has been well-documented (e.g., Meentemeyer and Butler 1999). Beaver dams trap sediment, reduce water velocity, and can redistribute water as hyporheic flow. However, by removing sediments, beaver dams also have the potential to increase the erosive potential of streamflow downstream of the dams. With respect to water temperatures, the conventional wisdom has been that beaver ponds raise water temperatures through increased surface area, often accompanied by a reduction in riparian shading. Recent work in Bridge Creek, a tributary of the John Day River near Mitchell (Lowry and Beschta 1994) suggests that the net effect of beaver dams may be to lower water temperatures by increasing bank storage, which leads to increased base flow levels.

4.1.1.2 Sedimentation

4.1.1.2.1 Surface Erosion

No quantitative estimate of natural, or background, surface erosion is available for the Canyon Creek watershed. Surface erosion potential has been mapped for all NFS lands within the Canyon Creek watershed (Map 3.6). Surface erosion potential within the watershed is highest in the Vance Creek subwatershed and lowest in the Middle Fork Canyon Creek subwatershed (Figure 4.1).

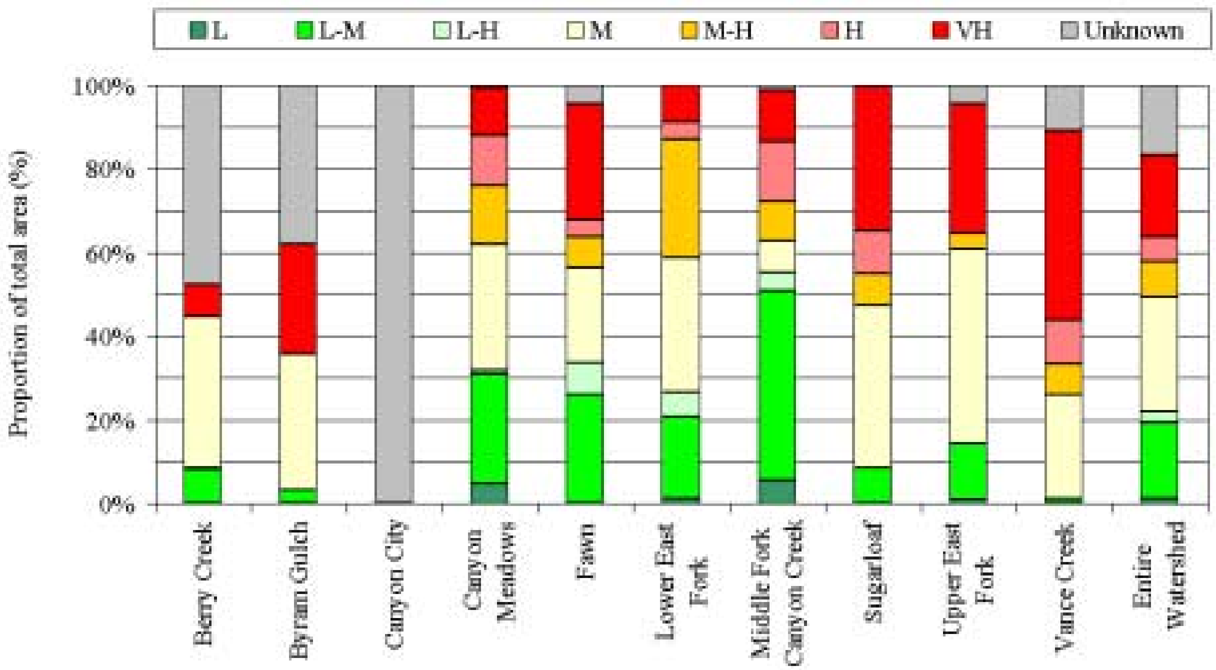

Figure 4.1. Summary of surface erosion potential within the Canyon Creek watershed.

Actual rates of surface erosion that occurred on any given unit of land would have been a function of both the erosion potential, and the sources of disturbance that were present. The relative difference between current and historic surface erosion can be assessed by evaluating changes in the disturbance sources. The two primary disturbance mechanisms that would have contributed to sediment production prior to European settlement were wildfire and grazing.

Wildfires within the watershed would have had a higher frequency of occurrence prior to European settlement of the area, but fires would generally have been of lower intensity than under a fire-suppression strategy. Sediment inputs would probably have been more frequent due to this fire pattern but would have been short-lived as vegetation returned quickly to the burned areas. Historically, there was no cattle grazing within the watershed and sediment delivery due to disturbance by cattle would have been non-existent. However, large elk or deer populations would have created similar disturbance, although the relative magnitude of the associated sedimentation is unknown.

4.1.1.2.2 Mass Wasting

As described in *Chapter 3* of this report, current rates of mass wasting appear to be very low within the Canyon Creek watershed and do not appear to be management-related. Although no quantitative data is available, it is unlikely that historic mass wasting rates were much different than under current conditions. The areas containing currently-active deep-seated failures are located in close proximity to mapped Holocene-Pleistocene landslide and debris-flow deposits within the watershed (Map 1.2).

4.1.2 Water Quantity

4.1.2.1 Low Flows

Historic patterns of low flow within the watershed are unknown. However, there are several factors that could have resulted in relative differences between historic and current conditions.

Regional climate trends were discussed in *Chapter 1* of this report. Results of that analysis indicate that a relatively warm/dry period appears to have prevailed from at least the late 1800s through the late 1930s. This in turn was followed by a relatively cool/wet period that lasted through the mid-1980s. Similar cyclical patterns undoubtedly existed in the region prior to climatic record keeping. The majority of stream flow data available for Canyon Creek and vicinity is from this relatively cool/wet period. Consequently, average low flow conditions may be somewhat lower than has been recorded locally.

As discussed in *Chapter 3*, low flows would be expected to vary in response to watershed-scale vegetation conditions. If forest vegetation was historically less dense than it currently is, due to a higher fire frequency, then relatively higher low flows would be expected historically, given lower evapotranspiration.

As discussed in *Chapter 3*, there has likely been (although not yet quantified) a loss of wetlands within the watershed, due to stream incision and down-cutting. A greater area of wetlands historically would have resulted in greater water storage within wetland areas, and relatively higher summertime flows relative to current conditions.

The final factor that historically would have resulted in higher summertime flows was the abundance of beaver within the watershed. As discussed above, beaver dams have the potential to redistribute water as hyporheic flow, which increases bank storage and results in increased base flow levels.

4.1.2.2 Peak Flows

As discussed in *Chapter 3*, the density of the forest canopy influences snow accumulation and melt rates during rain-on-snow peak flow events. Conceptually, to the extent that forested areas within the watershed were more open (due to a higher fire frequency), one would expect peak flows to have been historically higher then they currently are. The actual difference between current and historic peak flow magnitudes has not been evaluated.

4.1.3 Physical Stream Channel Characteristics

Historical conditions of stream channels within the watershed are unknown. However, certain assumptions can be made about historical conditions based on current channel conditions. *Chapter 3* of this report identified the Rosgen level I steam classification for the principal streams within the watershed. The majority of the mainstem of Canyon Creek, and the lower mainstem of Vance Creek, were identified as currently being in a "gullied" condition. These areas are typified as having a low width-to-depth ratio, are incised in alluvial or colluvial materials, and are generally unstable with grade control problems and high bank erosion rates. Historically, these areas are expected to have been less incised with more stable banks and channels, having conditions typical of Rosgen type "C," and in some cases type "B" channels.

4.1.4 Riparian Areas

Prior to Euro-American settlement of the Canyon Creek area, riparian habit conditions were markedly different than they are today. The lower gradient streams and tributaries were most likely stable with abundant summer flow and high quality water. Heavy riparian cover made up of dense alder, willow, cottonwood, and some aspen stands helped to moderate high summer temperatures by providing shade (Wissmar et al. 1994). Periodically, trees from the dense canopy fell and contributed large wood to streams that helped to diversify and stabilize the channels. Large, deep pools were probably common in the streams and few barriers to fish passage other than beaver dams and waterfalls were present.

4.1.4.1 Beaver Activity

Channel complexity and quality was augmented through the work of beavers. Estimates of beaver populations prior to the 1830s range from ten to sixty animals/mile of stream (Parker et al. 1985). Beaver dams functioned to elevate water tables and enhance riparian vegetation development. These effects improved water quality by trapping nutrient and sediment runoff. Beaver ponds improved water storage and stabilized stream flow through drought periods and added cool water from bank storage during summertime. Fish directly benefited from beaver activity through use of deep pools and cool water refugia (Olson and Hubert 1994). Deep pools were also refugia for over wintering fish. Beaver populations began to be depleted as early as 1820 by fur trapper exploitation.

4.1.4.2 Aquatic Dependent Species

Like beaver, salmon and trout were abundant in the watershed. Prior to Euro-American settlement, an estimated 10 to 16 million salmonids returned annually to the Columbia River (Behnke 2002). Historically, the John Day River was one of the most productive anadromous fish-producing rivers in the Columbia River basin (CRITFC 1995). Today, the John Day River spring Chinook salmon and summer steelhead populations are two of the last remaining intact wild populations of anadromous fish in the Columbia River basin. Historically, spring Chinook salmon probably reared and spawned throughout the larger streams in the watershed. Steelhead/redband are found throughout the Canyon Creek watershed (*Chapter 3*). Current steelhead/redband population within the watershed is considered to be a fraction of the historic population (ODFW 2002). Although there appears to be no conclusive evidence, bull trout are believed to have once inhabited Canyon Creek and its tributaries. Bull trout prefer steeper, high elevation streams and tributaries which are plentiful in the watershed. Apparently, the last bull trout found in the watershed was in a trap during the 1980s (Edwards, pers. comm. 2002). Westslope cutthroat trout, now considered to be a resident form in Canyon Creek, may have once been a fluvial form migrating between tributaries within the watershed. Cutthroat trout populations within Canyon Creek watershed are known to be functioning at a much lower capacity than historic populations (Shepard et al. 2002). Because brook trout were historically absent from Canyon Creek, competition between these non-natives and native salmonids was historically not a factor in limiting populations.

4.1.4.3 Anthropogenic Disturbance

After the beaver were trapped out, settlers established homesteads and ranches on the river corridor, where fertile bottomlands could be farmed and water was available for irrigation and livestock. Though the intensity and history is unknown, cattle grazing near fish-bearing streams contributed to degradation of water quality and fish habitat.

The discovery of gold in Canyon Creek in 1862 resulted in rapid population growth and further disturbance to the aquatic ecosystem. Miners used two different methods for extracting gold: hard rock and placer mining. Hard rock mining left mine tailings piled across the hillsides, resulting in surface runoff from the tailings and increased sediment loading to the streams. Placer mining directly impacted streams and riparian areas because miners built trails and cleared riparian vegetation to access streams. Placer mining extracted alluvium directly from the channel and adjacent floodplain. Streams became contaminated with mercury used in the mining process. In-stream water levels were altered when water was used to pan and sluice gold from dirt in the alluvial deposits. Fish habitat was either degraded or destroyed by mineral extraction.

4.2 VEGETATION

No historical data were available to quantitatively describe the composition or structure of vegetation within the Canyon Creek watershed. The Historical Range of Variability (HRV) for upland forest types described for the Umatilla National Forest was utilized for reference conditions to describe the historical range of vegetation structure within the Canyon Creek watershed (Powell 1998). This classification and analysis was designed for land areas larger than 15,000 to 35,000 acres (Powell 1998). The following is an analysis of the HRV for the 51,878 acres of upland PVGs NFS lands, or the “analysis area,” of the Canyon Creek watershed. In assessing the HRV for the analysis area, the following general assumptions were made:

- The Historic Range of Variability (HRV) for the Canyon Creek watershed is similar to that of the Umatilla National Forest and accurately represents pre-1850s conditions (Powell 1998).
- Potential Vegetation Groups (PVGs) and plant association groups (PAGs) identified from analysis of aerial photographs are within an acceptable range of variability (*Chapter 3*).
- Forest structural classifications (i.e., OFSS and OFMS) have been similarly classified and described for the Canyon Creek watershed (*Chapter 3*) and for the Umatilla National Forest (Powell 2001).
- Forest structural classifications identified by aerial photograph analysis are within an acceptable range of variability (*Chapter 3*).

The objectives of this chapter are to describe the historic array and pattern of plant communities within the analysis area and to describe what processes defined these patterns for upland forest, riparian zones, shrublands and grasslands.

4.2.1 Upland Forests

4.2.1.1 Dry Upland Forests

Dry Upland Forests dominate the vegetation types in the study area, especially ponderosa pine plant associations. Historically, these forests had a single stratum of large, old trees (i.e., old forest, single stratum, OFSS) (Table 4.1). Two groups of ponderosa pine plant associations were present: warm-dry (e.g., ponderosa pine/pinegrass) and hot-dry types (e.g., ponderosa pine/mountain big sagebrush). Low intensity fires occurred frequently in these stands (fire regime I), limiting aboveground tree biomass, moderating and localizing the degrees of infection by insects and mistletoe, and maintaining relatively low levels of ground fuels. Typically, grasses or long needles would carry fire in these systems and the resistant bark of large ponderosa pine, western larch, and large Douglas-fir trees would promote “park-like” forest settings of large-diameter trees with minimal understory growth (Table 4.1).

Other warm-dry plant associations were present in the watershed, including Douglas-fir and warm grand fir forest types that were supported by a moderate-frequency, mixed-severity fire regime (fire regime III). Discontinuous patches of ground fuels and pathogens (particularly mistletoe) helped moderate fire behavior. Historically, these disturbances promoted an uneven mosaic of even-aged stands or stands that had experienced ground-based and crown fires within the same stand or in adjacent stands. As a result, the historic structure for the Canyon Creek watershed had sizable components of stand initiation (SI), stem exclusion (SEOC and SECC), young forest (YFMS), and old forest structures (OFMS and OFSS) (Table 4.1).

Table 4.1. Current and historic ranges of variability among structural classes for Dry Upland Forest types within Canyon Creek watershed with emphasis on analysis area.

Description	Structural class	Warm-Dry PAG		Hot-Dry PAG	
		Current	Historic	Current	Historic
Stand Initiation	SI	<1	5 –15	1	5 – 15
Stem Exclusion Open Canopy	SEOC	35	5 – 20	66	5 – 20
Stem Exclusion Closed Canopy	SECC	11	1 – 10	4	0 – 5
Understory Regeneration	UR	<1	1 – 10	<1	0 – 5
Young Forest Multi Strata	YFMS	26	5 – 25	20	5 – 10
Old Forest Multi Strata	OFMS	26	5 – 20	8	5 – 15
Old Forest Single Stratum	OFSS	<1	15 – 55	1	20 – 70
Bare Ground	BG	2	0	0	0

After Powell 1998.

Today these stands differ markedly from the expected historic range of variability. In general, the lower elevation ponderosa pine stands having OFSS structure comprise only a fraction of the land area (less than 1%) within the study area instead of the historic range of about 15% to 55%. Timber harvest targeted toward large-diameter trees as well as the disruption of frequent burning have resulted in higher proportions of young forest (YFMS) and stem exclusion (SEOC and SECC) stage stands. These stands tend to have increased stem densities and lower base to live crown heights, which contributes to an increased continuity of vertical fuels. It is expected the increased ground fuels and vertical fuels structure would result in a higher proportion of mixed- and lethal severity fires (crown fires), which are uncharacteristically severe for fire regime I stands.

Timber harvest has altered the historic structure and composition of dry upland forests. Targeting ponderosa pine and other commercial species has led to an increase in stocking levels of late seral species, particularly Douglas-fir and grand fir. These changes are evident in the watershed with higher levels of stem exclusion stage Douglas-fir/grand fir stands with few large-diameter ponderosa pines and western larch trees remaining in the overstory (less than 10% cover). The absence of fire in these stands has further promoted increases in shade-tolerant species and increases in conditions that support pathogens, particularly western dwarf mistletoe. Sanitation thinning without the addition of fire has been prescribed in areas where severe mistletoe infection has occurred, of which the effectiveness for long-term forest health has not yet been evaluated.

4.2.1.2 Moist Upland Forests

The historic disturbance regimes of Moist Upland Forests (i.e., cool grand fir and lodgepole pine communities) have promoted multi-strata forest (YFMS and OFMS), with post-disturbance patches of stem exclusion closed canopy (SECC) and understory regeneration phase (UR) (Table 4.2). These forests have historically undergone a series of complex interactions among beetle activity, disease, and fire at moderate to long return intervals. The combined effects of disturbance have promoted multi-cohort stands, not all of which are dependent upon fire (Agee 1994). A general description of this disturbance regime involves beetle attack of large trees followed by a high probability of stand-replacing fires because of increased fuels loading. The "jackstraw pattern" of large wood produced by beetle attacks also promotes smoldering ground fires which in turn encourage future beetle attacks. These complex interactions promote stands of multi-aged structure.

Table 4.2. Current and historic ranges of variability among structural classes for Moist Upland Forest types within Canyon Creek watershed with emphasis on the analysis area.

Description	***Structure class***	***Current Cool/Moist PAG***	***Historic Cool/Moist PAG***
Stand Initiation	SI	1	1 – 10
Stem Exclusion Open Canopy	SEOC	36	0 – 5
Stem Exclusion Closed Canopy	SECC	<1	5 – 25
Understory Regeneration	UR	0	5 – 25
Young Forest Multi Strata	YFMS	61	40 – 60
Old Forest Multi Strata	OFMS	<1	10 – 30
Old Forest Single Stratum	OFSS	1	0 – 5

After Powell 1998.

The current structure of Moist Upland Forests is within the expected range of young forest (YFMS) but well outside the expected range of other structural classes, especially stem-exclusion (SEOC), understory regeneration phase (UR), and old-forest structural stages (OFMS and OFSS) (Table 4.2). The extent of SEOC structure in moist forest types is evidence to the effects of timber harvest and fire exclusion. Overstocked conditions and the absence of moderate return-interval stand replacing fires have led to increased levels of insect and disease outbreaks (Powell 1994). Because stand-level survey and downed fuels structure data are not available, the extent and effects of management are not clearly understood for these forest types.

4.2.1.3 Cold Upland Forests

Cold Upland Forest types in the Canyon Creek watershed are located in the upper elevations (ca. 6,000 feet). These forests experience long to very long fire return intervals with near-complete stand-level mortality (fire regimes IV and V). Subalpine fir, cool grand fir, and lodgepole pine dominate this low productivity, community type. After fire, shrubs dominate and may persist for decades before tree re-establishment. At the timberline, whitebark pine is a co-dominant with subalpine fir. The landscape features are typified by rock outcrops, which act as horizontal barriers to fire spread. Consequently, fires remain small and localized. Few large and drainage-size fires occur in this vegetation type.

Table 4.3. Current and historic ranges of variability among structural classes for Cold Upland Forest types within Canyon Creek watershed with emphasis on the analysis area.

Description	***Structure class***	***Current Cold/Dry***	***Historic Cold/Dry***	***Current Cool/Dry***	***Historic Cool/Dry***
Stand Initiation	SI	2	1 – 20	0	5 – 30
Stem Exclusion Open Canopy	SEOC	58	0 – 5	70	0 – 5
Stem Exclusion Closed Canopy	SECC	1	5 – 20	0	5 – 35
Understory Regeneration	UR	0	5 – 25	0	5 – 20
Young Forest Multi Strata	YFMS	28	10 – 40	30	5 – 20
Old Forest Multi Strata	OFMS	<1	10 – 40	0	1 – 20
Old Forest Single Stratum	OFSS	1	0 – 5	0	1 – 10
Bare Ground	BG	10	0	0	0

After Powell 1998

Because sites are marginal for tree establishment and growth, forest structure is highly dependant upon the time since disturbance. In the analysis area of the Canyon Creek watershed, only about 1,800 acres contain Cold Upland Forest, which is limited for making historical comparisons (Powell 1998). On the basin scale, Cold Upland Forests had predominantly multi-strata structure, especially in those areas with 100 and 200 years between fire events. Open canopy stem exclusion (SEOC) was the most common structural type in the study area and exceeded the historic ranges of 0% to 5% for cold-dry plant association groups (e.g., subalpine fir/elk sedge and grand fir/grouse huckleberry) (Table 4.3). This shift in forest structure away from other structural types is likely due to the time since disturbance. No information exists about stand-level fires before Euro-American settlement (~1850s) for the Canyon Creek watershed. The most recent fire affecting the cold upland forests of the watershed was from the "Wildcat Fire" crossing into the Canyon Creek watershed in 1996. After about five years, these stands are largely composed of subalpine grasslands, shrublands, and regenerating forest (i.e., less than 10% canopy cover).

4.2.2 Riparian Zones

No quantitative data exist on the historic stand composition and structure of riparian zones for the analysis area or for the Canyon Creek watershed as a whole. While only a minor component of the land area (about 3%), riparian zones are important for aquatic species and wildlife. Riparian zones are unique in their composition and structure from surrounding upland areas because of their proximity to water and their topographic position. Canyon relief allows for cool-air drainage at night, and fuels moisture is generally higher than in the adjacent uplands. These changes in microclimate support plant communities that are often found at higher elevations (Franklin and Dyrness 1973). Consequently, riparian zones respond differently to fire than adjacent uplands, often with longer fire-return intervals having lower fire severity. As a result, riparian zones have a direct influence on landscape-level fire behavior and fire spread (Agee 1994). Considering the divergence from historic conditions in the upland forest structure and composition, it is probable riparian zones have experienced effects of fire exclusion, particularly decreased nutrient cycling and shifts towards lower abundances of hardwoods.

4.2.3 Grasslands and Shrublands

In addition to fire suppression, livestock grazing has been a contributor to the decline of wildland fires in the intermountain west. Rangelands under intensive grazing rotations by cattle or sheep typically do not have the fine fuels structure that would carry fire with the intensity typical of a fire regime II (frequent, stand-replacing fires with low flame height). Grazing of grasses and forbs limits the aboveground biomass that carries the fire, as well as limits the aboveground litter sources that are essential for fire ignition (Covington and Moore 1994). The combined effects of minimizing fire disturbances and the competition by grasses allows for rapid establishment of conifers within grasslands; conifer encroachment further limits grass production from shade competition and ultimately can shift the grassland environment to a forested environment. Exotic species are also a concern for grasslands and shrublands. Annual cheatgrass (*Bromus tectorum*) is a common invasive species that has gained dominance in many community types within the Blue Mountains, and (while not known) the Canyon Creek watershed is probably no exception (Keane et al. 2002).

The current status and historical trends of grasslands and shrublands within the Canyon Creek watershed is not known. Other than classifications from aerial photographs, no site-specific or landscape data exist for rangelands, including degrees of exotic species invasion, site productivity, livestock use, or plant associations.

4.3 TERRESTRIAL SPECIES AND HABITATS

In general, historical vegetation conditions prior to Euro-American settlement are thought to have been old forest single-stratum stands, dominated primarily by mature ponderosa pine/dry upland forests with warm/dry to hot/dry plant associations. Frequent fires of low intensity and severity would have kept finer fuels to a minimum and maintained large, open "park-like" stands. Frequent fires would have prevented encroachment into grassland and shrublands, making these areas more extensive historically. Historically, beavers were likely more abundant, which would have caused meadows to be wetter and possibly larger where dams were located. Riparian shrub vegetation was probably more prevalent along streams. Aspen was probably more abundant historically in the watershed.

4.3.1 Proposed, Endangered, Threatened, and Sensitive Species

4.3.1.1 Shrubland and Herbland Associated Species

4.3.1.1.1 Pygmy Rabbit

As stated in *Chapter 1*, there are no historic occurrences of this species documented in Grant County (Csuti et al. 1997). It is unknown if big sagebrush dominated shrublands within the watershed historically provide the habitat features required by this species.

4.3.1.1.2 Western Sage Grouse

Sage grouse, an obligate resident of the sagebrush ecosystem, were probably never abundant in the watershed due to limited big sagebrush-bunchgrass and juniper-sagebrush plant associations in the watershed. Sagebrush communities may have occupied the transitional zone between the ponderosa pine and Douglas-fir plant series and the scattered grasslands in the watershed. Potential habitat is currently limited to mainly the Fawn subwatershed and probably was almost as limited historically.

4.3.1.1.3 Upland Sandpiper

Upland sandpipers breeding habitat is restricted primarily to extensive, open tracts of short grassland habitat in Logan and Bear Valleys. There are no large open short grassland habitats within the forest boundary of the watershed. The private lands within the watershed might have provided suitable habitat before they were converted to agriculture uses, but it is not likely that upland sandpipers were distributed historically in the watershed.

4.3.1.1.4 Gray Flycatcher and Bobolink

As there are currently acres of big sagebrush in Fawn subwatershed and it could be assumed that such acres of sagebrush existed there historically, it is not known if these acres would provide the suitable nesting habitat for gray flycatchers. The mountain mahogany shrublands scattered throughout the watershed may have provided dispersal and/or foraging habitat for this species.

Moist meadows, the preferred habitat of the bobolink probably existed at least seasonally on lands in the watershed that eventually fell into private ownership. The extent of this assumption is unknown for the purpose of this analysis. Within NFS lands, it is assumed that suitable habitat existed historically in the Canyon Meadow and Lower East Fork subwatersheds, because currently there are larger sized meadows in these subwatersheds. The distribution of these species and their habitat were probably historically low in the watershed as higher quality habitat exists in Bear Valley.

4.3.1.2 Wide Ranging Carnivores

4.3.1.2.1 Gray Wolf

The historic range of the gray wolf was most extensive of any wild animal in North America (Verts and Carraway 1998) Poisons, trapping, and shooting, spurred by federal, state**,** and local government bounties, resulted in its extirpation from more than 95 percent of its range in the 48 contiguous States.

Wolves are considered extirpated from Oregon. Historically, the wolf was considered to occur mainly in the Willamette Valley and west to the coast, at European settlement, and to continue to occur west of the Cascade Range during the first third of the 19th century (Bailey 1936). In 1999, one radio-collared, female wolf from the experimental Idaho population traveled through portions of the three Blue Mountain Forests. The female was trapped in the vicinity of the Upper Middle Fork Watershed and returned to Idaho. In 2000, a male wolf was killed on Interstate 84 near Baker City, Oregon. These incidents indicate that the Blue Mountains probably provide suitable habitat for wolves. Over time, wolves dispersing from the growing experimental, non-essential Idaho population could return to the Blue Mountains and establish breeding territories.

4.3.1.2.2 Canada Lynx

Historically and in general, self-maintaining lynx populations have been considered unlikely to exist in Oregon (Witmer et al. 1998). The watershed, which is on the extreme southern portion of their range, probably had few, if any, Canada lynx populations due to the lack of habitat. Under natural fire regimes, the lower reaches of the watershed, outside the wilderness area, was probably dominated by open ponderosa pine stands in warm/dry hot/dry PAGs, which are not conducive to lynx habitat. Habitat may have occurred as it does today in the cool/dry cold/dry PAGs found in the wilderness area. Lynx may have passed through the area or foraged in the area, but self maintaining populations is unlikely to have occurred in the watershed.

4.3.1.2.3 California Wolverine

Wolverine populations are thought to have occurred at low densities before Euro-American settlement (Witmer et al. 1998). Historically, the wilderness area most likely provided suitable habitat. Wolverines probably traveled through the lower reaches of the watershed as there were no roads and little fragmentation when moving between suitable habitats located outside the watershed.

4.3.1.3 Miscellaneous Habitat Associated Species

4.3.1.3.1 Tricolored Blackbird and Bufflehead

As stated in *Chapter 3*, these species generally prefer to breed in freshwater marshes with emergent vegetation. The moist meadows and riparian habitat could have provided suitable habitat for these species. The quality of the historical habitat for breeding is unknown.

Historically, within NFS lands, the watershed does not appear to have had provided suitable nesting or wintering habitat for buffleheads. Suitable habitat is defined as nests near mountain lakes surrounded by open woodlands containing snags. There is a lake located on private land, but the current or historical suitable nesting habitat conditions around this lake are unknown.

4.3.1.3.2 Peregrine Falcon

There is limited suitable nesting habitat in the watershed and it is limited mainly to the cliffs of Canyon Mountain. This habitat has remained unchanged through the years, but foraging habitats have been altered by agricultural activities on private land. Peregrine falcons may have historically occurred in the watershed, assuming forage opportunities existed in the lower riparian reaches.

4.3.1.3.3 Columbia spotted frog

Historic habitat for spotted frogs was most likely well distributed through areas of the watershed with permanent water. Although current habitat has been degraded by past management activities, historic habitat probably persisted except through extreme drought events.

4.3.1.3.4 Elk

Elk herds, which are thought to have existed in relatively low numbers prior to Euro-American settlement, were decimated by the late 1800s. Rocky Mountain elk were translocated from Yellowstone National Park in 1913 to repopulate the area (Irwin et al. 1994). Forest Service annual game counts on the Malheur National Forest in 1929 recorded that 47 elk occurred on the forest (Bailey 1936). Hunting restrictions resulted in increasing herds until herds grew to high-density levels by 1980 (Irwin et al. 1994). However both deer and elk are quite vulnerable to human disturbance. Scientific research shows that higher open road densities reduce deer and elk habitat effectiveness (Thomas et al 1990). Roads open to motorized traffic allow people easy access to big game habitat. Motor vehicles and associated human activities can stress big game animals, causing them to avoid use of available habitat and unnecessarily expend energy. Habitat for elk and deer was probably better prior to settlement by Euro-Americans than today because there were more open stands with native grasses and healthy fires adapted shrubs for forage, plus a good distribution of cover for thermal regulation. More importantly, roads and associated human access were much more limited prior to settlement, and consequently elk and deer were not impacted by human disturbance to the extent that occurs under present conditions. Although, American Indians had some effect on the populations of these animals prior to Euro-American settlement, it is unknown what extent, or degree this effect occurred. Actual numbers of elk on the National Forest may have been lower than the present numbers. This is because elk probably used more of the lower elevation foothills and valleys on what are now, non-National Forest lands. Human development in these bottomlands has pushed more elk up onto National Forest lands. Open ponderosa pine forests dominated the warm/dry and hot/dry plant associations and provided high-quality grass and shrub forage. Thermal and hiding cover was probably located in the mixed conifer stands found in the moister sites in the warm/dry plant associations.

4.3.1.4 Late and Old Structure Forest Associated Species

The V*egetation* section describes the historic condition of habitat for these species in the context of the HRV analysis. To summarize, the OFSS stands within the dry upland forest types are below the historic range of variability in both the hot and warm-dry PAG's. The OFMS stands throughout the watershed are within this range of variability. By contrast, the OFSS and OFMS stands within the moist upland forest types are well below the historic range of variability in cool-moist PAG's as well as in the cold and cold-dry PAG's in the cold upland forests.

4.3.1.4.1 Bald Eagle

Historically, the old forest stands located along Canyon Creek may have provided nest structures for bald eagles. A reduction in the number of large-diameter trees in the watershed, quality of riparian areas, and peak flows of Canyon Creek has altered habitat for this species range-wide.

4.3.1.4.2 Pacific Fisher

Suitable habitat would have been very limited in the watershed but may have been found in the moister warm/dry plant associations in the grand fir multi-strata vegetation types. Historically and currently, riparian corridors serve as travel corridors and provide productive habitat for fisher prey. As stated in *Chapter 3*, in the lower elevations of Sugarloaf, Fawn and Lower East Fork subwatersheds, fishers may occur in the old-growth and mature forests. However, these stands are generally above 4,000 feet, and snow accumulations may limit fisher use of these areas. The lower elevations within the watershed, in private ownership, probably did not serve as suitable habitat for this species

4.3.1.4.3 Pileated Woodpecker and Pine Marten

In general, woodpecker habitat is thought to have been more abundant historically than it is currently. Pileated woodpeckers are associated with moist forest types (which comprises 20% of the analysis area) because they need the high canopy for nesting. Populations of woodpecker species have probably fluctuated over time with large-scale fires and insect and disease mortality and most recently with timber management.

Pileated woodpeckers are associated with old-growth ponderosa pine-mixed conifer forests. Historically the OFMS stand condition was more prevalent throughout the watershed. The hot-dry and warm-dry plant associations in the moist upland forests would have provided habitat where large snags, down logs, and high canopies were present. As mentioned above, frequent fires would have created small patches of old forest multi-strata stands surrounded by old forest single-stratum forests (a stand structure that is virtually non-existent in the present-day watershed condition). Suitable habitat for this species was more prevalent historically than the current day levels. It can be assumed that this species was present in the watershed perhaps even well distributed given the amount of habitat.

Pine martens have similar habitat requirements to the pileated woodpecker but since the marten does not require large diameter trees the YFMS stand structure can provide suitable habitat for this species. Current structure stage percentages are in excess of the estimated HRV for YFMS but as is the case with pileated woodpecker habitat, pine marten habitat was also prevalent in the watershed.

4.3.1.4.4 Northern Goshawk

Old forest multi-strata structural stands were historically present in the watershed and would have provided habitat for the goshawk. Frequent fires would have created very fragmented small patches of old forest multi-strata stands surrounded by old forest single-stratum forests (this stand structure is nearly absent currently). This species is thought to use open, park-like stands for foraging, and the old forest single-strata stands may have provided this type of habitat. This combination of nesting and foraging habitat may have supported more nesting territories historically than the four territories currently found in the watershed.

4.3.1.4.5 Three-Toed Woodpecker

Lodgepole pine is an important habitat component for the three-toed woodpecker. Historically, lodgepole pine was the co-dominant species within the grand fir vegetation type, but distribution of these forest types was limited in the watershed.

4.3.1.4.6 White-Headed Woodpecker

This species utilized the old forest single-strata stand structure that dominated the warm/dry and hot/dry plant associations. The warm/dry and hot/dry plant associations occur in over half of the watershed. This species was probably relatively well-distributed, since this habitat type was well distributed in the watershed.

4.3.1.5 Deadwood Associated MIS

4.3.1.5.1 Lewis' Woodpecker

The Lewis' woodpecker needs open areas for foraging since it is an aerial feeder and also forages on the ground and in brush. The open ponderosa pine forests in the warm/dry and hot/dry plant associations would have provided habitat for this species. As mentioned above, this habitat type was abundant and well-distributed in the watershed. Cottonwood galleries probably were more abundant historically and would have provided habitat.

4.3.1.5.2 Black-Backed Woodpecker

Large-scale stand-replacement fires that would provide habitat for this species were not common in the watershed. This species is foraging for wood boring larvae so in the absence of intense stand replacement fires or if the fires were mainly cooler understory fires the black-backed woodpecker would seek stands with high snag density and decay to find suitable forage habitat. Mature and old-forest stand structures were probably more common throughout the watershed and may have provided habitat for these species.

4.3.1.5.3 Williamson's Sapsucker

This species uses mature higher-elevation coniferous forest for nesting and feeding. It prefers open ponderosa pine forest but may use lodgepole pine, grand fir, Douglas-fir and aspen forests (Csuti et al. 1997). There was probably more suitable habitat for this species in historical conditions, especially in the open ponderosa pine forests.

4.3.1.5.4 Downy Woodpecker and Red-Naped Sapsucker

The downy woodpecker and red-naped sapsucker are associated with riparian habitats but will use coniferous habitats. Historical riparian communities probably consisted of a mixture of grasses, shrubs, and hardwoods. Hardwoods may have included alder, willow, dogwood, cottonwood and aspen that would have provided habitat for both of these species. Aspen is an important habitat component for both species. Historically it is likely that aspen groves extended from the riparian areas and other moist areas in the watershed. This habitat was probably limited but well distributed in the watershed.

4.3.1.5.5 Hairy Woodpecker and Northern Flicker

Both the hairy woodpecker and the northern flicker use a variety of habitats but tend to prefer open habitats. As mentioned above, open forest habitat conditions were historically more abundant throughout the watershed.

4.3.1.6 LRMP Featured Species

4.3.1.6.1 Osprey

Historical habitat probably occurred along the Canyon Creek in the Fawn subwatershed as it does currently. Because the watershed does not have a high density of large, fish-bearing water bodies, this species was probably not abundant or well distributed in the watershed. Salmonids were present in the watershed historically and probably provided seasonal forage for this species. There is very little information on the abundance of salmon in the watershed but Native American fishing use in the valley suggest that there was an abundance of fish.

4.3.1.6.2 California bighorn sheep

Bighorn sheep were extirpated from Oregon by the mid-1940s. Historic records indicate that bighorn sheep were known to be present in the watershed. The size of the population throughout the Blue Mountains is not known but they were probably at higher numbers than the re-introduced population that occupy the Blue Mountains today. The last recorded native bighorn sheep in the John Day area was around 1915. Historical information suggests that one of the major causes for the demise of this species was a combination of contact with domestic sheep and unregulated hunting (ODFW 2001).

4.3.1.6.3 Blue Grouse

Hardwood thickets and aspen were more abundant historically in the watershed; however, Grouse also prefer large mistletoe-infected Douglas-fir trees for winter roosts. Historically, mistletoe was present in the watershed but was moderated by disturbance such as frequent fires. Currently, mistletoe infestation is much more abundant than historic levels with the absence of frequent fires in watershed. The historic distribution and abundance of this species in the watershed is not known.

4.3.1.6.4 Pronghorn

In Oregon, this species is associated with open grasslands, precludes it's presence in the analysis area. Outside of the watershed, it's has been documented that approximately 500 pronghorn occurred in Logan Valley (USFS 1971). Distribution of this species was probably concentrated outside of the watershed in Logan Valley and perhaps Bear Valley.

4.3.1.6.5 Neotropical migratory land birds

Neotropical migratory landbirds probably had access to a greater quantity of available habitats than the current situation. Studies have shown a slow but study decline of habitats through the range of these species especially in riparian areas. Riparian areas throughout the Interior Columbia River Basin, including those within the analysis area, have been severely degraded from its historic condition by over-grazing, timber management, climatic changes, and water diversions.

The following is a summary from the Partners in Flight Landbird Conservation Plan for Eastern Oregon. Landbird conservation faces numerous obstacles, either directly or indirectly arising from conflicts with human economic issues. The principal post-European settlement conservation issues affecting forest bird populations are habitat alteration due to suppression of fire and timber harvesting. Physical consequences of these alterations include changes in structural diversity, reductions in habitat patch size and increases in fragmentation, and reductions in the amount of old forest. Consequences for bird populations vary by species; favoring those associated with younger and denser forests and adversely affecting those associated with older forests and more open conditions.

Fire suppression and timber harvesting has blurred the relatively distinct historical elevational zonation of forest vegetation. Douglas-fir, grand fir, and Englemann spruce have expanded their range to lower elevations beyond their normal mesic locations. Old-growth stands of ponderosa pine have been harvested, and fire suppression and encroachment of other species has resulted in denser thickets of fir-dominated forest where ponderosa pine used to occur. Estimates of the extent of alteration vary. In the Blue Mountains, the proportion of forestland dominated by ponderosa pine has declined from 80% in 1936 to 25% in 1992. In the 1930s approximately 60% of the original low elevation old-growth ponderosa pine in the Blue Mountains still existed; by the early 1990s, only 20-25% still existed. Most of the remaining patches are less than 100 acres and likely too small to maintain ecosystem processes and many old-growth dependent species. For example, habitat for white-headed woodpecker, a species dependent on late-seral ponderosa pine forest, has declined by more than 60% from historical to current periods, and been completely eliminated in more than 40% of the watersheds within the ICBEMP (Wisdom et al. in press).

The effect of extensive road development networks also has adversely affected wildlife. Based on an extensive synthesis of the literature, Wisdom et al. (in press) identified 13 direct or indirect factors associated with road development that impacted greater than 70% of the 91 vertebrate species analyzed (includes many landbirds). Additionally, the adverse effects on wildlife from road-associated factors may be additive to that of habitat loss and alteration (Wisdom et al. in press).

In addition to forest ecosystems, other ecosystems have been degraded to the point of reduced functional integrity. For example, in lower elevation subalpine parkland, fire suppression has likely altered patterns of succession that favor a denser tree canopy and changes in species composition (Franklin and Dyrness 1973). There also has been a extensive invasion of meadows with tree species throughout the analysis area (Franklin and Dyrness 1973), perhaps due to climatic change in the last 50 years.

4.3.1.6.6 Raptors

The quality and quantity of habitat in the analysis area that was historically present for the seven species of raptors referenced in Table 3-63 is not known. It can be assumed that species that are more generalists in terms of their habitat preference such as red-tailed hawks, Cooper's hawk, and prairie falcons were probably well-distributed so long as prey items were readily available.

Northern pygmy owls, flammulated owls and even kestrels would have had ample habitat of snags and natural cavities to nest in historically as the HRV analysis indicates that more of this type habitat was available in the watershed.

The historic presence of golden eagles in the watershed is more difficult to determine. They have been documented at low breeding pair density of 4 to 5 pairs per 40 square miles in eastern Oregon (Csuti, et al. 1997) which would indicate that they have rather large home ranges spread over a large geographic areas.

4.4 HUMAN USES AND CULTURAL RESOURCES

4.4.1 Prehistoric Land-Use Patterns (11,000 – 400 years Before Present)

The archaeological record suggests that hunter-gatherer land-use practices in the Blue Mountains generally intensified as populations and competition for available resources increased on the Southern Columbia Plateau over time (Burtchard 1998).

Land use in the Canyon Creek area at the end of the Pleistocene was undoubtedly ephemeral. Hunter-gatherers operating in higher elevation mountains prior to the eruption of Mount Mazama (ca. 7,000 BP) foraged for a broad spectrum of resources over extensive ranges and had low population densities (Schalk and Cleveland 1983). An archaeological site in the upper portion of the watershed provides evidence of cultural presence in the watershed prior to the eruption of Mount Mazama at 7,000 BP (Rotell and Hann 2003).

As climactic aridity increased in the mid-Holocene and lowland habitats became degraded, it became more likely that hunter-gatherers from the Great Basin and Columbia Plateau made extended forays into the Blue Mountains (Burtchard 1998). Foraging strategies for groups that would have exploited resources in Canyon Creek between approximately 6,000 and 4,000 BP have been characterized as seasonally sedentary, highly mobile, with limited mass procurement of locally abundant resources and limited use of resource storage systems.

At approximately 2,500 BP, most of the interior Pacific Northwest experienced its peak prehistoric population density. Complex pithouse villages were established on the lower John Day River, the Deschutes River, and in lakeside environments within Harney Basin (Schalk and Atwell 1994, Aikens and Greenspan 1988, Minor and Toepel 1988) during this period. Large, socially complex, semi-sedentary groups situated on the Columbia Plateau and northern Great Basin at this time probably considered the southern Blue Mountain region and the Canyon Creek area hinterlands. Data from an archaeological site provides evidence that hunter-gatherers were harvesting and processing big game in the watershed at ca. 2,000-25,00 BP (Hann 1997).

After roughly 400 BP, aboriginal land-use systems were impacted both by the horse, which permitted long-distance transport of commodities, and by the introduction of New World diseases. During the ethnographic period, the primary occupants of the watershed were the Northern Paiute who wintered near Canyon City; although tribes from the Columbia Plateau such as the Umatilla, Tenino, Cayuse, Walla Walla, and Nez Perce also periodically visited the area (Blyth 1938, Stewart 1939, Suphan 1974). Cultural groups based in the Columbia Plateau and northern Great Basin gradually began to participate in Euro-American and European economies at this time.

4.4.2 Cultural Fire

Anthropogenic, or cultural, fire would have been the primary cultural mechanism of landscape transformation prior to Euro-American settlement of the area in the mid-19th century. Although assigning origins to fire ignitions that occurred in the prehistoric or early historic past remains an imprecise task, it is safe to say that the combination of cultural and natural fire had a considerable effect on vegetation patterns in Canyon Creek before hunter-gatherer burning waned. Intentional burning of Blue Mountain forests has probably occurred since the end of a middle Holocene thermal maximum (Altithermal), which occurred approximately 4,000 BP.

Historic and ethnographic records indicate that fire was routinely deployed by hunter-gatherers in nearly every ecosystem in North America for achieving both long and short-term goals (Lewis 1973). Hunter-gatherers would likely have used fire for most if not all of the following purposes: warmth, resource processing, creating or maintaining open ponderosa pine parklands, burning off dry brush and stimulating the growth of deer/elk browse, creating or maintaining higher elevation openings better suited for root crop and huckleberry production, mass driving of big game, forcing bears out of winter dens to be killed, improving open qualities of forested areas to facilitate travel, long-distance communication with other groups, creating fuel breaks around habitation or other special areas, and impeding the pursuit of enemies. The earliest settlers in the Middle Fork of the John Day River subbasin continued to burn the woods for similar and different reasons.

In other regions of Oregon, forests were burned in the historic-era to enhance ground visibility during gold prospecting and to permit unhampered travel (Lalande 1995). Burning may have also been employed in the historic period to improve cattle and sheep grazing in certain areas.

The burning patterns of the Indians of the inland Pacific Northwest were quite distinct from the indigenous groups of southwestern Oregon and the western flank of the Cascades (Agee 1994). The tribes to the east of the Cascade Range foraged within "classic fire environments" that were well suited for widespread underburns nearly every year (Agee 1994). Burning by hunter-gatherers most likely occurred in the spring and fall when fire intensity could most easily be controlled. Virtually all elevations in the watershed may have been burned intentionally by hunter-gatherers at some time; however, most burning during the prehistoric period probably was concentrated in the lower elevation areas of the Galena watershed. In the Southeast Galena planning area, stands of mixed conifer would have been the most likely candidates for the application of cultural fire. Coniferous stands of higher elevations may have been burned occasionally to create or maintain mosaic forest/meadow patterns (Lewis 1973).

Newspaper articles, diary and journal entries, and recorded personal recollections all provide evidence that Indians altered the local environment through burning. Early fur trappers and explorers of the Columbia River such as Lewis and Clark, Peter Skene Ogden, Benjamin Bonneville, and John Kirk Townsend all noted the application of fire to grasslands and forests by Indians in the early 19th century (Langston 1995). None of the evidence is specific to the Canyon Creek watershed, it is entirely anecdotal, and much of it is ambiguous. However, collectively it suggests that Indians commonly treated the landscape with burning in the mountains near Grant County into the latter years of the 19th century. Newspaper accounts of intentional fire deployment within or near Grant County include:

> In the fall of 1888, it was observed by the Grant County News (09/06/1888) that Indians were torching forests and grasslands in the County. The reporter observed that, "There is considerable fire in the mountains around Bear Valley. We passed through one fire but it was not burning very briskly. This intolerable firing of timber should be looked after by someone. If the Indians are to run off and kill all the deer and then burn up all the timber it is time something was done. . . . A band of noble red men are in the mountains – in fact several bands are roaming over the country killing the white man's game and burning off his winter stock range."
>
> The Grant County News (09/12/1889) reported in September of 1889 that, "A gentleman saw an Indian setting fire to the timber south of here, and knew of them setting fire a distance of thirty miles in one day for the purpose of corralling the deer for one great slaughter. . . . This smoky atmosphere and the destruction

of our game is bad enough, but to have the red devils destroy the best timber in the state is worse."

A year later the Grant County News (09/11/1890) again complains of the use of fire by the Indians, "Up to this time this summer Grant County was free from forest fires, but now the scenery is hid by smoke. Indians in the mountains as usual are setting fires to corral the game."

Phil Metschan, of the Oregon Inn-Side News (01/03/1947), referred to the days in Grant County when ". . . magnificent forest surrounding town was scarcely touched; when, following the custom of the Indians, the dry grass and debris were burned every year, and consequently there was no underbrush, no forest fires, giving the forest a park-like appearance."

4.4.3 Fur Trapping and Early Exploration (1826-1831)

Several European-sponsored forays were made into the Upper John Day River subbasin between 1826 and 1831 (Davies 1961). Peter Skene Ogden and John Work pursued a "fur desert" policy of the Hudson's Bay Company as they led trapping brigades through the Blue Mountains. The intent of this strategy was to trap beaver and river otter to the point of eradication in the area south of the Columbia River in an effort to deter American fur and settlement interests from becoming established in areas north of the Columbia River. John Work most likely traveled north through the Canyon Creek watershed in July of 1831 as his party trapped their way from the Silvies River to the John Day River.

4.4.4 Mining and Euroamerican Settlement (1862-1942)

The Canyon Creek watershed witnessed the familiar phases of boom and bust mining activity that were recurrent throughout the West. At the point of discovery in 1862, mining focused on excavating and washing the alluvial gravels of Canyon Creek. Soon after, prospectors, suppliers, and camp followers rushed to the area and the mining camp on Canyon Creek grew to a population of nearly 5,000 people.

George Hazeltine, who arrived at the Canyon Creek mining camp during the initial gold rush, anecdotally described the watershed prior to modification by settlers and miners in a letter to his wife dated August 17, 1862. According to Hazeltine:

> "...we are camped [in a crude brush shelter] on the bank of a creek called Canon Creek. The banks are covered with birch wood trees, with a heavy undergrowth of rose, gooseberry and currant bushes and the undergrowth is very hard to get through, of course. ...I started for the creek to wash my face and hands and get some water. Now there is a regular trail through the bushes to the water, that everybody traveled, but for some ... reason I did not take the trail but went scrambling through the bushes now diving under, now jumping over the tangled vines...the vines were more matted and tangled than any I had seen...".

The discovery of gold in Canyon Creek also stimulated the building of roads throughout the region. The Dalles Military Road was constructed in 1867 and it connected the city of The Dalles with Fort Boise via Canyon City. In later years, the town of Canyon City was established and it served as a central supply hub for miners and mining operations located throughout the watershed and all of Grant County. Canyon City was repeatedly destroyed by fires in 1870, 1898, and 1937 (Oliver 1961, Lewis 1950).

By the late 1860s, the infrastructure was in place to allow for large-scale hydraulic placer mining of high terrace deposits of gold. By 1871, over 50 miles of ditches had been built to supply placer claims with adequate water from Canyon Creek and tributaries of the John Day River to the east (Rossiter 1871). The Humboldt ditch was the most substantial ditch in the watershed. It was approximately eight miles long and was capable of delivering 24 cubic feet of water per second (cfs). Important placer mines in the watershed included the Humboldt and the Marysville claims (Lindgren 1901). Many ethnic Chinese miners purchased claims or found employment with hydraulicking companies during this period. Mining technologies utilized in the watershed had made the transition to principally hard rock or quartz techniques by 1900. Gold and chrome ore were removed from lode mines in the Canyon Creek area such as the Miller Mountain mine, the Little Canyon Mountain mine, and the Iron King Mine (DOGAMI 1941). A floating dredge also worked the alluvial gravels between the John Day River and Canyon City after the turn of the century (Mosgrove 1980). The Timms Gold Dredging Company dredged the bottomlands near the mouth of Canyon Creek for placer gold between 1900 and 1916. Sporadic hard rock and placer mining continued in the watershed until gold mining was essentially abolished by the federal government with the onset of World War II in 1942.

4.4.5 General Land Office Surveys (1869 and 1880)

The first direct information on vegetation in a broader sense comes from General Land Office (GLO) survey notes. These notes are taken by land surveyors walking a grid system projected on the land surface while describing landforms, vegetation, and water bodies on the various cardinal directions. The descriptions are necessarily brief and focus on aspects of economy (i.e., landforms, vegetation, soil). There are two sets of notes relevant to this analysis. David, Pengra, and Thompson (GLO 1869) conducted the first survey of the analysis area, seven years after the discovery of gold. Robb (GLO 1880) conducted a second survey of the planning area. Their notes describe a frontier environment for the watershed.

General descriptions include:

> "…the south boundary runs along the foot of rough and rugged mountains covered with scrubby pine timber. Most of this township is occupied by settlers and miners – Aug 23 1869"(GLO 1869, for T13S, R31E).

> "This Township is on south slope of mountain. The south half is rolling with soil 2nd rate and fine grass. The north half is on rugged steep broken hills and the soil is worthless."(GLO 1869, for T14S, R31E).

> "…The country is rolling Prairie covered with fine grass and is well watered and has large numbers of settlers. I think there are within 12 miles of the line on the south side near five hundred settlers with three considerable towns – Canyon City, John Day City and Dixie. (The first named place containing a population of about one thousand inhabitants, the two latter places from one to three hundred/ Canyon City is the County Seat of Grant County.

> "There are many fine farms in this vicinity and the country since the termination of the American War (one year ago) is rapidly settling up. The Blue Mountains are to the east and south of the settlements and afford abundance of fine fir and pine timber for buildings, fences and fuel." (GLO 1869, general description including Ranges 31 and 32).

Specific descriptions along section lines relevant to the analysis area include:

> "Land rough and broken, Soil 2nd rate, fine grass, Aug 22 1869" (GLO 1869, from Canyon City east one mile).

> "Heavy pine timber. Dense undergrowth of buck brush, willows. The line runs close to Canyon Creek" (GLO 1869, approximately one mile east of Canyon Creek).

In a later survey of the same area, GLO (1880) provides general and more detailed descriptions.

> "General Description - This Township is mountainous and rough and broken. The narrow valley and foothills toward the north are adapted to agriculture. The southern portion is covered with heavy timber pine, fir, tamarack and juniper and mahogany." (GLO 1880, for T14S, R31E).

For the northern boundary of township T14S, R31E, GLO (1880) details the following:

> "Country rough and mountainous, Soil 3rd rate, July 29 1880" (GLO 1880).

> "This line runs close to Canyon Creek is very rough and was projected with much difficulty. Pine timber, willows along creek. Buck brush on slopes. Soil 1st and 3rd rate" (GLO 1880).

> "This line runs along the north slope of Canyon City Mountain. The timber has all been cut off and there is a dense growth of brush and small pine. The country

> is very rough, rocky, mountainous and broken, Soil 2nd rate." (GLO 1880, southern boundary section 1).
>
> "a pine 24 in dia"
>
> "Country fearfully rough broken mountainous and rocky. Soil 3rd rate. Pine timber. Dense buck brush and willows." (GLO 1880).
>
> "Cross Canyon Creek"
>
> "a juniper 14 in dia"
>
> "a juniper 8 in dia"

For the eastern boundary of township T14S, R31E, GLO (1880) notes:

> "Country very rough mountainous and broken, Soils 2nd rate. Dense growth of buck brush, willow and sarves bushes. Line runs close along the breaks of Canyon Creek." (GLO 1880).
>
> "It being impossible to run the east boundary of Township 14S Range 31E on account of the line running along the west slope of Canyon Mountain which breaks off almost perpendicular towards Canyon Creek. I begin at the cor. to secs. 35 and 36 on the south boundary of the Township, and run north between secs. 35 and 36. Country very rough and rocky and mountainous, Soils 1st and 3rd rate." (GLO 1880).

For the southern boundary of township T14S., R32E., GLO (1880) reports:

> "Country very rough and mountainous, dropping off E + SE rapidly toward Canyon Creek. Not much good timber, but an immense quantity of fallen tamarack. Very dense buckbrush. Soils 3rd rate."
>
> "Country most fearfully rough, rocky, and mountainous. Fallen timber – Buckbrush of gigantic size. Timber scattered pine, fir, and hemlock."
>
> For the western boundary of township T15S., R32E., GLO (1880) describes:
>
> "Country rough and mountainous. Soils 3rd rate. Pine timber – dense sagebrush."
>
> "Canyon Creek, 30 links wide, flowing northwest. … Country is broken and mountainous. Soils 3rd rate. Heavy pine and fir timber. Dense buckbrush." (Near confluence of Road Gulch and Canyon Creek).
>
> "Set post on bald ridge for cor. To secs 24, 25, 19 & 30. with pits and mound as per instructions. Country rough, broken and mountainous. Heavy pine and fir

timber. Buck brush very dense in pockets." (On boundary between townships 15/31 and 15/32 near Hunters Cabin Spring).

4.4.6 Early Forest Service Administration and Fire Suppression (1906-1942)

In 1906, the Forest Reserve system was established under the supervision of Gifford Pinchot to manage the resources in the forests of Canyon Creek and the entire Blue Mountain region. Management of forests was largely custodial through the 1920s because fighting forest fires and administration of grazing were the chief concerns. Some large fires burned the watershed in the Fawn Springs and Wall Creek drainages between 1910 and 1920 but apparently they were not especially destructive. Malheur National Forest Supervisor Cy Bingham reported to the Regional Office, "3000 acres burned, no damage, no expense" (Schouten 1991).

The emphasis on fire suppression greatly increased in the 1930s, and it was a primary mission of the Forest Service by the time the Civilian Conservation Corps (CCC) was created in 1933. By 1935, the Forest Service had its "10 AM" policy in place. This policy mandated that all fires were to be controlled by 10 AM the morning following the report of the fire (Williams 2000). In 1937, the CCC brought 150 enrollees to Canyon Creek and a camp was constructed at the confluence of Vance Creek and Canyon Creek. The CCC began development of National Forest Service lands by constructing roads, fences, lookout towers, corrals, signs, markers and trails (Mosgrove 1980). The CCC also provided the majority of the manpower for National Forest Service fire suppression and timber stand improvement efforts. In the Canyon Creek watershed, the CCC constructed the Fall Mountain Lookout Tower, Wickiup Campground, and several roads.

4.4.7 Logging and Lumbering (1877- Present)

The earliest documented sawmill in the Canyon Creek watershed is the Dore Sawmill, which was in place in Canyon City by 1877 (Bradwell et al. 1958). The Dore Mill was located approximately twelve miles south of Canyon City and it supplied miners and settlers with lumber for buildings and timbers from mines. Between 1877 and 1906, six sawmills operated in the Canyon Creek watershed (Morrisette, pers.comm. 2002). The sawmills located near Canyon City at the end of the 19th century were most likely capable of processing only small diameter logs due to technological limitations.

In the 1930s, a spur of the Hines Logging Railroad system was constructed over Starr Ridge and in to the Canyon Creek watershed (Armstrong 1984). The Canyon Creek watershed is located just north of the Bear Valley timber sale that was advertised in 1922. The Bear Valley sale involved 860,000,000 board feet of timber and is one of the largest timber sales ever completed in United States history. The Bear Valley timber sale was closed completely in 1967.

There have been 26 NFS-sponsored timber harvest, thinning, or vegetation management projects in the Canyon Creek watershed since 1970. The most recent vegetation management project in the watershed was the Parish Timber Sale.

4.4.8 Cultural Resources Summary

Since 1980, 197 cultural resource properties (CRPs) have been documented during the ten cultural resource inventories conducted within the Canyon Creek watershed. One hundred and seventy-five of the properties are related to prehistoric occupation of the watershed, twelve are related only to historic period activity, and eight display prehistoric and historic components. Nearly half the CRPs in the watershed are isolated finds (n= 96) that are not eligible for inclusion on the National Register of Historic Places (NRHP). There are 87 lithic scatter sites that are eligible, or are potentially eligible, for an NRHP listing (Keyser et al. 1988) within the watershed. Six historic sites have been identified within the Canyon Creek watershed and only one of these properties has been evaluated as eligible for an NRHP listing. Eight sites in the watershed possess prehistoric and historic components. All multicomponent sites in the watershed have been evaluated as eligible for the NRHP.